European Commission

STRATEGIC EVALUATION OF THE BULGARIAN CENTRES OF COMPETENCE AND CENTRES OF EXCELLENCE AND RECOMMENDATIONS FOR THEIR FURTHER DEVELOPMENT

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EXECUTIVE SUMMARY

I. BACKGROUND AND CONTEXT

Bulgaria seeks to improve the national potential for applied research, experimental development, and innovation.

Bulgarian science is strong in physics, chemistry, biological science, and engineering. Key stakeholders recognise that the industries of the 21st century will depend increasingly on the generation of knowledge through creativity and innovation. Hence, traditional sectors of Bulgarian science are now combined with achievements in ICT and automation. Specific 'smart' sectors where Bulgaria possesses the potential to make breakthroughs have been identified and included as "vertical priorities" in the Smart Specialisation Strategy (S3) 2014-2020: Informatics and ICT, Mechatronics and CleanTech, Industry for a Healthy lifestyle and BioTech, and Creative and Recreative industries. The strategy also has two horizontal priorities: (i) resource efficient technologies and (ii) digital technologies.

Significant funding from the European Regional Development Fund (2014-2020) has been dedicated to the national priority axis (theme) "Research and Technological Development".

New research complexes established under the "Science and Education for Smart Growth" Operational Programme (SESG-OP) – including Centres of Excellence (CoEs), Centres of Competence (CoCs) are going through three stages: synchronisation (2017-18), building (2019-20) and development (2021-23). Total funds allocated for the Centers amount to approximately EUR 190 million. As per the current regulation less developed regions, which is the entire territory of BG in 2014-2020 period, are co-financed with 85 % ERDF funds[1]. The investment per CoE/CoC project is roughly between 13 and 69 million BGN with an average of about 25 million. Cohesion policy already invests largely in research infrastructure in Bulgaria, co-financing the creation of the flagship Sofia Tech Park project.

Bulgaria faces some policy, structural, and institutional challenges that must be addressed to improve its innovation performance in the EU and globally.

The lack of integrated policy instruments, including effective mechanisms to support shared infrastructures, limits the advancement of research and technology. These instruments are key to stimulating public-private collaborations and help create and foster markets.

Bulgaria's Research and Innovation (R&I) system faces a number of structural shortcomings. These include low levels of public and private R&I investment, fragmentation of the public science base, lack and ageing of skilled human resources, weak science-business links and inefficient governance.

OVERCOMING EXISTING CHALLENGES

The overarching strategy of all CoEs and CoCs is strongly focused on scientific research excellence and less so on commercialisation, market orientation, innovation capacity-building,

[1] Regulation 1303/2013 for further details

or self-sustainability. As a result, the activities envisaged for the Centres will significantly rely on public funding. Traditional activities of research and development (R&D) institutions, such as applied (predominantly contract) research and more complex collaborative research as means to develop or strengthen relations with industry and knowledge transfer, are currently not sufficiently utilised by the majority of the Centres' partner organisations.

In Bulgaria, technology transfer activity is still relatively limited. Several technology transfer offices (TTO) have been established, some of which are operational and slowly gaining momentum. The community of researchers is still lacking TT knowledge and skills. Various strategies on IP exploitation exist, however they are still nascent.

As part of their applications for funding, all Centres had to prepare research and innovation programmes; however, the planned actions are more generalist in nature and not sufficiently industry or market specific. This lack of clear, actionable objectives and specific steps required for each Centre to achieve the status of regional and national importance will need to be rectified at a minimum by:

(1) A development strategy that defines a clear scientific and innovation agenda aligned with the priority areas of the European market and with regional specifics;

(2) Innovation and technology transfer action plans that includes deeper and more comprehensive market analysis, competition analysis, services portfolio definition, talent acquisition and skill development, and;

(3) An industry collaboration strategy to create and grow structured collaborations with industry, customers and end-users of the technology.

II. STRATEGIC MESSAGES TO THE BULGARIAN GOVERNMENT

Public intervention in the research sector in Bulgaria must be optimised. The role of government is not only to provide the Centres with funding but also to create conditions for developing a R&I ecosystem that can serve as a means of enhancing economic performance. A range of policies, initiatives and mechanisms are required to support and enhance the long-term sustainability of the CoEs and CoCs. Creating the right conditions will be critical in enabling the national innovation potential and success of the Centres.

The Bulgarian government is currently in the process of consolidating its efforts in the R&D&I domain by establishing a State Agency for Research and Innovation – a body directly accountable to the Council of Ministers and aiming to address the lack of adequate institutional policy-making framework. It is recommended that the new Agency implements a **centralised, strategic and well-coordinated government policy directed strongly towards capacity building, targeted as well as facilitative measures to support academia-industry collaboration and technology transfer**. In this regard, the Agency's mandate should take into account the needs of and opportunities for the ongoing 14 CoC and CoE projects and could serve as an overarching organisation by pursuing a proactive and coordinated policy, including to undertake the necessary reforms, towards all publically funded research organisations and research infrastructures in the country.

A public body in the form of a **centrally coordinated and capacitated network with the mission to encourage academic collaborations with industry and technology transfer** could be one effective option to better organise the research system in Bulgaria. This will increase the exposure and awareness about the Bulgarian R&D&I capacity, facilitating the integration of the

Centres into the Bulgarian innovation ecosystem and the creation of expected value added. Equipment, human capital, competences and capacities, services offered, described simple procedures and most importantly some success stories should all be made available to interested parties such as users, investors and collaborators in order to initiate and streamline the research and development activities in the public sector in the country.

The recent changes in the Law on Higher Education made it possible for the **Minister of Science to agree with the rectors their tasks and strategic objectives together with the provision of *targeted funding* to realise these objectives.** These objectives should include the encouragement of collaborations with industry and in parallel technology transfer activities across the Bulgarian ecosystem. These are the core prerequisites for the sustainability of the projects for Centres of Competence, in particular. On the other hand, the **public block funding dedicated for independent research should be itself sufficient to guarantee continuity in pursuing excellence.**

Furthermore, technology transfer could be incorporated in the Law on Higher Education and linked to the activities of the newly designated (with the recent amendment of the law) **"research-intensive" higher education institutions** (Article 17a). For these institutions, the government could consider **designing specific stimuli such as funding for Proof of Concept and for spin-off creation** to incentivise the commercialisation of their inventions, as well as **programmes for supporting effective collaboration** between research organisations and industry. In the medium-to-long term, the research organisations should build strong capacities for interaction with industry. An amendment of the Law on Promotion of Scientific Research could also be considered to reflect the new instruments.

One of the challenges of the Bulgarian Academy of Sciences (BAS) in delivering technology transfer activities effectively remains in the organisational setup where the various BAS institutes are legal owners of the IP. The experts are of the opinion that the existing **Joint Innovation Centre at BAS**, in association with the individual teams at the BAS institutes, **should be strengthened**. In particular, its role for commercialisation and technology transfer should be enhanced so that it can more effectively **serve as a central hub to the institutes facilitating their participation in the various CoE and CoC projects**. This participation in multiple Centres necessitates the consolidation of capacities and streamlining of processes through a structural reform, update and adjustment of the Academy's industry collaboration and technology transfer policies, practices and arrangements.

Overall, there are no major obstacles for technology transfer in the Bulgarian legal framework in which the Centres operate and much depends on the **institutional motivation, competence, commitment and budgets of each research organisation**. Certainly, a **carefully designed national mechanism would be beneficial** to improve coordination and build capacities.

As the buildings and equipment procured under the Centre-projects remain in the ownership of the research organisations (as per the experts' recommendations), the **rectors and BAS institutes directors should commit to ensure that the research infrastructure received under the Centres-projects is made available for the purposes of these projects.** The agreed work packages in each Centre - in both aspects division of work and collaboration between partner organisations - will naturally serve as cornerstones in the organisational structures of the Centres and facilitate the latter's continuous operation also beyond 2023.

While at the moment the National Roadmap for Research Infrastructures recognises "research complexes" as eligible for funding, it would be useful that the Bulgarian government further

explores the needs and opportunities to formalise the existence of the CoCs and CoEs, including as separate legal entities. These Centres are entrusted with specific R&D&I activities, possibly including not only coordination functions but also the management of research infrastructures where applicable. Moreover, they would be one of the backbones in the plan for transformation of the Bulgarian economy and it is foreseen that the future Programme for Research, Innovation and Digitalisation for Smart transformation will continue their funding in 2021-27 period as well. Therefore, it is of utmost importance to ensure that all prerequisites and mechanisms for the Centres' sustainable development are firmly put into place.

III. RECOMMENDATIONS TO THE CENTRES AND THE FOUNDING PARTNER RESEARCH ORGANISATIONS

A SUSTAINABLE PATH FORWARD

1. Legal Structure for the Centres

Legally, the CoEs and CoCs have a flexible initial set-up, which provides possibilities to apply a different legal structure and incorporate dedicated entities with own legal personality. All Centres have initiated their operations based on and within the framework of Partnership Agreements defined for this purpose, with one Centre also incorporating an association. Almost all Centres will clearly benefit from the creation of separate legal entities, with a degree of autonomy, entrusted with the development of the common interest of the partner organisations within the Centre-projects. The proposed legal entities are generally divided in two broad groups:

- "facilitators" where some particular activities are entrusted to professional independent teams such as coordination, representation and promotion of industry collaboration; and
- "fully integrated governance structures" where Centres become even more integrated and empowered organisational structures capable of also managing the research infrastructure.

Thus, looking ahead, especially in the period after 2023, the Centres should establish a clear institutional setup, on a more permanent basis than the current consortia, with professional management and staff entrusted through clear rules with responsibilities to support or respectively lead the sustainable development of the Centres. Thus, the Centres should opt for one of the following scenarios:

- Incorporate Non-profit Organisations / Associations / Foundations with a **varying degree of competence entrusted to the separate legal entity – the autonomous organisational unit** (depending on the Centres' individual situations, goals and needs). This is recommended for the majority of the Centres. Each of these entities shall have their own clear mandate, whether:
    - acting as a **parallel body supporting particular activities** of the partner organisations (described across the report as **less integrated model or above - as "facilitators"**) serving for tasks such as better coordination, representation vis-à-vis third parties, improved industry collaboration, support to joint project application and participation. This model would be suitable for Centres which would benefit from some degree of integration but where the partner organisations prefer to preserve their competences over the research infrastructure and for Centres which have already opted for a federalised structure as the most suitable one (e.g. the National Centre of Excellence in Mechatronics and Clean Technologies with its

17 partners). Where sharing of infrastructure is necessary this can be done through (framework) agreements, OR

- as a **more integrated model** (**structure, referred to above as "fully integrated governance structures"**) entrusted with more competences including in the first place the ability to **manage the research infrastructure** as an independent entity, to **set the research agenda**, to manage its own scientists and larger number of staff. This structure would be appropriate for some Centres in which the work packages as well as the research infrastructure across the partner organisation and its usage are all fully interlinked and dependent upon each other thus requiring a deeper integration in decision-making (examples include CoC Clean and Circle).

In the case of CoE 'Informatics and Information and Communication Technologies' there does not appear to be an obvious need for creation of a separate legal entity due to the concentration of funding and leadership into one partner, and to their claimed successful previous experience in management of similar projects and.

For a number of Centres, updating the Partnership Agreements may serve as an intermediate step to the creation of separate legal entities. Similarly, the adoption of the less integrated model could at a later stage lead to more integration and more competences being granted to that separate legal and organisational entity.

For three of the Centres related to health and medicine and led by the Medical Universities in Plovdiv and Pleven, as well as the National Centre for Infectious and Parasitic Diseases, respectively, the situation appears to be more particular, in part due to the nature of their activities, and the creation of legal entities should consider this.

The purpose of creating parallel legal entities would be to facilitate operational R&D&I activities foremost among the partners and work for the interests of the Centre (with the caveat that some Centres will be more integrated structures and others less so).

By 2023, the cooperation between the members/partners of Centres is expected to be advanced. After 2023, the budget for management should be self-sustained. Having a separate entity will facilitate a framework to streamline the effective fulfilment of the five-year obligation period (2024-2028) of operation. Thus, the partner research organisations have up to 70 months overall to (re-) assess what the appropriate form should be to continue their operations, which allows them to work effectively both with each other and with third parties, including industry. Modifying the Grant Agreements before end of 2023 would create undesirable administrative hurdles. The legal entity form should correspond to the needs of each Centre. It should **ensure that the founding partner organisations involved in R&D&I activities at the Centres will preserve their interest** in the development of the Centres while they will **continue to provide their capacity** (scientific, infrastructural and administrative) and dedicate for the sustainability of the Centres, which in turn would guarantee prestige and contacts for the individual research organisations.

The above described options do not exclude the creation of public research institutes (which are organisational structures with external recognition and internal organisational independence) to help universities integrate and consolidate their R&D activities and thus participate more effectively in the Centres.

The possibilities for structuring some of the Centres themselves as public organisations should be further explored, including the example of the GATE project under Horizon 2020. Structures such as public (university) institutes could be relevant for Centres in which one organisation (e.g. a university) participates with several of its faculties requiring the pooling of human, scientific and technical resources by creating an institute entrusted with a degree of organisational independence within the parent organisation.

2. Governance Structure for the Centres

Whatever the legal framework, a streamlined governance and organisational structure is preferred which focuses its efforts on joint value adding RDI actions. Where possible, a **single structure** should be created for the effective management and/or coordination of the Centres' activities. Initially, activities could be grouped around thematic specialisations each with a manager (Component Leader and subject matter expert). The Director of the Centre, a dedicated leader with **both business understanding and scientific knowledge**, would manage the Centre and be accountable for its successful operation. Considering the reduced needs for procurements management and project implementation, the structures **after 2023 should have less layers of management and reporting and be essentially focused on research and innovation**.

Management should be able to both drive a healthy and competitive in-house research programme and to provide support for scientific access and use by external researchers as well as maintain stable collaborations with industry. This double requirement, as well as the proportion of each to be reached, will reflect on the choice of governance structure of each Centre and the qualification and competences of its leadership.

The Centres should have a professional manager with a high degree of autonomy from the partner research organisations, who can be held accountable for actions and results.

It is vital for the Centres (starting from their founding partners) to build a governance structure with **strong governance capacity** at the institutional sustainability level, strong administrative capacity as well as project application and management potential (R&D project management); and to develop common rules for functioning and ensuring **operational sustainability**.

3. Build an understanding of EU State Aid rules and apply them correctly

In order to achieve successful cooperation with industry, the partner research organisations (universities, research institutes at the Academy of Sciences as well as the private partner associations beneficiaries of funds for research infrastructure) need to build essential **knowledge and internal capacity in understanding and correctly applying EU State Aid Rules in R&D&I.** The research organisations managing infrastructure should be able to **differentiate between engaging in "effective collaboration" (which is a non-economic activity) and conducting research on behalf of undertakings (which is an economic activity).** To help with this, the report presents a step-by-step methodology based on the experience of the experts.
The Grant Contracts impose obligations, but even after formal ending of the implementation of the current funding period (2023) the state aid rules and principles will continue to apply. There are rules and requirements on two levels:

- on the level of the research organisation and research infrastructure (e.g. the 20 per cent capacity rule and the ancillary nature of economic activities), and
- in all relations, contracts, collaborations with other entities in particular undertakings (both in the context of economic and non-economic activities).

"Non-economic activity" is a concept with specific requirements and cannot be equated with "non-profit". **Separate accounting** of economic and non-economic activities is mandatory for all research organisations conducting economic activities, for which an adequate financial administration is necessary. **Analytical costing** is necessary for allocating the costs of **overhead factors** to the respective utilisation by the various activities. Cross-subsidisation of economic activities by public financial means must be avoided.

If the economic activities of the Centre do not exceed 20 per cent of the overall annual capacity and fulfil the conditions for being "ancillary" then State Aid rules do not apply in their entirety as regards the research organisations as recipients of State Aid (however, research organisations can still be a provider of aid to other entities).

If revenues from knowledge transfer (KT) activities are re-invested into non-economic activities, then the KT activity will not count towards the 20 per cent capacity threshold. Thus, it may be fully financed with public financial means. However, this only pertains to the activity on the level of the research organisation, not to the IPR /research results that may be licensed/transferred to undertakings. To avoid passing on State Aid to third parties the research organisation should charge **fees in conformity with market prices or the equivalent of market prices.** Research organisations need to distinguish between **KT/TT *as an activity*** (impacting capacity usage of the research organisation as a recipient of aid) and the actual **transfer *as assets*** (impacting relations with third parties and creating possible indirect aid).

4. Build capacity in Technology Transfer and strengthen collaboration with industry

Technology Transfer (TT) and industrial collaboration strategies should be developed according to actual demand needs and future opportunities including contract research, joint laboratories, Proof of Concept (PoC) funds, licensing and spin-off creation.

There is a clear need for TT capacity building in the country. This activity should include continuous education of the technology transfer offices (TTO) staff across all Centres. The **appointment of a TT manager** within each Centre will allow more efficient coordination of TT activities between the Centre and partner institutions' TTOs. Centre management should **create a favourable internal framework and streamline the process of spin-off creation** that will encourage scientists and researchers to engage in entrepreneurial activities in parallel with their research work, including networking opportunities and mentoring programmes. **Investor readiness programmes in Bulgaria must also be improved and adjusted** to the needs of the research and deep-tech oriented funds, as well as to the particular characteristics of researchers.

Academia-industry collaboration could be formalised to discontinue some non-transparent practices, which can be self-interested and do not bring the added-value potential to the economy and society. Research organisations should build experience in negotiating and structuring more complex and longer-term joint activities with industry including of the type "effective collaboration".

5. Strive for sustainability

The Centres should **utilise their full potential for increased sustainability** achieved through:

- Increased economic and non-economic collaborations with industry in the short-, mid- and long term;

- Research commercialisation through licensing and spin-off creation in the mid-to-long term
- Increased participation in international projects (e.g. Horizon Europe).

The Centres should take a more proactive role in organising their sustainability, especially after 2023, by not relying exclusively on (guaranteed) block public funding and support.

Since most Centres have prepared their scientific programmes and plans for collaboration with industry in 2016-2018, these should be substantially updated, taking into account that a large part of the infrastructure has been procured and the Centres are becoming increasingly operational. While in some Centres the plans for collaborations are based on careful and detailed track record and analysis, others only have plans at conceptual stage and will need to conduct a deeper and/or more specific market consultation. The Centres would also benefit from developing more comprehensive business plans that capture the vision and strategy for their long-term sustainability.

1. INTRODUCTION

1.1 BACKGROUND OF THIS PROJECT

About €220 million of funding from the European Regional Development Fund (2014-2020) has been dedicated to the Priority Axis (theme) "Research and Technological Development" in Bulgaria. Of this, approximately €160 million EU funding (combined with national co-funding resulting in a total of approx. €190 million) is dedicated to the establishment of 14 Centres of Excellence (CoEs) and Centres of Competence (CoCs) in the country, under the "Science and Education for Smart Growth" Operational Programme (SESG-OP). The SESG-OP is managed by an Executive Agency to the Ministry of Education and Science of Bulgaria, acting as a Managing Authority (MA).

Based on the partnership principle, the Centres are projects that involve a large number of partner organisations. Fourteen contracts for Centres are signed and the projects are at different stages of implementation. The CoCs and CoEs follow the Smart Specialisation priorities of Bulgaria (Mechatronics & Clean Technology, Informatics & Information and Communication Technologies, New Technologies in Creative and Recreational Industries, Industry for Healthy life and Biotechnology) and are to be operational by 2023.

Four Centres of Excellence focus their activities more on fundamental research and require strong involvement of the science community. In addition, ten Centres of Competence focus on applied research activities with potential for quick industrial uptake.

A major goal of the supported actions is to enhance the level and market orientation of research activities of the leading scientific organisations in the country, to improve the potential for applied research, experimental development and innovation. The financial support is provided not only for infrastructure (including the construction/modernisation of buildings and the purchase of equipment) but also for knowledge transfer activities, commercialisation, and creation of spin-out companies, among others.

After procedural delays and challenges in the initial phases of selection and implementation, the Managing Authority of SESG-OP approached the Joint Research Centre (JRC) – through DG REGIO – with a request to provide external support. The JRC was tasked with supporting the projects with concrete recommendations and suggestions for the operation and effectiveness of the Centres, in particular with a view to facilitate the deployment of the projects and help ensure their long-term sustainability.

1.2 NATIONAL RESEARCH AND INNOVATION OVERVIEW

Bulgaria is in the process of transformation from the era of centrally planned economy with common ownership of the means of production, and its legacy in terms of structure, governance and focus of scientific institutions, infrastructure. Currently, the Bulgarian Research and Innovation (R&I) system is composed of non-integrated public and private segments. The public segment comprises the state-owned higher (tertiary) educational institutions (HEIs), public research organisations (mainly the two leading academies, Bulgarian Academy of Sciences (BAS) and the Agricultural Academy (AA)), and other public research institutes (centres/labs) working under different sectoral ministries or agencies. The private segment covers higher education institutions,

private research organisations (including those registered as non-profit NGOs) or privately held companies, involved in RDI.[2]

The system is highly centralised in terms of regulation and control. The main competences in scientific and innovation policy are clearly divided between the Ministry of Education and Science (oriented towards the public segment) and the Ministry of Economy (dealing with the private sector).

Although a relatively new phenomenon, clusters, TTOs, Sofia Tech Park, networks and platforms in Bulgaria are the organisations responsible for the dissemination of knowledge and research results. They facilitate the search for partners in Bulgaria and the EU for joint RDI projects, and promote cooperation and development of scientific, technological and business collaborations.

New research complexes established include contracted CoEs, CoCs and planned Regional Innovation Centres (RICs). The CoCs and CoEs go through three stages: synchronisation (2017-18), building (2019-20) and development (2021-23). Total funds allocated by 2023 will amount to €504M, of which 45 per cent will come from national funds and 55 per cent from EU funds, thus providing a balance between the state and EU financing.[3]

SCIENCE BASE

Bulgarian science is strong in physics, chemistry, biological science, and engineering. The traditions of Bulgarian agriculture and medicine are combined with achievements in ICT and automation, recognising that the industries of the 21st century will depend increasingly on the generation of knowledge through creativity and innovation. Specific "smart" sectors have been identified, where Bulgaria possesses the potential to make a breakthrough Informatics and ICT, Mechatronics and Cleantech, Industry for a Healthy lifestyle and BioTech, and Creative and Recreational industries.[4]

Research infrastructures and the large scientific complexes guarantee a high level of research and create conditions for fast economic growth and employment.[5] Mapping of Bulgarian research infrastructures and research equipment in 2017 counted 161 research infrastructures, facilities and equipment: 57 in Physical, Material Science and Engineering; 61 in Medical and Agro-biosciences field; 29 in Social Science and Humanities; and 14 in e-Infrastructure for multidisciplinary research fields. There are 12 research infrastructures with EU-level significance, 84 with national, and 65 with regional significance.[6] The CoEs and CoCs are also a part of the National Roadmap, which allows the provision of additional funds for operational R&D activities.

R&D FUNDING

There are three main sources of R&D funding in Bulgaria: the business sector (25 per cent), the government (30 per cent), and foreign funding (45 per cent). Since 2010, the direct support from the government has declined. Support from the European Commission - as the main source of

[2] https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/rio-country-report-2017-bulgaria

[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/764557/Bulgaria_Country_Snapshot_2018.pdf

[4] Ibidem.

[5] https://ec.europa.eu/research/infrastructures/pdf/roadmaps/bulgaria_national_roadmap_2017_en.pdf

[6] https://rio.jrc.ec.europa.eu/en/library/specific-support-bulgaria-final-report-research-evaluation-and-performance-based-funding

foreign funding - remains almost stable in size but is low in comparison to the other sources of R&D financing.[7]

R&D intensity in Bulgaria is very low: only 0.75 per cent of GDP in 2018, far below the national target of 1.5 per cent. R&D spending is very low, in both the public (0.21 per cent of GDP in 2018) and the private sector (0.54 per cent of GDP in 2018). Investment in research remains fragmented and is concentrated in the capital region and within multinational companies.[8] However, the Bulgarian Government has announced its intention to gradually increase public R&D spending and by 2025 it should reach 1 per cent of GDP. The authorities have also announced a doubling of the budget for research programmes to support the Strategy for Development of Scientific Research 2017-2030.[9]

Bulgaria has a 'dual-support' system for public research funding: competitive (project) funding and institutional funding. In institutional funding for research, different models apply for the public research institutes (PROs) and the public HEIs.[10]

The PROs receive block funding for infrastructure, equipment, salaries, etc. Different rules for the budget definition apply for:

- The BAS, for which the amount of institutional funding is defined annually by the parliament in the Budget Law where the Ministry of Education and Science (MES) acts as an intermediary without supervisory power; and
- The AA is funded from the state budget through the Ministry of Agriculture and Food (MAF) and is under the dual control of MES and MAF.[11]

In the case of the public HEIs, funding for research is a component of the overall institutional funding. The budget comprises three components: block funding for educational activities, performance-based funding, and by law a minimum 10 per cent earmarked for conducting research. In all three components, the size of the HEI budget is based on the number of students.[12]

There are three main sources of competitive funding for research:

- The **National Science Fund (NSF),** managed by the MES, is in charge of the national competitive funding for research. The NSF funds both basic and applied research as well as training for public-sector institutions.
- **ESIF Operational Programme funding for 2014-2020** dedicated to R&I; and
- **EU research funding programmes** such as COST, Horizon 2020 etc.[13]

EU funding through the Operational Programmes (OPs) and the Framework Programme (Horizon) is the main source for the funding of competitive research in Bulgaria.[14]

The 2014-2020 European Structural and Cohesion Funds has been strategic for the R&D system. National co-financing for R&D projects, funded by operational programmes like "Education and Science for Smart Growth" and "Innovation and Competitiveness" is estimated at €27.75M for

[7] Ibidem.
[8] Ibidem.
[9] Ibidem.
[10] Ibidem.
[11] Ibidem.
[12] Ibidem.
[13] Ibidem.
[14] Ibidem.

2018-2020, whereas EU funding for the same period is estimated at €157.25M.[15] Funding for the National Roadmap for research infrastructures is estimated at a total of €35.5M, given that the EU funds for CoEs and CoCs will fund the budget gaps[16] of research infrastructures in the National Roadmap. The NSF will provide €9M to national research infrastructures, mostly for operational R&D projects and programmes. Provided that CoEs and CoCs became fully operational in 2018[17], it was expected that the total value of successful project applications by Bulgarian partners to Horizon 2020 Programmes and other competitive EU calls will reach a total €170M in 2018-2020.[18]

Challenges and Restraints

The most serious, overarching challenge for the country's R&I system is the lack of integrated policy instruments including mechanisms to support shared infrastructures[19], which play an increasingly important role in the advancement of knowledge and technology. In other countries and ecosystems integrated policy instruments have been key to stimulating public-private collaborations and to create and stimulate markets.

The other principal challenges and failures in the Bulgarian R&I system may be categorised according to a typology of failures in national innovation systems (See details in Table 1):[20]

- capability failures
- institutional failures
- network failures
- framework failures

***Table 1**. Failure Mode Analysis of the Bulgarian R&I System*

Failure Mode	**Causes**
Capability failures:	• Decline in research capacity • Stagnation in research quality • Insufficient research activity in universities • Insufficient exploitation of R&D results • Insufficient absorptive capacity in the domestic business environment
Institutional Failures	• Fragmentation of the research system • Fragmentation of the HE system • Ongoing research-education divide • Insufficient co-ordination and integration of research
Network Failures	• Barriers for intra-research collaboration • Barriers for industry-science collaboration

[15] UK Science and Innovation Network Country Snapshot: Bulgaria, 2019 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/764557/Bulgaria_Country_Snapshot_2018.pdf

[16] Ibidem. The funding for the CoEs and CoCs is at present only for the project period (2018-2023)

[17] This appears to have been an overly optimistic prognosis considering the constructions works and time needs.

[18] UK Science and Innovation Network Country Snapshot: Bulgaria, 2019

[19] Except the National Roadmap under which distributed infrastructures complexes (groups of infrastructures) are eligible, for which however national funding remains rather limited in size.

[20] https://rio.jrc.ec.europa.eu/en/library/specific-support-bulgaria-final-report-research-evaluation-and-performance-based-funding

	• Barriers for internationalization of research
Framework Failures	• Little demand for innovation • Limited value attributed to research and knowledge creation among politicians and governments

Bulgaria's R&I system also faces a number of structural shortcomings. These include low levels of public and private R&I investment, fragmentation of the public science base, lack and ageing of skilled human resources, weak science-business links and inefficient governance. All these deficiencies are holding back the potential contribution of R&I to productivity and economic growth. Bulgaria is among the worst performers ('modest' innovator) in the European Innovation Scoreboard, with an overall level still below 50 per cent of the EU average.[21]

The quality of the Bulgarian science base (measured by the share of highly cited scientific publications in all national publications) is the lowest among all EU countries (in 2016, 3.1 per cent of Bulgarian publications were highly cited, compared to the EU average of 10.3 per cent).[22] This reflects the low public expenditures for R&D.

High fragmentation of the research and higher education system is a key obstacle to improving its performance. The small public research budget is distributed over a large[23] number of universities and research institutes.[24] The results of the 2018 report led by Luc Soete highlight that increased funding for R&D will not bring the desired results unless the number of public universities (grouped into entrepreneurial and research universities) is reduced.[25] This report's findings from 2018 were not easily welcomed by the core stakeholders in the country. Nevertheless, we note that in mid-2020 the government published for consultation its newly proposed Strategy for the Development of Higher Education 2021-2030 which appear to have taken into account at least some of the recommendations.[26]

Links between academia and businesses are still insufficiently developed to support knowledge and technology transfer (TT). This is also reflected in the low share of public-private scientific co-publications. Several relevant initiatives to promote innovation, knowledge transfer and science-business links are slowly progressing, supported by the ESIF. The planned Regional Innovation Centres (RICs)[27], as well as the CoCs and CoEs, will serve as a link between science and business and local/national authorities. Participation of Bulgarian scientists and innovation entrepreneurs in European programmes, as well as synergies between national and operational programmes and other Commission programmes such as Horizon 2020, are limited.[28]

Knowledge circulation among universities, research institutes and the business sector is a major challenge. The deficit in knowledge exchange and cooperation is visible at various levels. Knowledge exchange between universities and the research institutes of the BAS and the AA

[21] https://ec.europa.eu/info/sites/info/files/2020-european_semester_country-report-bulgaria_en.pdf
[22] https://ec.europa.eu/info/sites/info/files/2020-european_semester_country-report-bulgaria_en.pdf
[23] In Bulgaria there are 51 Universities (state and private financing), 42 Institutes of the Bulgarian Academy of Sciences (BAS), and 17 Institutes of the Agrarian Academy (AA).
[24] The Managing Authority expressed the following clarification: "*The conclusion on the large number of Higher Educational Institutions should be considered together with an assessment of their size. 1/3 (a total number of 17) of Bulgarian HEIs cover more than 70 % of the students in the country. 60% (a total number of 31) of Bulgarian HEIs cover more than 90 % of the students in the country. Further assessment could be done with regard to their research activities and potential.*"
[25] Luc Soete (2018), Specific Support to Bulgaria: The research evaluation and performance-based funding system in Bulgaria, https://rio.jrc.ec.europa.eu/sites/default/files/report/SS%20Bulgaria_Final%20Report_3.pdf
[26] http://strategy.bg/PublicConsultations/View.aspx?lang=bg-BG&Id=5238
[27] The status of the RICs as of February 2020 was: procedure ongoing.
[28] https://ec.europa.eu/info/sites/info/files/2020-european_semester_country-report-bulgaria_en.pdf

predominantly occurs both in the context of formal post-graduate education, and at an individual informal level through teaching activities in the universities by scientists employed in the BAS/ AA institutes[29]. Long-term strategic partnerships between universities and BAS/AA research institutes are rare[30]. The CoEs and CoCs are among the first coordinated initiatives to foster collaboration between research institutes and universities.

Research-industry links are impeded by the lack of a critical mass in research performing industrial actors in the country and the low technological absorptive capacity of the domestic private sector.[31] Intellectual assets are a strength in Bulgaria in terms of trademark and design applications. However, Bulgaria still performs far below the EU average in terms of PCT patent applications (EC, 2017).[32]

1.3 PROJECT OUTLINE

A group of independent experts in the thematic areas outlined below carried out research and fact-finding missions to meet with relevant stakeholders and assess Bulgaria's research and innovation context first-hand. Their analysis and recommendations are presented in this report.

This study, led by the JRC's Centre of Competence on Technology Transfer (CCTT), presents tangible and customised recommendations divided into the following themes:

- ***Legal and Organisational Frameworks:***
  - An analysis of the existing legal framework and relevant legislation was carried out to identify opportunities and challenges for the Centres, as well as potential improvements needed.
  - Recommendations based on existing best practice are outlined to determine potential governance and organisational models for each Centre.
  - The advantages and disadvantages of each model are also analysed.
- ***State Aid rules:*** The experts have assessed the possible State Aid related implications of the Centres' activities and provided basic recommendations.[33] This includes:
  - Differentiation and proper classification of economic and non-economic activities
  - Requirements and conditions in various situations, activities and collaborations
- ***Research Infrastructures:*** Recommendations on:
  - The most appropriate management scheme and approach to access rights for RIs for the Bulgarian context.
  - Actions to optimise the utilisation of the RI's are outlined, with some detail on appropriate monitoring mechanisms. The effective, full and State Aid-compliant utilisation of the RI is necessary to support the sustainability of the CoEs and CoCs.
- ***Technology Transfer and Commercialisation:*** This study presents in-depth analysis of:

[29] https://rio.jrc.ec.europa.eu/en/library/specific-support-bulgaria-final-report-research-evaluation-and-performance-based-funding
[30] Still, there appear to be "framework agreements" between research organisations for certain joint activities.
[31] Ibidem.
[32] Ibidem.
[33] JRC published in Q4 2020 a dedicated Guidance in the form of a Decision Tree for research organisations to help the latter better understand and correctly apply EU State Aid rules in R&D&I: https://ec.europa.eu/jrc/en/publication/state-aid-rules-research-development-innovation

- Existing national legal framework for TT in Bulgaria, as well as advice on how to improve the national legal context.
- An outline of local TT offices, with recommendations on optimisation, use, and possible collaborations.
- Current TT skills in the country, identifying training and development gaps.
- Current Proof or Concept (PoC) mechanisms for technical and financial support along with gaps and advice for enhancing the current context.
- Incubators and accelerators in Bulgaria, with recommendations on the future development needs.
- Identification of stakeholders and existing resources in early stage investment and investor readiness, and necessary conditions for the increased support.
- Approaches to most effective models of industry-academia interaction.

The report concludes with a roadmap for longer-term support, to be procured in a potential second phase of this work, and presents Centre-specific recommendations for the 14 Centres.

2. LEGAL FRAMEWORK

2.1 EXISTING LEGAL FRAMEWORK AND EXPECTATIONS

There are several relevant policy documents and legislative acts identified in relation to the overall R&I system in Bulgaria:

- The **National Strategy for Development of Scientific Research in the Republic of Bulgaria 2017-2030: Better Science for Better Bulgaria** is the main overarching policy document on research, which defines the basis for future development.
- Operational Plan for the execution of the first stage of the Strategy[34]: clearly stipulates that the Law for the Promotion of Research should be amended to put the two activities research and technology transfer on equal footing with the educational activity of the HEIs.
- National Roadmap for Research Infrastructures 2017 – 2023: recognises the CoEs and CoCs as structures of national significance.
- Law on Higher Education: provides universities the right to conduct commercialisation activity that is connected to their primary purpose and orientated at the realisation of scientific research results and other IPRs. Universities in Bulgaria currently do not have a specific clear mission to commercialise research results, although they have the full right to do so.
- Council of Ministers' decree of 2 April 2020[35]: the act implements the relevant provisions of the Law on Higher Education and stipulates specific conditions and limitation concerning the creation of commercial companies (including spin-offs) by HEIs (see more in the Chapter on Technology Transfer of this report).
- Law for Promotion of Research Activities: stipulates that the state shall create specialised framework, order, and conditions for operation of unique scientific infrastructures. Unique scientific infrastructures are facilities, research centres and integrated complexes that have highly specialised equipment and facilities, offer specialised scientific services, have no analogue at national level and / or are a partnership structure of infrastructures defined by the European Strategic Forum for Research Infrastructures and included in the European Roadmap for research infrastructure. The **Law further** states that TT is one of the priorities to be promoted alongside the dissemination of the scientific research results.
- Law on Patent and Utility models registration.
- Law on the Bulgarian Academy of Sciences: provides that the BAS can conduct commercial activities connected to its research and the application of its scientific research results. The BAS and its independent institutes can own rights in properties, patents, and hold equity in commercial companies or associations.
- Statute of the Bulgarian Academy of Sciences: provides that the budget of the BAS cannot be used to sustain commercial activities. The units of the BAS that conduct commercial activity

[34] Operational Plan for the execution/implementation of the first phase of the National Strategy 2017-2030, http://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=1231.
[35] ПОСТАНОВЛЕНИЕ № 61 на МС от 02.04.2020 г. за условията и реда за създаване на търговски дружества от държавните висши училища за целите на стопанската реализация на резултатите от научни изследвания и обекти на интелектуалната собственост.

must ensure the application and utilisation of the research results are economically beneficial/efficient for the Academy, including the benefits obtained through the financing of scientific projects of the independent scientific units. The Statute confirms that the Academy can take an equity stake in commercial companies.

- Rules of the Academy of Sciences on the protection and utilisation of IPRs (2009): **stipulates that** the respective employer institute is the owner of the created IPR. The general rule is that 50 per cent of the income from the commercialisation goes to the inventor, 30 per cent for the institute and 20 per cent for the BAS. The institutes of the Academy are separate legal entities and may have their own rules on the revenue sharing from commercialisation (we have observed that some institutes provide for slightly different revenue sharing vis-à-vis the Joint Innovation Centre, however the institutes' rules appear to have similar provisions to the BAS Rules).

In all institute-specific IPR regulations, the general principle used is that ownership over the research results belongs to the respective institutes as employer, and the scientists have the right to be 'joint owners' and to participate in joint applications for IPR protection (e.g. patent applications). In any case, the scientists are entitled to compensation for IPR creation.

Beside the above-mentioned laws and regulations, most large universities participating in the CoEs and CoCs have implemented their own rules and policies related to IPRs protection and management and some have developed commercialisation policies. The rules of the Centres on IPR either are based on or largely resemble the rules of the founding partner organisations. Often, there is a direct reference to the rules of the lead partner, which shall "apply to the activities of the Centre". Examples are:

- IP Rules Academy of Sciences BAS, 2009, General Rules (mentioned above)
- IP Rules Sofia University & Commercialisation policy
- IP Rules Technical University Sofia
- IP Rules University of National and World Economy Sofia (UNWE)
- IP Rules Plovdiv University
- IP Rules Plovdiv Medical University
- IP Rules University Hospital Plovdiv

In general, these rules tend to be similar, mostly regulating the internal procedures between researchers and the host institution/employer, notification of potential inventions, decisions on funding the patent filing, while the main difference being in terms of income sharing arrangements from commercialisation activities between relevant parties. In parallel to the IP Rules, there are also usually the Rules for Access to RI/equipment. It falls outside the scope of this study to assess the IPR rules of all universities in Bulgaria and it might be the case that some still do not have their own IPR policies and guidelines. Even where universities have the IPR rules and policies, they may not have a commercialisation strategy or policy yet.

In Table 2 we provide an overview of the types of organisation involved in the Centres, this has important implication in several aspects (legal, State Aid, access to RI, etc.)

***Table 2**. Overview of types of organisations participating in the CoCs and CoEs as beneficiaries of funding*

- State Universities
- BAS Institutes
- Agricultural Academy
- State Institutes with particular status (Institute for Infectious and Parasitic Diseases directly under Ministry of Health; National Diagnostic Science and Research Veterinary Medical Institute; Medical Institute of Ministry of Interior)
- Private Associations & Foundations in several Centres (HITMOBIL, Quasar, Clean and Circle, Miracle)
- One private university (College of Insurance and Finance)
- Museums, Libraries

Several of the public organisations partners are of a more distinct nature, including:

- The Institute for Infectious and Parasitic Diseases is a publicly funded entity directly under Ministry of Health. Although the Institute officially produces some biological preparations for diagnosis, therapy and immunoprophylaxis, its income is structured under the principles of the Health Act, i.e. sources are limited within: budget subsidies, donations and wills, state fees, scientific and expert activity, higher education fees. It has a status of a research organisation that also conducts applied research. The National Diagnostic Research Veterinary Medical Institute is a specialised structure of the Bulgarian Food Safety Agency. The latter is a budget-funded agency, but its sources of income include all kinds of services and "other activities". It is clearly allowed to perform economic activities, most specifically services, within its competencies.

It should be noted, that the assessment of the status of knowledge transfer in Bulgaria delivered by the World Intellectual Property Organization this year (2020) confirms that "the core legal framework of IP laws needed to protect innovation and facilitate commercialisation" seems to be sufficiently developed in the country, opinion also shared by the authors of the present report.

2.2 Institutes of the Bulgarian Academy of Sciences and Universities/HEIs

Two types of public institutions make up the majority of entities participating in the Centres of excellence (CoE) and competence (CoC): 1. The *Institutes of the Bulgarian Academy of Sciences* (BAS) and 2. *Higher Education Institutes (HEIs)*. In some cases, other smaller entities are involved (e.g. smaller academies, private not-for-profit associations in public and private interest).

Associations in private interest are: (i) Advanced Flight Technologies in CoC QUASAR, (ii) Clean Technology Institute (SICT) in HITMOBIL. Cleantech Bulgaria in CoC "Clean and Circle" is a foundation in private interest. GIS Transfer Centre participates in CoE Miracle and is a foundation in public benefit. The Clean Technologies Institute under the Bulgarian H2 Society is an association in public interest.

The *Institutes of the Bulgarian Academy of Sciences* (Institutes) are independent legal entities and act as largely independent units in the structure of the BAS. The Bulgarian Academy of Sciences (BAS, the Academy) is a national autonomous research organisation operating under a law completely separate from the HEIs.

In terms of the activity and structure, the following laws and regulations apply to BAS:

- Bulgarian Academy of Sciences Act, promulgated in 1991, last amended in 2018;

- Statute of the Bulgarian Academy of Sciences, promulgated in 1994, last amended in 2010;
- Rules of Procedure, Organisation, Management and the Internal Labour Order of the Institutes of BAS (Regulations).
- IPR Management Rules of 2009
- Rules of individual institutes on IPR (some have, others may not have and use the general rules of 2009)

In relation to universities /HEIs, the following are applicable:

- Higher Education Act;
- Council of Ministers Decree of 2 April 2020 (see Chapter on Tech Transfer below)
- Individual internal IPR rules and Commercialisation strategies (where these exist)

The provisions of the **Development of Academic Staff Act** apply to both universities and Institutes of BAS. The Act regulates the professional development and hierarchy of the scientists in their academic career, which will be very relevant to their willingness to dedicate a larger portion of their time to the Centres.. The sustainable engagement and interest of capable scientific specialists is affected by a variety of factors and conditions, one of these being their academic career and its gradual development.

Most of the Centres' founding partners are public/budgetary organisations and, yet, none of them has a (financially) sustainable separate legal structure. If the Centres become legal entities later, they will most probably not be treated as a secondary distributor of budget funds. In any case, their relationship will be regulated by the principles of the **Public Finance Act.**

Heads of budgetary organisations are responsible for the establishment, operation and reporting of financial management and control systems in accordance with the Public Finance Act. The same persons are also responsible for carrying out an assessment of compliance with the legislation in the field of State Aid in the cases when funds are allocated at the expense of the respective budgets in favour of persons that are non-budgetary organisations (e.g. private companies), including for: (i) expenses, subsidies and remunerated financing, (ii) guarantees, capital transfers and lost revenues and benefits, as well as for other forms of support. The same assessment is carried out before the allocation of the funds and in the cases when the persons - non-budgetary organisations (i) are partially exempted from payments to the budget in any form, (ii) receive or provide rights, assets or services under conditions other than market conditions and (iii) receive selective preferences and reliefs.

The National Strategy for the Development of Research 2020 is also important for the direction of development of BAS and, accordingly, for the financing and perception of its Institutes as part of the state-supported sphere. This document should not be treated as a legal act *per se*, because it does not meet the requirements of the strict structure of the Legislative Regulations Act. However, because it is adopted by the National Assembly and it comments on EU regulations and their local application, it can be considered as a *sui generis* form of law. Similar treatment should be applied to the Innovative Strategy for Smart Specialisation 2014-2020 adopted by the Council of Ministers in 2015 and similar subsequent documents regulating the same field.

Universities are HEIs whose activity is regulated by the Higher Education Act/Law. Almost all universities participating in the Centres are state-owned. One of the beneficiaries (VUZF) is a private university and receives rather limited funding and mostly for services (370k BGN). These state universities teach a wide range of vocational disciplines in at least three of the four major fields of science - humanities, natural, social and technical. They are created and closed by a

decision of the National Assembly. The decision for their creation shall specify: (i) type, (ii) name and headquarters, (iii) activities, and (iv) ownership and mode of funding. In addition, universities are managed by the Council of Ministers, the Ministry of Education and Science and, from a budgetary point of view, they are controlled and supervised by the Bulgarian National Audit Office. In Q1 2020 a new model was introduced for the overall strategic management of the state HEIs and the setting of their priorities – see Table 3 below for an overview.

***Table 3**. Relevant extracts from the amendments of the Law on Higher Education (25th February 2020)*

Overall goal: The new model of management of the higher education institutions aims to have set clear responsibilities over their management, transparency and accountability.	• The Minister of Education and Science establishes a policy for the development of each State Higher Education Institution with strategic objectives, tasks, target values and performance indicators. • The Minister shall conclude a contract for management with each rector for the duration of the term of service of the Rector supervises the execution of this contract and adopts an annual report for its implementation. The management contract stipulates the concrete mechanisms and indicators for the implementation of the policy for development (for each year). The rectors are obliged to report on the execution of the policy and the results achieved, the financial situation of the organisation and the problems encountered. The transfer from the public budget can now also be used for the realisation of the strategic objectives and tasks agreed with (adopted by) the Ministry. • A higher education institution which makes a significant contribution to the development of important societal areas/fields through research excellence and high results of scientific research activity - assessed according to objective indicators/criteria, including the number of published and referenced scientific articles in international databases, number of international patent applications, to be specified in an act of the Council of Ministers - can be designated as a "research university". The list of "research universities" is adopted by the Council of Ministers. Once listed, the status of Research University is valid for 4 years. The list is updated yearly. PhD teaching can only be conducted by the universities that received accreditation grade/level between 8 and 10 (on a 1-10 scale). • The minimum salary for the lowest academic posts in the universities is determined by the Council of Ministers.

STATE BUDGET FUNDING FOR BAS

The applicable legislation provides for considerable freedom in the formation of the budget of the BAS, giving it the opportunity to develop independent economic activity and to generate revenue under concluded contracts for research projects, from the transfer of intellectual property rights, and other services or products. BAS's budget is formed by a state subsidy specified in the annual *Law on the Budget* and by the revenue from its own activity. The budget of BAS, including real estate projects and the distribution of the budget, are approved and distributed by the General Assembly of the Academy upon the proposal of the Board of the Academy. The Chairman of BAS is authorised to manage the budget of the Academy and its funds in accordance with the resolutions

of the General Assembly. This mechanism has a direct impact on the funding and distribution of the budget of the Institutes, with the waterfall principle being applied for redistribution. For many Institutes, this is only a part of their budget because their own-source revenues do not fall back into the financial flow to the Academy. Instead, revenues generated by the individual Institutes remain at their own disposal. This arrangement supports the impression for only partial implementation of the principles of budgeting in public administration and the obvious possibility for independent business initiative. State budget is centralised and its distribution is fixed for the respective accounting period. For the academic structures, it covers only expenses for salaries, social insurance and taxes, without any funding for investment or business initiatives.

During the meetings in September 2019, Prof. Rivalski explained that out of the 150m BGN budget overall for the Academy, approx. 60 per cent comes from the government and 40 per cent is project-based while about 10m BGN comes from industry. The Institutes' revenue is formed of contributions from the Academy's budget, research income, and other sources.

In terms of flexibility in using the financial resources, the Institutes have to comply with the debt ceiling (i.e. cannot commit funds which have not yet been transferred) for the state subsidy but not to funds received through external activities. This is a framework requiring combining public and private administrative approaches, which may become rigid if the public approach extends to all income. The Institutes' property is virtually private property consisting of real estate rights and limited real estate rights, bonds, shares in commercial companies, and intellectual property rights. In addition to the aforementioned rights, the National Assembly also gave the Academy ownership rights over state-owned and movable property in possession of the Academy. The Institutes have no right to dispose of the real and bond rights of the Academy, but there is full freedom of disposition with respect to the real and bond rights acquired through their own funds or transactions concluded with third parties. The law provides for full autonomy of the Academy vis-à-vis the Institutes and vice versa with respect to the obligations assumed by each of these structures. Only in exceptional cases, by decision of the General Assembly, BAS may secure and be responsible for the obligations assumed by the individual Institutes. In this sense, there is no automatic connection between the obligations of the individual institutes and the Academy. All BAS Institutes – partners in the Centres – are able to undertake commercial initiative, to transfer and acquire ownership, and to enter into the full variety of commercial agreements available to commercial entities. On the other hand, institutes could be subject to enforcement proceedings.

In the case of the universities, state subsidy is also a major source of funding. Additional sources of funding are rather minimal. Even the case law perceives universities as so-called "public institutions" against which enforcement of court decisions is not allowed, subject to the provisions of the applicable procedural laws.

The different level of freedom in commercial activities, flexibility in taking decisions and the different exposure to risk from sanctions will cause differences between the universities and BAS institutes in a fully operational Centre after the end of the project, provided the latter is not a separate legal structure. A separate legal structure may serve to limit the risk and liability for both universities and institutes and will disconnect the liabilities of the Centre from the different partners' patrimonies.

Existing Organisational Aspects and Participation in Commercial Ventures by BAS Institutes and Universities

BAS Institutes also have complete freedom to form and participate in trade companies and other organisations for the purpose of conduct and application of research activities. Occupation of

management positions in companies is not permissible by persons holding managerial positions in the Institutes, except in the capacity of representative of the Institutes or of the respective independent unit. Resolutions on disposal of property owned by the Institutes and on participation in commercial companies are vested in the Directors of the Institutes upon approval by their scientific councils.

As the Institutes' scientific excellence improves, interest in its rights, resources and capabilities is expected to develop. It is advisable to develop clear mechanisms for shaping the position of Institutes vis-a-vis industry, which provides safe and credible protection of the rights of their teams and future work, and ensures the correct application of EU State Aid law (this is also valid for universities[36]).

The Board of Trustees of BAS suggests financial and other necessary mechanisms for joint scientific, educational and applied activities with Universities and commercial enterprises and assists in the creation of innovation Centres. The Scientific Boards of the Institutes approve the decisions of the directors of the respective Institute for participation in commercial companies and in non-governmental organisations.

For higher education institutions , the legislature has envisaged a somewhat more restrictive regime, both with regard to the ownership of the real estate and with respect to their income deriving from own activity. State higher education institutions may acquire and own real estate property rights only for the pursuit of their principal activity. The real estate provided by the state to higher education institutions is usually state-owned. Income from economic activities of Universities directly related to their main activities, as well as from consultancy and IP commercialisation forms part of the budget of the organisation (Article 90 of the Higher Education Act). Academic councils of the Universities decide on association with other persons, as well as on set up of commercial companies for the purpose of economic realisation of the results of research and intellectual property objects under the terms and conditions already determined by the Council of Ministers' Decree of April 2020.

2.3 Analysis of Options and Needs for the CoEs and CoCs

The analysis of the present situation shows that the Centres have started the set-up and operations based on and within the framework of "Partnerships Agreements" (one Centre has also incorporated an association). First, this approach allows assessing how the collaboration between the partners develops. Second, it allows to identify a need to form an additional legal entity, and a suitable and effective structure/form to operate effectively and with stability not only among themselves but also vis-à-vis third parties including industry.

We have looked into each of the 14 Centres and assessed the arguments posed by the Centres for or/and against the need for a legal entity (see Centre-specific part of this report). In general, this shows that the need and form for the future structuring of the Centres is influenced by the perception that the Centres at present are limited in their economic activities and cannot effectively engage with industry.[37] This was believed to become further complicated by the rather loose partnership-based structure of the Centres and the absence of a dedicated incorporated entity with own legal personality.

[36] In addition, this is also valid for all organisations (public and private) which qualify as "research and knowledge dissemination organisations" and which receive public funding.

[37] In the meantime, the implementing rules for the business activity of universities have been enacted by the Council of Ministers, which regulate part of the commercialization activities of universities (e.g. spin-off creation).

A further uncertainty seems to have been added by the condition that the Centres are limited in utilising up to maximum 20 per cent of their capacity for economic activities and the lack of understanding how to property differentiate economic from non-economic activities. This is not only related to the Grant Contract with the MA, which obliges the partners but also because EU State Aid law applies to "research & knowledge dissemination organisations" and research infrastructures regardless of their legal form. In general, we would advise against coming up with concrete ideas for a legal entity solution before analysing the arguments and the actual problems that have to be solved (focus first on identifying the problem, not the solution). In the present report, we will discuss whether separate legal entities are needed and how their creation would benefit the operational sustainability of most of the Centres.

In all cases it can be underlined that the existing Partnership Agreements (on intellectual property rights, representation, etc.) indicate the will of the founding partners to structure the Centres in a manner to give each member a fair share in participation in the strategy, functioning, management and revenue distribution of the activities of the Centre.

Boundary/Structural Conditions for the choice of a Legal Entity: Eligibility for funding from national and EU sources and related

One of the main aspects to be clarified for the future funding of the Centres and for the choice of their legal form is the need to be fully eligible after 2023 for 1) operational funding for particular R&D projects and activities from both national and EU programmes; and 2) funding for upgrade of the infrastructure in the new programming period post-2023. The idea and wish expressed by the Centres and the MA is that the legal form of the Centres should allow maximum eligibility for funding.

In Table 4 we list the sources of funding (instruments), the eligible costs/activities and the eligible beneficiaries.

Table 4.

Document/Act	**Relevant Provisions**
Horizon Europe (Proposal[38], COM/2018/435 final)	**Funding for operations and R&D Projects:** • Entities eligible for participation: any legal entity provided it fulfils the condition of the Horizon Regulation as well as the particular call/work programme. • 'legal entity' means any natural or legal person created and recognised as such under national law, Union law or international law, which has legal personality and which may, acting in its own name, exercise rights and be subject to obligations, or an entity without a legal personality in accordance with Article 197(2)(c) of the Financial Regulation. • "Coordination and support actions may be implemented by one or more legal entities […]"[39] • As a rule, entities shall be part of a consortium from at least three

[38] Proposal for a Regulation of the European Parliament and of the Council establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination.

[39] This practically means if for instance several partner organisations are applying for funding and executing joint actions under Horizon Europe, they may also utilize a separate legal entity for these coordination and support actions.

	independent legal entities each in a different country, unless other provisions apply (e.g. the work programme provides otherwise). The work programme may stipulate the number of legal entities, the type of legal entity among others. • Eligible costs: for "innovation actions" the eligible costs are up to 70 per cent except for non-profit legal entities where it is up to 100 per cent of the costs.
Financial regulation applicable to the general budget of the Union, 2018	Art. 197 (2) (c) provides that among the applicants eligible for participating in a call for proposals are, in addition to legal persons, also: • entities which do not have legal personality under the applicable national law, provided that their representatives have the capacity to undertake legal obligations on behalf of the entities and that the entities offer guarantees for the protection of the financial interests of the Union equivalent to those offered by legal persons. In particular the applicant shall have a financial and operational capacity equivalent to that of a legal person. The representatives of the applicant shall prove that those conditions are satisfied. A reference to this definition can be found in the Horizon Europe Regulation Proposal.
H2020 Programme – Annotated Model Grant Agreement (AGA) Version 5.226 June 2019[40] (pages 80-90)	Costs of renting or leasing of equipment, infrastructure or other assets as well as costs of equipment, infrastructure or other assets contributed in-kind against payment can be declared as direct costs by the beneficiary. As to depreciation costs: if the beneficiary does not use the equipment exclusively for the action, only the portion used on the action may be charged. The amount of use must be auditable. This budget category covers the costs of renting or leasing equipment used for the action (i.e. finance leasing, renting and operational leasing). One of the conditions is that these costs must not exceed the depreciation costs of similar equipment, infrastructure or assets. For renting and operational leasing: the equipment rented or leased by the beneficiary is not recorded as an asset of the beneficiary: There is no depreciation involved (since the item is still the property of the renting or leasing firm), but the rental or lease costs of the beneficiary (i.e. its periodic payments to the renting or leasing firm) are eligible, if they follow the beneficiary's usual practices and do not exceed the costs of purchasing the equipment (i.e. are not higher than the depreciation costs of similar equipment).
EU ERDF funding for Bulgaria	Eligible activities: at present, 75 per cent for infrastructure including equipment and 25 per cent for R&D projects, salaries, services etc. ➢ Note: Post 2023 the percentage ratio between infrastructure and operations should be adjusted as, in the opinion of the experts, infrastructure has already been built although there will still be needs for significant upgrading and expansion. Eligible final beneficiaries: although the major part of the funding goes to public research organisation, other actors such as private associations are also eligible under the current programme. ➢ Note: The experts believe that the next programming period of ERDF OP should envisage funding for the following two activities: 1) Independent research including for joint project of multiple research organisations

[40] https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf

	and 2) "effective collaboration" research projects performed together with undertakings, both within the Smart Specialisation sectors of Bulgaria.
National Roadmap for RIs (2017-2023)	The National Roadmap recognises and includes "Research complexes" – networks of concentrated or distributed infrastructures, consortia of research organisations, CoEs and CoEs have also been included with a view to support their sustainability. Each of these complexes/consortia may receive individual and targeted approach (understood to address its specific needs or activities).
National Science Fund Regulation for the Science Fund	The funding under the Science Fund is given for fundamental, applied research and for the dissemination of results. The Science Fund Beneficiaries are *scientists or teams of scientists from established in Bulgaria scientific organisations - legal entities that conduct research in accordance with applicable law (Art 44 of the Regulation of the Fund).* When the scientific teams are from several research organisations, a partnership agreement is to be signed in advance, stating the distribution of activities and tasks among the partners as well as the allocation of funding.

Eligibility for funding depending on the legal entity form:

- For overview in case the Centres decide to create additional parallel associations;
- Depending on the competences and mandate of separate legal entities and unless duly justified and carefully arranged, the legal entities/associations should not artificially replace the partners as the main actors and beneficiaries but streamline governance and coordination, R&D&I activities, and actually expand the funding opportunities;
- The four Centres (out of the 14) that feature private partners might not be fully eligible to apply with all their partners (as a package) to public funding specifically designed for public or public research organisations, although these partners might still be able to become involved in the execution of specific projects or activities.

Universities, BAS Institutes and other public research organisations	The public research organisations, whether individually or in partnerships, shall remain eligible for all funding that is naturally designed for them both on EU and on national level, such as funding for infrastructure and equipment, winning competitive R&D projects, block funding for independent research, funding for collaborative projects with industry etc.
Associations in private interest	More flexible decision-making and less scrutiny, however they might not be fully eligible for some national schemes designed only for associations in public interest. Pays taxes and state fees as any other legal entity in the country.
Associations in public interest	Eligible under all national programmes designed for supporting not-for-profits/NGOs/associations, however somewhat stricter requirements for decision-making and publicity. Associations in public interest could spend their funds solely for: i. development and promotion of civil society, civil participation and good governance; ii. development and promotion of ethical values, health, education, science, culture, technology, technology or physical culture; iii. support for children, people with disabilities and persons and communities at risk of social exclusion; iv. protection of human rights or the environment;

	v. other purposes defined by law. The State pursues a policy to support the development of civil society organisations and creates conditions for the promotion and financial support of civic initiatives. The state policy in the field of civil organisations is implemented by the Council of Ministers. The Council of Ministers periodically adopts and updates a Strategy for Support of the Development of Civil Society Organisations in the country. Subject to external control - the annual financial statements of associations in public interest are subject to independent financial audit under the conditions of the Accounting Act. Entitled to some tax exemptions, e.g. in cases of donations and inheritance.
Companies	We would not advise the Centres to use a company form for all their operations but only for the purposes of commercialising specific research results (e.g. a patent) through the creation of spin-offs and only where this is more appropriate than licensing. An academic spin-off is eligible for funding under various instruments including grants and equity investments including from Venture Capital Funds (see Chapter on TT of this report)

RESEARCH RESULTS /IPR SHARING BETWEEN THE PARTNERS IN A CONSORTIUM

After looking into the individual Centres we note that the IPR sharing principles *between the partners only (so not vis-à-vis external parties and undertakings),* as the rules are at present, can be grouped into the following broad categories:

1) Centres/partnerships in which the IPR ownership is shared between the partners based on the contribution of each relevant partner to its creation, usually laid down in a "Protocol of Contribution" to be signed. In this case, if only one partner creates IP it will be the sole owner of it. We do not see a problem in this arrangement. This is the case for the majority of the Centres.

2) Centres/partnerships in which all IPR created are automatic joint ownership of all partners. This is present in at least one or two Centres. In our opinion, this does not reflect the real input (including costs for labour, materials) that has been provided/invested by the different partners especially where some partners do not participate in the relevant research activity leading to the creation of the IP. The situation becomes more complicated where private organisations benefit from rights/results to whose creation they have not (proportionally) contributed.

3) Other arrangements also exist, resembling a mix between the first and the second model, such as providing the benefits of the IPR commercialisation for the equal use and benefit of all partners within the Centre.

In Table 5 we present an overview of the arrangement for IPR sharing in consortia of partners according to the proposal for regulation for the upcoming Horizon Europe programme. The Centres can use this as a good practice and example. We also encourage the Centres to check the **DESCA 2020 Model Consortium Agreement** (www.desca-agreement.eu).

Table 5. IPR sharing in consortia of partners under the Horizon Europe proposal	
Horizon Europe (Proposal, COM/2018/435 final)	Ownership of research results: beneficiaries own the research results they generate. Two or more beneficiaries shall own results jointly if they have jointly generated them and it is not possible to either establish the respective contribution of each beneficiary or to separate them when

	applying for, obtaining or maintaining their protection. The joint owners shall agree on the allocation and terms of exercise of their joint ownership and normally licensing to third parties can be done by each owner while the other owners receive a fair compensation.

2.4 Legal Entities and Structures

The possible and presently available legal forms are the following:

Civil Partnership (unincorporated, no separate legal entity)

Civil Partnership (in Bulgarian *гражданско дружество*) pursuant to the Bulgarian Obligations and Agreements Act (Chapter XV) is a form that envisages common activity of members without creation of a separate legal entity (no legal personality) and respectively envisages separate ownership of goods and other non-monetary assets brought or procured by members. This legal structure is rudimentary and was created in the time when there was no Commercial Act and the economic structure of the country was based on socialist principles with no private business initiative in mind. It is now used predominantly by participants in tenders organised pursuant to the Public Procurement Act. In effect, this is a contractual relationship allowing partners to register a common tax number. The latter creates a lot of formal requirements and complications related to accounting and tax reporting. The property that is acquired by the partnership is common property of all partners with equal or different shares. Each partner can manage the common partnership, but some have the power of veto, and decisions are taken by majority vote. The rights and obligations do not formally bind the partnership (as there is no legal entity) but the partners directly. Partners are personally liable. From an organisational perspective, decision-making is impeded as all partners usually have to agree on every contract with third parties. It is a structure usually designed for a concrete project or with short-term functionality. In practical terms, this structure does not seem to meet the requirements and necessities indicated by the Centres. Nevertheless, we need to note that one of the Centres has registered such civil partnership – Heritage.BG giving an equal share of 6-7 per cent to all partners, although the same Centre has also registered an association (in Bulgarian *сдружение*, see centre-specific case study).

Non-Profit Organisations / Non-Governmental Organisations (NGOs)/Associations/Foundations

NGOs established under the Bulgarian applicable legislation are essentially associations and foundations.

The three questions that we need to answer here are:

1. Do the Centres need to form a separate non-for-profit legal entity and why?
2. For what purposes and activities should the separate legal and organisational structure be used?[41]
3. In public or in private interest (benefit) shall it be?

In the case of **associations**, its founders are free to participate in the activities and management of the association. Ownership rights related to membership are transferable and inheritable.

[41] For the possible competences, see also the proposed two models/options (less integrated and more integrated) in the Chapter on Organisation and Management.

Instead, **foundations** are established by a unilateral memorandum of association, which charitably grants property to achieve a non-profit purpose. Ownership rights belong to the foundation and members of the management body are elected with no other purpose than to implement the strategy of the foundation. They do not have members' rights *per se.* Foundations are less flexible to respond to developing and new circumstances, since their purpose and activities are fixed with their incorporation act. Management bodies are rather limited with respect to their powers and even necessary and crucial measures related to the activities of the foundation could be out of the scope of powers given to their management, which could cause unexpected hurdles in a dynamic environment, as the world of scientific research often is. Nevertheless, for one of the CoCs (HITMOBIL) due to its specific situation the recommended structure is a foundation in public interest.

The experts have taken into account as much as possible the needs and the specific circumstances of each Centre. Therefore, the recommendations concerning the legal entity vary from one Centre to another and it is in all cases recommended to conduct an internal evaluation before taking a decision. That being said, for most Centres, a suitable form to incorporate would be an association (sdrujenie) with a varying degree of competences vis-à-vis the partner organisations.

In specific cases where some of the partners are NGOs, depending on the competences and mandate granted to the separate legal entities, the involvement of private partners should not lead to unduly benefiting from IPR/research results to which the private partners/members have not proportionally contributed. This is the case for Advanced Flight Technologies in QUASAR, Scientific Institute for Clean Technologies (SICT) in HITMOBIL, Cleantech Bulgaria in Clean&Circle, and for MIRACLE.

One of the Centres has already created an association (sdrujenie, see specific case on Heritage BG).

Moreover, only NGOs/associations registered in public interest could be fully eligible for public funding that has been designed for such organisations. If associations are registered for public interest, they should apply appropriate rules for their aims, management, spending funds and liquidation. This means less flexibility in management however, compared to associations in private interest.

A core question that arose during the meetings is whether the Centres themselves should be *transformed* into legal entities (e.g. associations) or whether they should register an *additional* legal entity/association only for specific common objectives or activities. The ultimate answer to this would be in how much of their powers the partners are willing to give in favour of the common organisational structure and entity. This is discussed in more detail in the next chapter of this report where we propose two options for the range of competences of the new legal and organisational entities (one less integrated and one more integrated). One needs to remember that there cannot be a solution that "fits all", neither from a legal nor organisation perspective.

Associations may carry out additional economic activities only if they relate to the subject matter of the principal activity for which they are registered and by using their revenue to achieve the objectives laid down in the statutes or instrument of incorporation. However, it should be born in mind that non-profit organisations are not allowed legally to distribute profit, which must be reinvested in the specific activities.

We will give an **example of the case of Mechatronics and Clean Technologies CoE**, the largest Centre with 17 partners, for which in our opinion a less-integrated option/model for a common legal entity may be more suitable than transferring exclusive core powers. The three main partners (two universities and one leading institute of BAS together with several others) agreed to

operate the Centre as a decentralised and in their words "federalised" structure. This seems reasonable to us and if they opt for an umbrella legal entity it should in our opinion *serve* the partners in the Centres (and not the Centres artificially serving the new entity). In this sense, the creation of a separate legal entity (e.g. association) would build upon the existing partnership mechanism, bringing the following potential benefits without substituting the core activities of the partners:

1. Improved representation vis-à-vis third parties, especially industry. Although the PRO-partners do not necessarily need to speak with one voice, this voice should at least be well coordinated against external stakeholders. This is in particular true for projects, activities and transactions requiring the participation of several partners within the Centre.

2. From purely operational perspective, an improved overall coordination and synergies between the joint work packages and R&D activities. The separate legal entity would not substitute the personal relations between the research teams but it can oversee common activities and act as a liaison unit. This is also valid for independent research. In numerous Centres the work packages and R&D projects depend upon each other (and/or feed into each other), which requires very close coordination between teams, as well as somebody keeping track on progress, needs, resources etc.

3. From organisation and management perspective, a legal entity/association can bring benefits consisting of a degree of independence from the partners and direct accountability for the fulfilment of its mission. In several Centres there is a recommendation to have one manager who is responsible, accountable for his/her actions possibly being a professional manager hired under an appropriate contract.

   An association will enable the hiring of professionals, managers and experts under more flexible conditions compared to the PROs: as it was mentioned during the meetings "to be able to effectively hire and fire".

4. As to the financial situation, there are several aspects. The creation of a legal entity/association will inevitably have operational costs, at the very least for salaries of a manager and possibly a small team. This means that, in the absence of (sufficient) independent revenues the partners will have to make regular financial contributions to the association (as in the case of HeritageBG). One option could be that a small part of the revenues from commercialisation be dedicated to support the budget of this entity. This is similar to the examples of the Joint Innovation Centre at BAS and the R&D Centres/TTOs of the large universities in Bulgaria, which have separate budgets and receive part of the revenues from commercialisation such as 10-20 per cent to maintain their operations.

5. Under the Horizon Europe proposal, a separate legal entity could participate in projects with the mandate and role to implement "coordination and support actions" for the participating consortium partners (see above in Table 4).

The creation of entities with separate legal personality will facilitate the setting of clear roles, responsibilities and accountabilities.

The associations of the **less integrated** model should start with clearly defined and targeted objectives (not general powers to fully manage the Centres), and with time operational experience will show the path forward and if it would be desirable to move to the more integrated model. Thus, the specific objectives of the legal entity (association/foundation) and its scope of operation may be different for the different Centres. Some have many partners with strong internal

capacities (e.g. the CoE Mechatronics and Clean technologies National Centre) and may prefer to keep the legal entity mostly for coordination, liaison and representation.

Others, such as CoC Clean and Circle require more powers to be given to the common legal and organisational entity – i.e. transforming into a **more integrated** Centre. This more integrated option/model goes further than the above-listed points and also entails the transfer of the management (the use) of the equipment/infrastructure and all R&D operations to the new jointly created entity. This model also entails an organisational structure with strong "component leaders" for the several main fields/packages of operation of the Centre, IPR ownership and strong TT and industry liaison capacity.[42] Chapter 3 of this report extensively presents an organisational and management model of a more integrated nature for the development of the Centres after 2023.

The role of the leaders of the work packages (*or where several WPs are consolidated into broader components/fields – then the role of the leaders of these components*) should be recognised as essential for the success of the RDI activities of Centre.

Finally, we have also shown above in Table 4 that in order to participate in Horizon projects**,** the applicant does not need to own the equipment but can lease it, for which there are rules and requirements on the eligible costs (compare to depreciation costs). In general, the rules seem to allow sufficient flexibility for organisations to participate and the Centres should study these more carefully.

Further analysis, including several years after the Centres have become operational, is required to reassess the advantages and disadvantages of the approach of using associations/NGOs and any possible negative aspects.

As to the question whether young scientists can effectively pursue a career within an association/NGO, it can be noted that first, by working on various externally funded projects (e.g. Horizon), young scientists can still pursue career goals whether or not they are employed by an NGO or directly by the main institution. Second, a compromise could be sought by being employed part-time in different organisations so to keep the formal attachment to the main organisation (university/institute). The scenario of scientists employed directly by the separate legal entity is valid mostly for the more integrated model i.e. not for all Centres.

Thus, 13 out of the 14 Centres will clearly benefit from the creation of a dedicated legal and organisational entity with separate legal personality (be it less integrated or more integrated).

- In the case of CoE 'Informatics and Information and Communication Technologies' there does not appear to be an obvious need for creation of a separate legal entity due to several cumulative factors. These include the concentration of funding and leadership into one partner (institute of BAS), the lead partner's claimed successful previous experience in management of similar projects in terms of scale and duration, and to avoid expanding (duplicating) the administrative structure. Rather than creating a legal entity, this Centre would update its organisational arrangement to ensure that the Centre's objectives and needs are given sufficient attention, operational recognition and mandate within the institute for the period after 2023.

[42] See more on the two proposed models (less integrated and more integrated) in the next chapter on organisational framework and management.

COMPANIES

Establishing the Centres as commercial companies would provide for corporate structure and procedures, relationships and management. Companies could also distribute profit to their members. Initial investments will need to be classified as capital and then appropriately amortised. However, if the commercial and other income is not sufficient to cover the losses due to amortisation, this may translate into loss of capital and a critical need of new investments.

Deeper involvement requires a higher level of trust and commitment, acceptance of common management, and respectively appetite for bigger risk. Similarly, new structures could require a separation of the activity, related assets and people, from the original structure of each partner institution. Weaker involvement in a common structure would avoid separation from the original structures but can complicate decision-making and would make common achievements and further developments also dependent on any changes in each of the participating partners.

In general, we would not advise the Centres to be transformed into companies. The Centres are mostly composed of public research organisations (PROs), and their mission as well as the nature of their activities remain to be that of a PRO. It should be noted that EU State Aid rules and the capacity limitation for economic activities utilising the infrastructure remain valid whatever the legal form. However, where relevant and for the implementation of successful commercial activities the Centres (the partners) are allowed and sufficiently regulated to establish commercial companies for the realisation of their research results (e.g. spin-off companies as individual projects). Following best practices, the establishment of these companies should have a clear "core business" and be decided on a well-defined market analysis. It is not unusual practice that European PROs use legal entities in the form of companies for their general commercialisation activities (i.e. not only for specific spin-off projects).

PUBLIC INSTITUTES WITHIN A UNIVERSITY STRUCTURE

The possibility to structure some Centres as public institutes under the current legislation should be further explored, including the example of the GATE project under Horizon 2020. Such structure could be relevant for Centres in which one organisation (a university) participates with several of its faculties or departments requiring the pooling of human, scientific and technical resources within that university by creating an institute entrusted with a degree of organisational independence within the parent organisation. The ex-ante evaluation[43] of the feasibility and need to create an institute within the framework of Sofia University in order to implement more effectively the GATE project mentions several factors, believed to add value, including:

- Improved conditions for R&D&I in collaboration with industry;
- More opportunities for technology transfer.

An institute, according to Articles 25 and 26(6) of the Law on Higher Education, is a main unit of a higher education institution. Although the Council of Ministers decides on the creation of an institute, it is the university, through its academic council, that enacts and determines the structure of the institute and its governance frame and rules of operation.

Institutes are not separate legal entities but they may have an independent budget (despite the funding from university) and to an extent autonomous organisational structure.

[43] Ministry of Education and Science of Bulgaria, Partial ex-ante impact assessment/evaluation. Формуляр за частична предварителна оценка на въздействието, 12.12.2018, www.mon.bg.

We note that in April 2020 the Council of Ministers decided on the establishment of two institutes within the existing state universities in the cities of Burgas and Ruse.[44] The justification for the creation of the Scientific Research Institute in Burgas and the Scientific Research Institute for Technology and Innovations in Ruse, within the framework of these two universities, claims that the new institute structures will:

- be necessary in order to consolidate the R&D activities of different faculties;
- allow for inter-disciplinary value creation as well as;
- facilitate the participation of the respective university in national and European projects;
- support the commercialisation of technology, with a long-term perspective;
- make more effective the use of the research infrastructure and the research activity overall;
- allow taking part in international networks.

The activities of these institutes are financed by the university budget, participation in projects, and realisation of research results.

Despite limited availability of information regarding the specific rules and organisation of these institutes, several issues arise that should be further analysed:

- To what extent can some Centres benefit from the creation of similar organisational structures in the framework of their partner organisations as a way to institutionalise/formalise the university participation in Centres?
- Can several universities jointly create an institute under Articles 25 and 266 of the Law for the purposes of participating in the CoE and CoC projects?

Please note that the above questions relate only to universities, as the Academy of Sciences does not operate under the Law on Higher Education.

Finally yet importantly, the MA suggested that one option for the legal status of the Centres could be "secondary or tertiary budget spending units to an institute or university". It is understood that this alternative would require legislative changes, which necessitates a separate assessment and recommendations with the participation of a broader range of stakeholders nation-wide, beyond the scope of the present report.

The Current situation: Signing agreements, Contracting Parties and Representation

As it became apparent from the above discussion, the creation of separate legal entities will allow the Centres to structure and exercise their R&D operations more effectively. As is the situation at present, with partnership agreement forming the basis for cooperation, several or all partners either could participate together in each agreement and contractual relationship as separate parties, or could empower one of them (most probably the leading organisation) to sign agreements as their representative.

Authorising one partner to represent the others is currently the case for representation in front of MA by the lead partner. However, this might become complicated in relations with industrial third

[44] Ex-ante evaluation and Report of the Minister, Проект на Постановление на Министерския съвет за откриване на институти в структурата на Университет „Проф. д-р Асен Златаров" – Бургас, и на Русенския университет „Ангел Кънчев", http://www.strategy.bg/PublicConsultations/View.aspx?lang=bg-BG&Id=5018.

parties. As a matter of principle, it is advisable to have the relevant partners *involved in the execution of the particular project/activity* as contracting parties and that each contract clearly stipulates the rights and obligation of all parties, including the allocation of IPR.

The Higher Education Act restricts universities in performing commercial activities to only those related to their core business, and to achieve realisation of the IP rights obtained through these activities. In this way, the law introduces a rigidity in sharing rights and obligations with other partners as all commercial activities should meet the requirement of being within the core business of that particular university. On a separate note, any agreement signed by each university should be compliant with the abovementioned law. This means that Centres, if represented by one partner, may not be able to take obligations or obtain rights affecting another partner/university. Their rights and obligations shall remain separate as far as any third party is concerned.

Separate legal entity post-2023, funding for staff and having a manager

The creation of separate legal and organisational entities that requires restructuring (i.e. of a more integrated model) is recommended only after 2023, when the internal budget for management would be limited (or non-existent) so that a frame is provided to preserve the Centres' activity and facilitate not only the effective fulfilment of the 5-year obligation to operate the Centre after the end of the formal project period (2023-2028), but also thereafter.

The presently existing Centre agreements seem to focus only on the current projects. Even though most agreements have outlined representation, distribution of funds and functions, use of equipment and future IP rights, none of these arrangements are effectively designed to survive beyond the projects already in place, especially due to the lack of dedicated funding after 2023 for salaries of staff, for organisation and management costs (unless these are significantly reduced) and for commercialisation. In most cases, the Centre agreements are business plans. Only in a few cases, they outline an effective and proven capability to generate income, either from public contributions or industry related activities.

Currently, movable and immovable property is procured in a distributed approach between the participants and they provide (free) mutual access for the purposes of the project. Sustainability of the partnership following the project completion (and expiry of the funding for management and R&D in 2023) is not effectively based on forward looking programmes embedding common goals or principles outside the pure understanding of commitment to the usage of buildings and equipment in a just and reasonable manner. This is combined with the largely unrealistic income that many Centres plan to have from non-public sources post-2023 (see individual Centre studies). We note that the costs for management and administration of the current Centre projects (2018-2023) are significant, in some cases several millions BGN, but this is mostly justified since the large and complex procurements require highly specialised technical staff. However, this will have to change after the procurements have been completed resulting in less layers of management and reporting after 2023 and a focus on R&D (See Chapter 3 Organisational Framework).

Partners keep clear separation of ownership rights both with respect to buildings and equipment. Access would be needed in cases of common projects and will be granted in such case. However, consideration (fees) could be requested by the owner university/institute and in case of overlapping times for internal and common (Centre) projects, there is a risk that priority (working hours, consumables, etc.) be given to internal projects and teams as opposed to the fulfilment of the CoC/CoE common programme, projects and objectives. Right of access is not formulated as a registered right in itself and is actually not opposable to any future owner of buildings funded by the current project (should such new owner appear in the future). Therefore, clear commitments of

the partners to prioritise the operation of the "Centre" projects is a basic prerequisite to keep the CoEs/CoCs alive after 2023.

In case the members keep working as a partnership (without an additional legal entity), the Centre is not in a position to conclude labour agreements itself. This may hinder the capability to form a team or attract and keep young specialists, unless they are hired by one of the partners, mostly the lead partner or the larger partners. The question is that the salaries of the Centre-managers will also have to be paid after 2023 and it is not clear if this funding is to come from the budget of only the lead partner or from a joint contribution from at least several of the partner PROs. The creation of a legal entity/association will facilitate the independent engagement of a manager (strong in business development and industry liaison) and possibly a team that will serve for the development of the Centre's activities, within its mandate. In this way, also the financial contribution channels from the different partners to the common management could be streamlined.

Theoretically scientists could be hired under a consultancy agreement (i.e. civil contract as opposed to labour agreement), but it is usually a limited term contract which would not allow to retain the best staff.

If partners in the Centres do not form a separate legal entity, with clear view of the funding of the common management and administrative team, their cooperation is likely to come apart automatically after 2023. When the CoC/CoE project funding comes to an end all goods/equipment purchased or buildings constructed will remain ownership of the respective PRO partners. In the absence of a continuous dedicated operational funding and if there is no established organisational structure (with clear roles and separate legal personality), there is a risk that the planned joint activities be discontinued or severely reduced thus jeopardising the required sustainable operation of the Centres until 2028.

Insights into European Research Infrastructure Consortia (ERICs)

In most EU Member States' legal systems, there is a clear separation between the not-for-profit and the for-profit (commercial) legal frameworks. When the access to public funding (whether national or EU) is analysed, most countries have different budget lines and come from (or through) different ministries, for instance:

- Research ministries for non-commercial activities and
- Industry (or Health, Environment, etc.) ministries for commercial service oriented activities.

If a Research Infrastructure is set up within a research ministry, the access to industrial research-related funding, coming from another ministry can be difficult to implement. In addition, for EU funding, it may become difficult for a research-oriented Centre to participate in large industry-oriented programmes, which need strong strategic and long-term collaboration with industries.

In most countries, in the last two decades there has been a strong evolution of the legal framework of universities and research entities, from commercial activities being an almost forbidden aspect to a more or less complete liberalisation. An ongoing difficulty in many countries is the capability to hire and use flexible employment rules of personnel connected to these project-based activities, and this is one of the main drivers in the setting-up of external firms or other entities capable of operating outside the public administration rules.

In the case of Research Infrastructures this uneven development of the legal frame in Europe has raised the necessity, and opportunity, to define a European Legal Form, the ERICs (European

Research Infrastructure Consortia) established by European Law, with the Regulation N. 723/2009 of 25 June 2009. This Regulation, which is now part of the legal frame of all EU member States, has been developed using as reference to a number of cases both at international level (e.g. EMBL or CERN) and at National-legal level (e.g. ILL or Elettra). It allows a governance and operational framework inspired by the best international practices, while offering some specific advantages of international organisations, e.g. tax exemptions (from VAT and excise) and exemption from a rigid application of the EU procurement rules. On the other hand, this legal framework allows "limited commercial activities, provided that they are closely related to the principal task and that they do not jeopardise the achievement thereof". We need to underline that this verbatim sentence does not state the limit of the commercial activities, but only that these should not "jeopardise" the principal task of performing research.

The case of the ERICs is interesting in that it has embedded and allowed, in a single legal form, some of the conflicting aspects, which have been found in the examples we have analysed for the Bulgarian legal frame and which are also present in other national legal frames. The ERICs are Consortia, where countries participate, and they are international entities with special status, and as such act as private entities (i.e. are not subject to state employment and accounting rules). Their core activity is a public service mission, and the basic recurrent funding comes from public money. Therefore, their reporting and accounting must be transparent and public and they report to the member countries as well as to the EU Commission. The statutes of these entities can limit the liabilities of the members to their contributions, as it is the case of a limited liability company. This, however, does not impede commercial activities, insofar as these do not jeopardise the scope of the Consortium. The Consortium form (from Latin meaning: "put together your sorts") has also the advantage that the members may allow the use of their own goods and services without the need to transfer ownership while still being able to purchase additional goods and services, and account the values of both available and proprietary goods in a transparent and synergic way (e.g. also for accounting in EU funded projects). Finally, the governance can be clearly defined while giving full autonomy to the management and allowing flexible internal rules of procedure.

Although the above-described legal form may provide useful insights into the story and legal status of the ERICs, this form is only applicable to their particular situation and not automatically transposable to those national contexts where consortia are not legal entities themselves.[45] The structure and the governance of the ERICs can be taken as a reference case in which best practices derived both from national and international research infrastructures have been consolidated. A more careful study of the structure and operational elements of the ERICs is necessary to identify potential elements and best practices that can be transposed to the national context, and to situations of setting up Centres operating within one country, allowing to link diverse members having common interests and allow both research of a public nature and commercial activities.

2.5 RECOMMENDATIONS

There are two sets of recommendations: those to be proposed to the Government of Bulgaria and those to the stakeholders who are driving the set-up of the Centres. Centre-specific

[45] Under Bulgarian legislation, consortia are either companies or civil agreements forming a version of joint-venture agreements. The latter are called civil partnerships, but they are not companies. In both cases, however consortium is a structure composed of traders, i.e. persons either legal or physical, performing commercial activities professionally. So, institutes and universities can form civil partnerships (and name/call/designate these partnerships as "Consortium" and/or "Consortium Agreement" - as in the case of the CoCs and CoEs) but they cannot form consortia per se.

recommendations are provided in the second part of the report (Chapter 9). However, some key contextual aspects are highlighted below.

First, we would like to note a number of legal developments (potentially) facilitating the operations of the Centres. We note the introduction of National Roadmap for RIs providing funding for research activities in the CoEs and CoCs, which are recognised as eligible beneficiaries. We also note that after the latest changes of the law, the minister is now able to agree with the rectors their tasks and strategic objectives together with "*targeted funding*" to realise these objectives. It becomes apparent to us, that some of these objectives could be supporting research and technology transfer within the framework of the Centres in which the universities take part. Another legal development we observed during the preparation of this report is the adoption of the rules regulating the creation of spin-offs by universities.

Taking into account that the ERIC legal structure is already part of the national legal frame (as an EU regulation), there could be the opportunity to define a similar type of body. Bulgaria could even host some of the nodes or partner facilities of these type of Research infrastructures by allowing an attractive fiscal and employment environment[46].

Without prejudice to the main recommendation for creating separate legal entities for almost all Centres, other forms of collaboration between research organisations in Bulgaria will continue to be relevant and could help further integrate the Centres themselves into the ecosystem. One example are "Framework Agreements" such as the ones concluded between institutes or between universities and institutes of BAS.

The existing Joint Innovation Centre at BAS should be strengthened, in particular its role for commercialisation and technology transfer so that it can effectively serve as a central hub and support the BAS participation in the CoEs and CoCs. This hub structure could provide relevant services and capacities for the whole BAS/the institutes in their efforts as well as the Centres where required.

The sustainability of the Centres already created on the basis of heavy infrastructural investments is not a problem specific to Bulgaria. Observations from other EU Member States, in particular the largest beneficiaries of the Structural Funds in the last 10 years (e.g. Poland, Lithuania) lead to a conclusion that sustainability of heavy infrastructure investments in R&D infrastructure is usually under serious risk. Therefore, inspiration may come from their reforms and implemented solutions.

In many developed and developing countries there are separate research organisations with a more detailed focus on fundamental and industrial research. Assuming that universities and BAS represent a fundamental research branch of the research landscape, there is a need to create a new research and innovation organisation with a mission to focus on industry-driven R&D activity, commercialisation, contracted research, etc. These could be the planned Regional Innovation Centres which feature strong private participation from the very beginning and are to operate under a different State Aid regime that allows activities much closer to the market (GBER, funding for research infrastructures).

A model that Bulgaria could follow may be inspired by number of research organisations starting from top European players like Fraunhofer Gesellschaft (DE), TNO[47] (NL) or VTT[48] (FI), but also some

[46] The ERICs are set up by an agreement between the states. In the process of defining the statutes, it is possible to define (as countries hosting an international body) specific fiscal and employment rules. Normally it is a limited cost but can be very effective way to attract siting.

[47] Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (TNO); English: Netherlands Organisation for Applied Scientific Research.

good examples could come from TECNALIA in Spain or recently launched Łukasiewicz Network in Poland.

- The Łukasiewicz Network is called network but from legal point of view the structure is set up as an umbrella legal entity for the network, while research institutes - separate legal entities - are network members. The umbrella organisation (the central organisation of the network) has quite strong supervising and coordination role over institutes – members of the network. In the opinion of the experts, some CoCs/CoEs could be organised in a similar way, but even further, part of the research system in Bulgaria could be organised in a similar way. Since research activity at present is rather fragmented and distributed between a number of different, sometimes small research organisations, this kind of network structure could generate significant synergy and could improve efficiency of the system.

One alternative model which is also relevant for the TT Chapter of this report, based on the previous logic, could be to create a Hub-and-Spoke model for TT activities for the Centres. The activities are concentrated in only one new legal entity or a limited number of entities for major research/industry areas to play a role of the hub/hubs to manage relations between CoC/CoE and industry. This type of interface organisation could work as a kind of external TTO or sales department (outsourced activities) which coordinates marketing, sales and other income generating activities on behalf of represented organisations. A legal framework for this rather light intermediary or umbrella structures should allow flexible commercial activity but for the purpose of commercialisation of 'public goods'. The most important risk for that option is the possible tension between research and intermediary organisations, but that could be to large extent mitigated with relevant legal requirements and strong KPI-based evaluation.

An example for lessons learnt from designing and implementing significant investments in the whole R&D&I ecosystem of a country would be the Lithuanian "Valleys" project, which ran in the previous programming period 2007-2013 (with the additional +3 years, until 2016). It encompassed investments of more than 300M EUR into several "valleys" – defined as **integrated** science, study and business centres building upon a concept of a **concentration** of R&D and study infrastructure. The Valleys adopted an open access practice, providing services not only to innovation-oriented companies, but also to the wider public. The Bulgarian Centres-projects resemble to an extent the Lithuanian Valleys in that:

> *"Within the format of the Valley development programmes, it is sought to upgrade Lithuanian scientific research infrastructure and provide conditions for active cooperation between business and science which helps create high value added. The Valleys will offer infrastructure to carry out applied research and technology development and favourable conditions for the establishment of new or young innovative companies."*[49]

Some of the lessons learnt were presented during the JRC conference *'Unveiling Serbia's Smart Specialisation Strategy and exploring the role of incubators, accelerators and S&T Parks in delivering sector specific support in the Western Balkans and South East Europe'* in 2019 in

[48] VTT Technical Research Centre of Finland Ltd.
[49] For more information see the website of the Lithuanian Ministry of Economy and Innovation: https://eimin.lrv.lt/en/sector-activities/innovation/valleys.

Belgrade and involved addressing sustainability in ensuring the continuation of operation of the research infrastructures.[50]

To the Stakeholders and Partners in the Centres

Taking into account the degree of development of most Centres, we suggest to adopt a graded incremental approach allowing to "learn by doing" in particular in the period from inception until 2023. The initial arrangements of the Centres often build upon and strengthen existing or past development of joint initiatives/ventures.

The Centres should further integrate their current operations and activities by incorporating a joint entity with separate legal personality, clearly defined mandate, competences and financial relations vis-à-vis the founding partners. For most Centres an association would be suitable form.

Important components of whatever legal form is chosen, is the presence of evaluation and scientific/technical advisory committees helping to steer the collaborative effort towards the best quality/cost ratio.

One other important element is the capability to attract and retain the right type of staff especially in the critical transition between setting up and operation of the Centres. This is not only related to the salary levels (which can be relatively high due to the flexibility of the ESIF funding) but also to the career perspectives, the allowance to junior people to get responsible positions, the overall family allowances, the possibility for couples to get both reasonable employments in the same area etc. For research and management staff, you can refer below in the Chapter on Sustainability to the case/example of CERTH where 90 per cent of the researcher staff are paid from projects and not from state block funding. The legal structure of CERTH institutes and their relations with the universities should be explored in more detail by those interested.

In the period 2021-2023 the Centres will have completed the installation of the research infrastructure and built some operational experience. The Centres should evaluate the first years of R&D operations within the rather loose partnership structures and identify what competences they would like to confer to the separate legal entities to be created. The founding partner organisations should then decide how the partnership-based Centres should develop:

- what the exact competences, mandate and finances of the new separate legal entities will be (laid down in the statute);
- whether and for which Centres it would be appropriate and sufficient to establish a separate legal and organisational entity entrusted with particular and clearly defined activities of common interest (a less integrated model, see also Chapter 3);
- whether and for which Centres it would be more appropriate to go further and entrust the newly created structures also with the management of the research infrastructure, the setting of the research agenda and the hiring of own researchers (a more integrated model, see also Chapter 3);
- what the appropriate form of these entities should be (associations, foundations, companies etc.);
- whether the creation of a university institute or a similar type of public research institute could be useful to facilitate (part of) the activities within some of the Centres projects;

[50] For the presentation see: https://ec.europa.eu/jrc/sites/jrcsh/files/20191016-s3tt_serbia-valanciauskas_en.pdf.

- whether there are any specific circumstances that need to be taken into account such as the integration of already existing structures (e.g. companies used for commercialisation) or the stricter requirements for protection of patient data relevant for the Centres engaged in healthcare-related activities, or the role of university hospitals, to mention some.

That being said, for most Centres a suitable form for the separate legal entity to be established would be an association, with a varying degree of competences entrusted to that entity by the founding partner organisations.

Note: The above presented Legal Framework chapter should be read and understood in conjunction with the forthcoming chapter on Organisation Framework. In other words, the choice how the Centres will be structured and managed in future may necessitate the incorporation of a legal entity and vice versa – the legal possibilities and limitations will also likely influence the operational and governance regimes/structures of the Centres.

3. ORGANISATIONAL FRAMEWORK

3.1 REQUIREMENTS AND EXPECTATIONS

A streamlined governance and organisational structure is necessary for the joint RDI operations within the Centres. Based on the evidence gathered, the experts recommend that, where possible, a single structure be created for the effective management and/or coordination of the Centre's activities. This will help to communicate the Centre's unique identity externally, and allow operational effectiveness and efficiency. The most important consideration is that it should be clear that each Centre exists in its own right and how potential users can interact with it.

The Centres have, in most cases, a plurality of research actors/partners coming from different laboratories, research institutions, and universities with several different sub-research projects under implementation in various combinations of laboratories. In addition to this, each project is funded by structural funds, which requires certain procedures to be in place. It is expected however that, with the completion of the EU-funded projects from the current period (until 2023), the creation of the legal entities would help each project partnership to sustain its joint vision, projects and activities, developing an effectively operational CoC or CoE with its own identity, and an efficient and lean management structure and procedures. It should also be remembered that the Grant Contracts with the MA formally oblige all Centres to continue their operations for at least five years after project completion.

The experts propose here a series of approaches regarding:

a) ownership structure of the infrastructure of the Centres acquired by the project
b) governance and decision making/management at the Centres

OPTIONS, COMPETENCES, OWNERSHIP STRUCTURE AND THE USE OF EQUIPMENT AND BUILDING INFRASTRUCTURE

At this moment, based on legal, economic and practical considerations, as can be seen in the experts' reports on individual Centres[51] as well as the inputs from projects partners, it is advisable that the ownership of the infrastructure (buildings and research equipment) bought/procured remains in possession of the respective founding partners while it is made available for use for the purposes of the individual CoEs/CoCs. Research infrastructure should not be transferred[52] to the new legal entity of a Centre as this would create amortisation complications and negative impacts to a Centre's financials, or legal complications at the original partner/owner organisations. The only exception to this is Hitmobil CoC where it is recommended to transfer part of the infrastructure to a jointly created foundation.

Below we provide two options for the Centres, especially post-2023. The options should not be seen as mutually exclusive. A mixed model might, with time, be found to be effective as well.

[51] See the 14 case studies in the centre-specific analyses part of the present report (Chapter 9).
[52] The experts are of the opinion that, valid for almost all Centres, the partner organisations do not need to (and some experts expressed that they should not) transfer the ownership of the newly procured infrastructure to the new legal entities. That is yet another reason why the commitment of the rectors and BAS-institutes directors is key as all partners have an obligation to ensure the effective operation in the 5+ year period post-2023. But even after that, most Centres should continue functioning unless the first approx. eight years will have proven totally unproductive.

- ***Less integrated option/model.*** This option can also be used as a first step as it requires fewer common staff and possibly lower common management costs. This option may be easier to implement and preserves more powers at the founding partner organisations. The common management has a strong liaison function not only between the partners but also vis-à-vis industry, as well as a representation and promotion role aiming to bring added value without substituting the core/natural activities of the partner research organisations. The manager is supported by a rather small permanent professional team with a degree of independence from the partner organisations. A legal entity would be created in the form of an association with a clear mission and mandate; this would allow the necessary degree of independence.

  The manager in this less integrated model could be given the powers to conclude broad framework contracts (e.g. expressions of intention) and to take their own initiative in identifying opportunities, new contacts or activities. The actual decision-making power, however, will remain with the partners of the Centre and more specifically with the partners that take part in a specific activity. This form could probably be suitable for Centres with several large partners and/or a high number of partners where a less integrated "federalized" structure is preferred, at least at the beginning. An example is the National Centre for Mechatronics and Clean Technologies CoE.

  This model/option likely does not require the transfer of the exclusive use of the equipment/ infrastructure to the new entity, i.e. it allows some flexibility in having the partners commit that they will give priority to common projects or make the RI and equipment fully available for common projects for the purposes of the Centre. In this option, the work packages and work programmes usually have clear "leader partner research organisation" and clear "participant - supporting partner research organisation". The IPR created is owned by the partner who created it or, in certain cases, jointly (see Table 4 on the example from Horizon Europe), while a small part of the revenues from commercialisation in the future can still go to maintain the common staff and their operations.

- ***More integrated option/model.*** This requires transferring higher competences to a new legal and organisational entity, including the guaranteed use of research infrastructure and equipment, together with more complex financial and governance regimes, including between the partners and the new legal entity. In this option, the partners should guarantee also the appropriate access to the buildings and research infrastructures to the Centre so that the Centre can pursue its strategic goals. It is proposed that new buildings, as well as refurbished buildings that house new equipment for the CoC/CoE projects be made fully available to the Centres. Moving forward, a new MoU between the founding members (project partners) who will transfer the use of existing infrastructure to the new legal entity of the Centre, will detail the conditions of transfer (e.g. grace period for a period after project completion and new entity kick-off, definition of a percentage of overheads of new projects that will go to owner to cover some basic operational/maintenance needs of these buildings etc.) All these financial implications should be taken into account in the sustainability business plan as proposed in the later paragraph. The same MoU will also deal with any necessary transfer of use of new equipment to the new entity, while the new entity will be fully responsible for maintenance and keeping the equipment in excellent condition. The actual cost of maintenance as well as replacement of outdated equipment within the next 10 years (e.g. in case of ICT Centres) has to be included in the business plan proposed in the viability chapter of this report. For example, overheads of new projects could be used for maintaining initial CoC/CoE infrastructure and equipment. Any new

equipment acquired under various future funding programmes should be made available to all the partners in the respective Centre with guaranteed access conditions. All research results, patents and revenues belong to the Centres. Partners receive royalty fees for participating in their development. IP regulations should be developed internally, but in full compliance with the national and EU legislation.

The two above-proposed models are believed to apply to 13 out of the 14 Centres. One exception to the recommendation to create separate entities is the CoE for Informatics and ICT, in which the lead partner is by far the largest beneficiary receiving very high percentage of the funding and de-facto controlling and leading the full development of the Centre.

Another aspect is the sharing of IPR. Private partner associations should be allocated partial ownership or given preferential access to IP only where they have proportionally contributed. In other words research results/IPR should be attributed to or shared among the public and the private partners within one Centre based on each partner's respective contributions. This is to avoid a situation where PROs create an invention, which benefits private organisations that have not (or not proportionally) contributed to its creation.[53]

Table 6. *Example of an existing arrangement of the CoE Heritage BG.*

The CoE has already incorporated an association which seems to resemble some of the elements of the above-described models. We do not state that this is the "right model" but it certainly shows that steps have been made in an attempt to integrate the activities.	
The current arrangement is based on three documents: Statute of Association Consortium Agreement Partnership Contract *Please note that where translation was made, this may not be accurate; please refer to the originals of the respective documents in Bulgarian!*	▪ The founding members/partners are obliged to submit[54] the real estate/premises (the modernised infrastructure includes buildings, rooms, laboratories) for use for the needs of CoE "Heritage BG" for the period of its existence.[55] ▪ The association becomes titleholder of all rights in properties, receivables, money, securities and other assets acquired in its name in the course of its activities. ▪ The activities of the association seem to resemble the ones of the partners – fundamental research, applied research, knowledge transfer as well as the ancillary economic activities (up to 20 per cent). ▪ Operating revenues are formed through membership fees, economic activity, and project funding. ▪ The rights on the equipment and fixed assets acquired during the Project shall be allocated among the Parties as follows: 100 per cent for CoE "Heritage BG" as assets to the allocated scientific and research infrastructure of CoE. ▪ The properties will be used jointly as a shared infrastructure by the founding members to conduct RDI activities and projects. ▪ The partners retain their full property rights over the real estate and movable assets with which they participate (in particular the buildings, labs and rooms funded by the Operational Program). ▪ The Board is entrusted with the management and has, among

[53] See the Horizon and other sharing arrangement principles listed in Chapter 2.

[54] The original text states in Bulgarian: "Партньорите се задължават да предоставят имотите/помещенията за ползване за нуждите на Центъра."

[55] Source: Partnership Contract (2017); the Statute of the Association (Sdrujenie) from 2018 stipulates the same.

	others, the power to dispose of the assets of the legal entity.

GOVERNANCE AND DECISION MAKING: TOWARDS A MORE INTEGRATED MANAGEMENT OF THE CENTRES

From the project implementation organisation, we often see a very complicated setup with too many levels of decision-making and control. For example, there are often five or more levels of management and reporting and, in extreme cases, as many as seven. There are typically also too many bodies (Management, Supervision, Advice, Scientific Advice, Control, etc.). During the project period (2018-2023) there is funding envisaged for organisation and management of the Centres, allowing in particular the Centres to conduct their procurements. However, once all equipment/infrastructure has been procured and installed, and the buildings constructed, the Centres need to adapt and streamline their organisational structures to focus their efforts on RDI operations. We should not forget also that there are costs (of not an insignificant amount) associated with the organisation and management of the Centres, in particular funding for salaries and certain operational activities.

See example below (Figure 1): the management structure for one of the Centres - Clean and Circle, with several layers of management and control. This multilayer structure, which is encountered in many Centres, might serve the purposes and needs of the implementation period but definitely is cumbersome and not an efficient operation model for the post implementation period.

Project Implementation Period

Figure 1: Current Management Structure for many centres

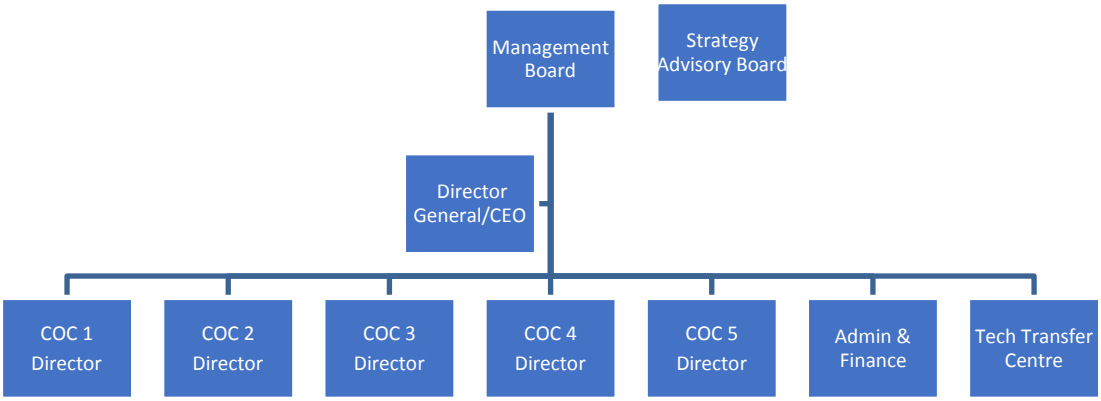
The experts propose instead the organisation of a simple research type of multidisciplinary institute organigram, **grouping activities around thematic and laboratory specialisations**. These would correspond to the actual groupings of disciplines around a central theme. For example, the CoC Clean and Circle thematic has the following lab platforms: water, wastes, and cyclical economy. Next to those are two units, for TT and Innovation and for Administration and Finance.

On top of these discipline or support units is the **Director of the Centre, a full-time dedicated leader with combined market and scientific background and experience**, able to drive both the sustainability plan of the Centre as well as its scientific excellence.

This approach allows specific subject matter expertise to play its role in the thematic areas while at the same time making use of professional expertise of a dedicated leader to **guarantee the efficient running of all multi- and interdisciplinary activities and the general management and administration functions.**

Post Implementation Period (post-2023)

A structure with less layers of management and reporting is proposed for the post implementation period (after the project officially is completed) resembling most of the European Research Institutes management structures. Thus, for example, the multilayer implementation structure of Clean & Circle CoC presented in the previous paragraph is transformed into the following one for the post implementation /sustainable development period:



Figure/Graph 2: Proposed Management Structure, where CoC 1/2/3 etc. are the sub-sectoral thematic Units i.e. municipal waste, solid wastes and recycling, efficient use of energy etc. For other CoEs or CoCs this is applicable with the respective subsectors such as Energy storage/Res etc. Individual research project leaders fall under the sub-thematic Director for the scientific area they are working.

The thematic "Directors" presented above can also be named "**Component Leaders**" to avoid any confusion with the management.

Two main bodies for the management and strategic steering *above* the Thematic and Operations Directors are proposed:

Management Board, a directional, supervisory body that represents the interests of the founding partners with members coming from the partner research organisations. The Board carries out the usual activities of a Management Board as well as receiving financial and operational reporting on progress, monitoring Centre's performance against KPIs, reporting to the general assembly of the founders (irrespective of the legal form). It also supports the Director in strategic planning, monitoring the business plan, acquiring and delivering the research programmes and identifying new opportunities, ensuring smooth cooperation with founding member universities and institutes. The Board liaises with Government and its institutions when needed.

The Board members shall be with up to 2-3 years mandate (not more than 5 members). The number of mandates shall not be restricted and shall impose a KPI evaluation on a mandate. If successful, the CEO might have another mandate/s. Successful managers/professionals might not be so many and so they will bear the "organisational DNA". The profile of the members should preferably not just be academics but a mixture of professional backgrounds and the professional competences needed to guide an organisation. All PROs have professionals on their staff and they should take the management of the CoCs or CoEs sufficiently seriously to assign persons with appropriate professional profile.

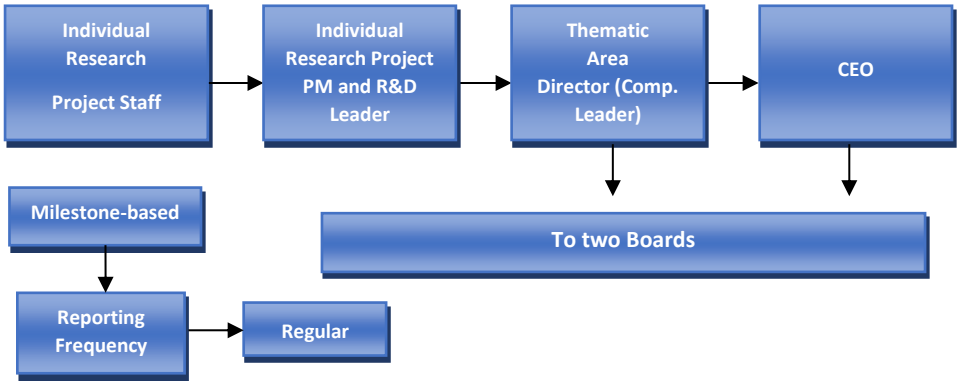
The CEO/Director General of the Centre should be a single full-time leader with a broad mandate needed to achieve ambitious goals (if the first, less integrated option described above is selected, the powers would be less and more specific). He or she should also be **accountable and responsible for results and periodically be monitored by the Management Board**.

- Note: The mandate of the CEO and of the Centre's team clearly depends on whether a Centres chooses a more integrated model or a less integrated one (as described previously). Although in both options the Centres' activities are project-oriented, the delegation of powers and the execution modalities differ.
  Below we focus on describing the more integrated option, which also requires larger staff employed by the Centre's independent legal entity.

Because the **Centres' activities are project oriented**, the personnel for a given RDI project could be drawn from either the partners' staff or from outside on a collaborative basis (these are not staff being recruited but external parties collaborating on a specific project).

Each consolidated Thematic Unit is maintained permanently as a unit as it is one of the basic strategic thematic specialisations of the Centre. Under the Director (or Component Leader) of the Thematic Unit, who is a Lead researcher himself for the projects he runs as a scientist, fall the individual projects that the Centre performs in the respective area, whether competitive EU/national or contracted research projects. Each project has a Project Manager (PM) and a R&D leader, who is supported by scientific and technical staff, attracted and hired by the new (post-2023) legal entity on a project-basis and subject to project needs. The reporting relationship is: Project research and development leader to Thematic Director (or Component Leader) to CEO and then to the two bodies - Management and Scientific - on a less regular and milestone-based level. Regular meetings are held between CEO and Thematic Director with Research Project Leader to monitor the progress of the research projects and resolve problems. At any given point of time, a scientist whether at leadership or associate researcher position should not be involved in more than a small number projects (to be defined specifically for each Centre and may be different depending on the nature of the thematic area).

Figure/Scheme 3: Reporting line within sub-Thematic Unit



Scheme 3: Reporting relationships

Each research proposal encompasses financial planning. The scientists/researchers have to provide estimates for capital and recurrent expenditure for the project. This includes funds for equipment, utilities, chemicals, consumables, and materials.

The Centre is also responsible for accreditations of labs (where available), maintaining the equipment, and delivery of consumables.

All Centre departments work closely in planning, budgeting, risk mitigation and implementation of every project.

Strategy/Scientific Advisory Body or Board is a consultative body with no voting power. It provides specific scientific and stakeholder inputs, which supports the Centre with international networking, scientific, and technology guidance and strategic advice for its future. It comprises of the Thematic Directors (Component Leaders) in pair with renown international Bulgarian scientific and business experts in the specialised field of the Centre as well as scientific and business personalities in the sector living in Bulgaria (all non CoC /CoE members, coming from institutions outside of the Centre initial founding partner organisations). It includes not only representatives of industry and academia, but a broader circle of stakeholders. These should be well recognised locally and/or worldwide by the business and scientists.

The body should help link the Centre with the market, as well as with national priorities, including stakeholder groups, sectoral business associations or clusters. In specific occasions, it should help link the Centres with high public interest (health/heritage), representatives from relevant government and public sector organisations with responsibilities and interests in the specific thematic sector of the centre (e.g. Health, Environment, Energy etc.).

This body could assist in setting the KPIs of the Centre based on international best practice, monitor and advise on the quality of research performed, advise on international business and research partnerships, advise on the Centre's future technology direction and strategy based on international foresight. It could help to attract diaspora from abroad to the Centre, help with attraction of international and national donations from wealthy groups that support scientific organisations, and in other outreach related activities towards the international community.

The Strategy/Scientific Advisory Body acts as consultative organ and should include the associated partners of the Centre.

Once the Centre is established with its Managing Director/CEO under the proposed Management Board[56] and Thematic R&D Units/Platforms (Components) are established with their own leadership, then it is up to the management of the Centre to prioritise and allocate the use of Centre's equipment. This could be based on their engagement in achieving the sustainability targets of the Sustainability Plan that each Centre should develop.

- *Note*: *Management of the equipment and the setting of research programmes by the Centre on its own is valid only if a more integrated model/option is chosen (refer to the two models above) and is not applicable to all Centres (e.g. not to the National Centre for Mechatronics and Clean Technologies).*

[56] See the chapter on Sustainability for case studies on selection of such leader.

The rules of use of this equipment, beyond the time needed for internal Centre projects and purposes, should follow the usual rules as proposed in the chapters on research infrastructure and on State Aid rules. This applies to third parties either research/university institutes (non-founding partners of the Centre) or private sector which should follow the principles set out already in most of the Centres' proposal documents and further elaborated suggestions proposed in this report.

3.2 Best Practices and Further Considerations

This part of the report aims to identify existing inter/national practices that could be potentially used, firstly to compare the current strategic profile of the Bulgarian Centres with other similar profiles, and secondly to identify complimentary initiatives which could constitute meaningful benchmarks for CoEs/CoCs.

Local Ecosystem Interrelation

It is essential that the organisational structure of each Centre be outward looking and fully integrated with the ecosystem around it. It is necessary to concentrate and put into close collaboration the actors in the Bulgarian ecosystem including Sofia Tech Park, the universities, the Academy of Sciences and the future Regional Innovation Centres[57]. Such a collaboration shall be carefully designed and assisted with government/public instruments both financial or other incentives, e.g. TT funding, project grants (National Scientific Research Fund, National Innovations Fund, National Roadmap of R&D Infrastructure etc.), training and consultancy to improve capacity to apply and implement EC research projects.

This kind of integration does not happen by accident so each Centre's organisational structure should include at least one member of the team with specific responsibility for cultivating this integration.

Synergies with Sofia Tech Park

Recently, the Bulgarian RDI infrastructure is improving its scale and quality. The last 7-8 years have been benchmarked with significant investment in academic and research institutions, along with a research facility in Sofia Tech Park (STP). Thus, there is a remarkable potential for development of joint capacity. These investments shall be sustained ensuring operational support and continuous long-term investment along the way.

However, the Bulgarian CoEs, CoCs, and the Sofia Tech Park as a science and technology park, have noticeable potential that can go beyond the region in terms of research. For example, STP is already making efforts in improving its international recognition and expanding its international contacts.

The thematic synergies with STP have been described or already referred to in other parts of this report including in the Centre-specific analyses.

There are further possibilities to link the Centres with STP in order to bring more value-added for both. These are still at initial, design phase. One such possibility created from within STP is the so-

[57] The elaboration of RICs has been halted by the Bulgarian Operational Programme Innovation and Competitiveness (OPIC) Managing Authority. Due to their importance and expected impact, RICs are going to be designed and re-launched in 2021-27.

called “Associated Laboratories” which has not been communicated to nor agreed by any public authority. This is an idea at a very early stage that STP plans to develop in 2020-21.

Open Platform Creation

An option is the creation of an open platform with an extensive database of science, research and development infrastructures and competences of the Bulgarian R&D and academic centres. Such a project could increase the exposure and awareness about the Bulgarian RDI centres.

The Ministry of Education and Science has already started to work on such a database and the continuation and completion of the project will bring exceptional added value for the establishment of sustainable and long-term interconnection with the most modern technologies. By itself, this platform will usher in new opportunities for collaboration, broadening the boundaries of competences and opportunities, and expanding the capacity of the Bulgarian scientific community. Thanks to contemporary ICT and AI technologies, such a platform has the capacity to provide instruments to review, suggest, book, and even pay usage of R&D infrastructures nationwide.

An up to date practical example of an open approach to Research Infrastructure governance and access management can be found in the BIO – Open Lab project in Italy described in detail in Annex I.

3.3 Recommendations and checklist

Although there can hardly be a ‘one size fits all’ solution fitting all 14 Centres, each Centre should, consistent with the legal framework, work toward a fully transparent governance structure and a streamlined lean organisational structure.

In order for the governance to be effective it is essential that the vision and mission of each Centre be crystal clear, be it of a more integrated nature with more powers and more developed structure centred at the common legal entity or a less integrated (including federalized) one, or eventually an intermediate variant. A useful model for this is the New Zealand Centre of Excellence model, which also provides extensive examples of KPIs and performance measurement criteria.[58]

Each Centre should then **develop strategic plans and detailed sustainability plans coherent with the vision and mission and then design their organisational structure** to actuate these plans. The organisational structure should be as lean as possible but include all the necessary competences. Channels of communication should be kept short with **clear lines of responsibility and accountability**. Staff, wherever possible, should be assigned full time to the activities of the Centre to avoid conflicts of interest or conflicting requests for their time or attention.

Finally, the Centres should draw on the experiences of other international cases and not “re-invent the wheel” but simply adopt a governance and organisational that is tried and tested (which still has to be adjusted to the Bulgarian context).

For ease of reference, the following **checklist highlights some of the key issues and questions** to be addressed in a serious, realistic and quantitative way, in the definition of each Centre’s business/strategy plan and organisational structure to ensure coherence with long-term sustainability:

[58] See Chapter on Technology Transfer of this report.

1. What, specifically, will each member of the consortia confer to the new legal entity (and organisational structure) and how will they benefit in return?

2. To what extent are the founding partners ready to make regular financial contribution for the salaries and operational costs of the permanent team at the central level/legal entity (this is valid in particular after the project funding expires post-2023)?

3. What are the fixed versus variable costs and is a plan in place to minimise the former and to render the latter a function of the expected revenues?

4. Has a comprehensive business development plan been developed with adequate staffing and realistic achievable targets for business acquisition locally, nationally and internationally?

5. Are specifics provided on the planned sources of income including?

    a) Technology fields of major interest
    b) Sectors in which these technologies are applied
    c) Examples of target companies by sector, size and geographical location
    d) Estimate of resources needed to effectively target these companies
    e) List of priorities for action

    Although the above are already listed in one form or another in the project documentation (Project Proposal and Project Justification of each Centre), these documents have been prepared in between 2016 and 2018 and since then the market may have changed. Secondly, in a number of Centres the joint activities and plans for engagement with industry have not been described nor sufficiently substantiated. Third, these documents were prepared in a situation of "application for funding" and often contain unrealistic figures or repetitive information as we have seen from detailed examination of each of these documents. In some Centres, however, the information is more detailed and collaborations or client-provider relations seem to be based on previously existing strong relations with industry. In any case, the above-listed sources of income (point 5) have to be regularity re-examined and re-evaluated.

6. Specifics should be presented/contained on the staff who will work in the Centre, their competences, activities, training needs etc. (This should include not just commercialisation staff such technology scouts and brokers, key account managers etc. but – especially for the more integrated model/option - also research staff.)

7. A plan for the internationalisation of the activities should be developed (updated) to include:

    a) International collaboration on fundamental research, which could receive independent funding.

    b) International education and training opportunities. Possible secondments of staff for 3-5 months at more advanced R&D ecosystems.

    c) International expertise that could be attracted to the Centre to enhance its offering.

    d) International clients that could be interested in accessing the services of the Centre at market rates.

8. We specifically recommend that the Centres have a **strong focus on cultivating a multitude of revenue streams to enhance their sustainability.** For instance:

a) Grant schemes that could finance fundamental research to be carried out using the research infrastructure and which could contribute to covering a portion of the fixed costs as well as a contribution to overhead

b) Collaborative research projects with co-financing at the local, national or international level

c) Commissioned research projects for other public or private sector organisations

d) Development of proprietary IP for future commercialisation

e) Valorisation of research results through three distinct channels

    1. further collaborative research with industry with shared IP
    2. license IP to industrial partner or partners
    3. spin-off or start-up companies with ring-fenced risk and genuine scalability and growth potential

Think box. Questions and situations. Aspects for consideration when structuring the future organisational and legal form of the Centres.

- There are two main situations that seem to exist related to the installation of equipment and infrastructure: at the locations and buildings of the partner research organisations (most common case) or in brand new buildings that are being constructed (in particular Sofia University in campus Lozenetz and TU-Sofia in Campus Student-Town). The existence of new buildings that concentrate the RDI activities has implications on the organisational and legal form consisting in the need to form specific rules for the common use and management of the activities in those buildings, which could eventually be able to attain a degree of integration, based, among others, on the common co-location.
- For Centres in which the majority of the funding is concentrated into one partner and there is already a single clear leader of the project (receiving min. 75-80 per cent of funding) and taking overall strategic responsibility: to what extent is this leading partner ready to take over most of the costs for management and coordination to maintain the Centre's operations after the six years project period?
- To what extent do the Work Packages (WPs) and work programmes/research plans integrate activities from different partners that cannot be clearly separated and cannot be effectively performed independently by the individual partners? To what extent do most WPs in each Centre require the active engagement and participation of more than one partner organisation?
- In the context of various activities and engagements with industry, to what extent can the founding partners not perform these activities effectively if they don't integrate their activities in the Centre? How much integration of activities and conferral of competences to the new separate entity is necessary in order to maximize R&D results, collaborations and the performance of client contracts/services?
- Do the core individual partners have their own TTOs and industry liaison teams with track record whose capacity can be utilised for the Centres or should a totally new TTO and industry liaison office be developed from scratch, to serve the common activities of the Centre?
- To what extent are the partners ready to delegate power to a common manager in an separate entity to conclude contracts vis-à-vis third parties binding the founding partners to execute those contracts and/or activities? Can this be fully delegated or should there be an anonymous vote/agreement by all partners, or should only the partner(s) that is (are) impacted have to agree? In the questionnaire, the majority of the Centres have answered that *"Centres should have a degree of independence from its partners in its management and execution of operations but should agree its*

strategy and budget with the founding partners and report on outputs annually/quarterly''.

- The majority of the Centres have also answered that: *''there is not a sufficient number of skilled financial and legal experts for the business planning, controlling, contracting and monitoring of the use of the research infrastructure''*.
- An apparent need has been identified to consolidate the activities of the four centres engaged in ICT/Big data/High-Performance Computing. This could be done in different ways: e.g. through a framework agreement or regular meetings in this format to identify synergies or complementary initiatives.
- Heavy administrative procedures seem to often require the signatures of rectors for multiple documents. This is understandable in the process of large procurements that impact the long-term properties of the partner organisation but as soon as R&D operations have started rectors do not need to be involved in the daily management and operational activities of the Centres. The Centres need a sufficient degree of autonomy in R&D.
- Regardless of the choice of either a more integrated or a less integrated option/model for the Centres, the management should have a sufficient level of process ownership, responsibility and accountability to executive the business plan.

Transition from procurement management and establishment phase to operational R&D activities

4. UNDERSTANDING EU STATE AID RULES in RDI

Disclaimer: The writings, explanations and opinions expressed in relation to EU State Aid rules contained in this chapter, as well as in the individual 14 centre-specific analyses, should serve to help the numerous research organisations in Bulgaria (involved in the establishment and development of the 14 Centres of Competence and Centres of Excellence) to better understand the basic principles of EU State Aid law in RDI. This report does not constitute an official position, decision or guidance of the European Commission or any other national State Aid authority and cannot, under any circumstance, be construed in a manner that may prejudice any such position, decision or guidance. Nothing herein can in any way be considered as an authoritative interpretation of the applicable rules and regulations. The JRC, the independent experts, the contributors and the editors cannot be held liable for any decisions readers may take pursuant to the information and observations provided.

This chapter should be read in conjunction with the sections on State Aid rules in each of the 14 Centre-specific analyses.

4.1 Introduction to EU State Aid Rules

State Aid is defined as an **advantage,** in any form whatsoever, conferred on a **selective basis to undertakings** by national public authorities. State Aid therefore exists when there has been an **intervention by the State or by State resources** (e.g. grants, funding, tax relief, goods and services on preferential terms). The intervention must also give the recipient an advantage on a selective basis, e.g. to specific companies or industry sectors.

The European Single Market – one of the key elements of the European Union – seeks to guarantee the free movement of goods, capital, services, and labour between the EU Member States. With some exceptions, this Single Market has been extended to the EFTA countries to form the European Economic Area. This presupposes a level playing field within this area. Selective aid granted by Member States (and EFTA-countries, but for simplicity below we only refer to Member States) to *undertakings* could distort that level playing field. Therefore, Article 107 of the Treaty on the Functioning of the EU (TFEU) generally prohibits the granting of State Aid. For a measure to be incompatible, it has to fulfil a four-factor test:

- be granted by a Member State or through State resources and
- distort or threaten to distort competition
- favour certain undertakings or the production of certain goods
- affect trade between Member States

Thus, in order for a national aid measure to be incompatible with the internal market, it should not only distort (or threaten to distort) competition by favouring certain undertakings or the production of certain goods but also affect trade between Member States. These factors are cumulative, i.e. both have to be fulfilled. When both conditions are present, then according to Art. 107 (1) TFEU, the intervention is incompatible with the internal market and, generally speaking, forbidden.

The European Commission's Directorate-General (DG) for Competition is responsible for the enforcement of EU Competition rules along with, in certain cases, the national competition authorities. DG Competition is thus responsible for evaluating the compatibility of measures adopted by the Member States. The relevant direct counterpart for the research organisation are however the relevant authorities within the Member States.

Three scenarios for Research Organisations

Research Organisations (ROs) can have **three different scenarios** under EU State Aid rules:

- ***outside* the scope** of EU State Aid control – the publicly funded activity concerned is of a non-economic character;
- ***recipient* of State Aid** – the research organisation qualifies as an 'undertaking' in relation to the publicly funded activity concerned;
- ***grantor* of State Aid** – the research organisation provides an advantage to an undertaking.

The scenario must be defined in relation to the research organisation's activities.

The 14 Centres of Competence and Centres of Excellence

Specifically, with regard to Research, Development and Innovation (RDI) the Commission has published its policy in the "Framework for State Aid for research and development and innovation" (2014).[59]

We note that all 14 Centres (meaning the individual organisations participating in the partnerships) have undertaken to operate under the assumption laid down in the RDI Framework that public funding for the research infrastructures will be considered to fall outside State Aid rules provided the economic use remains purely ancillary, consuming exactly the same inputs, and if economic activities do not exceed 20 per cent of the overall annual capacity. This is combined with the necessity that all publicly funded research organisations, which exercise economic activities, should conduct separate accounting.

Additionally, the Commission provided clarification in its "Notice on the notion of State Aid" (2016). Both documents have the status of a Communication, i.e. they are not formal legislation. As a result, the European Court of Justice (ECJ), which ultimately decides on the legal construction of EU State Aid law, will take the contents of these Communications into account, but is not bound by them.

Exemptions: GBER and De Minimis

State Aid measures that fulfil the basic conditions of Article 107 (1) are generally not compatible with the internal market. However, as we shall see, there are certain exceptions to this general rule. Sometimes, aid measures by Member States are necessary to create, foster or safeguard a well-functioning economy. For this reason, despite the general prohibition of incompatible State Aid, Art. 107 (3) of the TFEU has opened up the possibility for the European Commission to approve certain aid measures by Member States. Such aid must be notified by the Member State and can only be granted after approval by the Commission has been obtained.

However, there are a number of important exceptions to the requirement of prior notification and approval. The first one being the "De Minimis Regulation". This regulation sets a threshold figure below which Article 107(1) can be considered not to apply on the basis of the assumption that, usually, aid measures up to this amount do not affect trade and competition between the Member States. This threshold is currently set on €200K per undertaking over three fiscal years. However, please note that the "de minimis" exception is not available to all sectors. Given the limited

[59] Communication from the Commission. Framework for State aid for research and development and innovation (2014/C 198/01)

importance of this exception to the Centres we do not cover this topic in more detail, but it may be relevant where university incubators or accelerators support start-ups or spin-offs.

Of far greater importance to the 14 Centres is the General Block Exemption Regulation (GBER). The GBER exempts certain categories of State Aid if certain conditions are met. These categories encompass aid for Research, Development and Innovation to the Centres. We will revert to the GBER later.

4.2 State Aid for Research, Development and Innovation (RDI)

The promotion of research, development and innovation is an important EU objective and is expressed in Article 179 of the TFEU. This article states that the EU *"shall have the objective of strengthening the scientific and technological bases by achieving a European research area in which researchers, scientific knowledge and technology circulate freely, and encouraging it to become more competitive, including in its industry, while promoting all the research activities deemed necessary (...)'*. The other articles of Title XIX of the TFEU deal with the ways in which this is to be implemented in the Union, including the large multi-annual Framework Programmes. The aid granted directly by the Commission in the context of such Framework Programmes (*the "grant to the budget")* does not qualify as State Aid and it has its own requirements and criteria under the specific programmes and projects. By definition, this aid is not granted by a Member State and thus does not fall under the four-factor criterion of Art. 107 that we discussed earlier. National public means used for matching the *grant to the budget* may however qualify as State Aid (and may thus be allowed under certain exemption or prohibited, respectively).

When, however, a Member State has decisive powers over the allocation of European financial means, e.g. ERDF-means, the use of such European financial means is imputable to the State and the measures are subject to the EU State Aid rules. In addition, the Member States themselves may take national regional or local aid measures for RDI, e.g. the granting of subsidies or loans. Such measures are also fully subject to the EU State Aid rules. Given the scope of Art. 179 above, it comes as no surprise that the Commission has issued specific legislation and policies on State Aid control with respect to RDI. Most notably the GBER and the RDI Framework.

Relationship between the GBER and the RDI Framework

Art. 107 of the TFEU allows the Commission to exempt certain categories of State Aid under certain well-defined conditions. One of those sectors is RDI. The GBER, therefore, applies to aid that matches the four-factor test of Art. 107, but is exempted. Such aid does not have to be notified by the relevant national authorities to the Commission. Other aid that qualifies as incompatible State Aid under Art. 107 (meaning it falls neither under the GBER nor under De minimis regulations) must be notified to the Commission and may not be implemented before the Commission has given formal approval. Given the nature of this formal exemption, the GBER mainly applies to aid granted by/through the Member States to research organisations acting as *recipient* of State Aid (some practitioners call this direct aid – it is aid at the level of the research organisation). Please note that the RDI part of the GBER not only applies to research organisations, but also to SMEs and larger undertakings, although the allowable aid intensities vary.

State Aid can also be given indirectly, via a research organisation to undertakings. This chapter will also explore situations where the research organisation acts as a grantor of aid - this is sometimes referred to as *indirect aid* since it is not granted directly, but through the research organisations to third parties (this includes for instance the rules on setting the price/fees for services).

- It follows **ROs can act as *recipients* of aid and as *grantors* of aid to other parties (in the latter scenario the aid passed on to other parties is referred to as indirect State Aid)**. Point 22 of the RDI Framework stipulates that the Commission will not consider the RO or RI to be a beneficiary of State Aid if it **acts as a mere intermediary** for passing on to the final recipients the totality of the public funding and any advantage acquired through such funding.
- There are two important conditions to this. The RO or RI must be able to quantify the aid and must be able to show that it is fully conveyed to the final recipient, such as an undertaking. It must also not benefit in any way, e.g. by having been awarded a tender due to pricing under normal market conditions. Please note that the final recipient, then, is considered to be the beneficiary of (possibly incompatible) State Aid.

Aid measures according to Art. 107 TFEU and which do not qualify to be exempted under the GBER or another legal act such as De minimis, must be notified to the Commission. Where an aid measure is notified to the Commission, or a measure should have been notified, the Commission will conduct an evaluation and decide on the compatibility of the measure with the internal market. Please note that the GBER is a "safe harbour" arrangement. The fact that a measure falls outside of the GBER is not a presumption of illegality and the measure may well be allowed.

The most important policy and guidance document specifically for the field of RDI – for measures on research and development is published as the "Framework for State Aid for research and development and innovation" – from now on to be referred to as the RDI Framework. The current version was published in 2014. Please note that the RDI Framework has the status of a Communication. It has no formal power of law, but still serves as the main source of information for the applicability of State Aid rules to research and development. It lays down and explains a number of important principles for the application of EU State Aid rules specific for the domain of research and innovation and public research organisations such as publicly funded universities or research institutes. This includes the research organisations participating in the 14 Centres. The focus of this chapter will therefore be on the RDI Framework.

Main guidelines under the RDI Framework

First and foremost, it should be noted that the RDI Framework sets out a policy adopted by the Commission. It does not have power of law. This is reflected in the statement that the Commission considers certain types of aid to be compatible with the internal market. Eventually, it is up to the EU Court of Justice to decide on the legal construction (interpretation) of the TFEU. Secondly, the RDI Framework deals with State Aid for research, development and innovation in a broad sense. It also covers aid for SMEs and larger corporations. However, in this chapter we will focus on the specific arrangements of the RDI Framework for research organisations and research infrastructures.

Both the GBER and the RDI Framework distinguish between aid given directly by the Member State to research organisations (such as the partners executing the Centre projects), and aid given to an undertaking *via* a research organisation. It is beyond the scope of this report to assess whether aid granted to the Centre partners by or via Bulgarian public funding bodies has been given in accordance with the EU State Aid rules and the respective notification requirements. Since this report is written for the Centres, we focus on the aid that may be granted via the Centres (or the research organisations involved in these projects) to undertakings, e.g. by means of technology transfer, by renting out of equipment, by performing contract research on behalf of an undertaking,

or by engaging in collaborative research jointly with undertakings. State Aid granted to undertakings is aid at the level of these undertakings (for which the research organisation is responsible). To find out which activities by the Centres give rise to what considerations and what requirements are valid in the different scenarios, we must first distinguish between economic and non-economic activities.

Economic vs non-economic activities: research organisations as recipients of State Aid

Pursuant to Art. 107 (1) TFEU, State Aid measures are compatible with the internal market if they do not affect trade between Member States, and do not distort or threaten to distort competition, i.e. that no selective aid is granted to *undertakings*. An *undertaking* is defined as an entity carrying out economic activities consisting of offering any product or service on a given market. It is therefore not important how the undertaking is organised, whether it be under public or private law or whether it aims to make a profit or not. This means that in principle a Centre itself, if organised as a legal entity (or the partner organisations respectively), may be deemed to be an *undertaking* for the purpose of State Aid control. This is valid for the Institutes of BAS, the universities, other public institutes such as the National Centre for Infectious or Parasitic Deceases, but also for the private partner organisations (associations) within some of the Centres which receive funding for research infrastructure (in particular the Association Scientific Institute for Clean Technologies (SICT) within Hitmobil and Association Advanced Flight Technologies (AFT) within Quasar).

Non-economic activities

Regarding the scenario of research organisations as recipients of State Aid, EU State Aid law applies only to the public funding of *economic* activities, which these organisations conduct. It does not apply to non-economic activities, which are normally the main activities of research and knowledge dissemination organisations. The RDI Framework gives considerable guidance on this subject, especially with regard to *Research Organisations* and *Research Infrastructures*. For the time being we will first focus on *Research Organisations*, defined in both the GBER and the RDI Framework as follows:

> *A "research and knowledge dissemination organisation" or **"research organisation"** means an entity (such as universities or research institutes, technology transfer agencies, innovation intermediaries, research-oriented physical or virtual collaorative entities), irrespective of its legal status (organised under public or private law) or way of financing, whose primary goal is to independently conduct fundamental research, industrial research or experimental development or to widely disseminate the results of such activities by way of teaching, publication or knowledge transfer. Where such entity also pursues economic activities, the financing, the costs and the revenues of those economic activities must be accounted for separately.*
>
> *Undertakings that can exert a decisive influence upon such an entity, for example in the quality of shareholders or members, may not enjoy a preferential access to the results generated by it.*

In the way that the Centres are set up:

1. In the current situation, operating through partnerships, the partner organisations (listed above which receive funding for infrastructure[60]) are research organisation for the purposes of EU State Aid rules.

- We also note that the private organisations receiving funding for infrastructure have also committed that they are/will be 'research and knowledge dissemination organisations' in the implementation of the Centre projects, and this is embedded into the Grant Contract. Unless suitable arrangement is found for these private entities involved in the Centres, they may experience heavy sustainability issues to sustain their activities once the project funding for R&D activities is over (post-2023). The associations SICT (in Hitmobil) and AFT (in Quasar) have been created shortly before the applications to participate in the Centres-projects and do not appear to have a previous track record of independent operation.

2. If the Centres decide to set up an additional legal entity, depending on the powers/competences of this entity, it may also qualify as a research organisation according to the definition.

Especially with regard to Research Organisations, in point 19 of the RDI Framework the Commission gives a list of activities that it considers generally to be of a non-economic nature. These are activities of public interest that are of paramount importance to the proper functioning of society, like primary, secondary and tertiary education and independent basic ("blue sky") research. Please note that the definition of research organisation requires a certain amount of independence from undertakings. This means that if the Centres are created as joint legal entities, the private partner organisations should not be able to exercise decisive influence or benefit disproportionately from their participation in the Centre (as a RO). Otherwise, the Centre in question could lose its status as a Research Organisation under State Aid rules. This is especially relevant for research organisations that focus on applied research. **The non-economic activities include:**

i. **primary activities of research organisations and research infrastructures**, in particular:
    - public education organised within the national educational system, predominantly or entirely funded by the State and supervised by the State. Please note that *workforce* training[61] is excluded;
    - independent R&D for more knowledge and better understanding, including collaborative R&D where the research organisation or research infrastructure engages in effective collaboration;
    - wide dissemination of research results on a non-exclusive and non-discriminatory basis, for example through teaching, open-access databases, open publications or open software.

ii. **knowledge transfer activities**, where they are conducted either by the research organisation or research infrastructure (including their departments or subsidiaries) or jointly with, or on behalf of other such entities, and **where all profits from those activities are reinvested in the primary activities** of the research organisation or research infrastructure. The non-economic nature of those activities is not prejudiced by contracting the provision of corresponding services to third parties by way of open tenders.

[60] We do not include here the Centres which have private partners receiving funding mostly for providing services (such as GIS-TC, VUZF as well as the Cleantech Foundation). This does not however mean that these partner association can benefit from IPR for the creation of which they have not proportionately contributed.
[61] For more information, see Commission Notice on the notion of State Aid as referred to in Article 107(1) of the Treaty on the Functioning of the European Union C/2016/2946.

The Centres (more precisely partners in the Centres) have generally committed in their Grant Contracts to apply this reinvestment. From the perspective of State Aid law, **revenues from knowledge transfer (KT) activities that are not reinvested by the respective research organisation into its non-economic activities will have the effect that these KT activities will be considered as "economic".** Although the re-investment requirement applies only to KT, it is advisable (not mandatory) that the research organisation re-invest revenues also from other activities into non-economic in order to avoid an unintended cumulative expansion of economic activities over time.

This clarification gives the Member States some leeway in the public funding of research organisations. The funding of their primary activities is not subject to the State Aid rules. This guidance is quite clear and should not lead to any misunderstandings. However, there are a couple of remarks that need to be made here. Where point 19 of the Framework states that knowledge transfer activities are non-economic in nature, we must clarify that this refers only to the public funding of the *activities* of for instance the technology transfer office and not to the *subject* of the transfer (e.g. a licensing agreement). If the research organisation wishes to transfer any result of publicly funded research to an undertaking, then usually a fee in conformity with market prices is required. Furthermore, in a later part of this chapter we will make some additional remarks on the topic of *effective collaboration*.

ECONOMIC ACTIVITIES

All other activities in markets are economic activities, whether it be the manufacture of goods, the rendering of services or the renting out of equipment or capacity; all such activities must be considered "economic activities" under State Aid law. Please note that it is not required that such activities are offered for compensation or that they generate a profit. In principle, the Member States are not allowed to use public funds to finance economic activities by either Research Organisations or Research infrastructures, unless one of the exemptions applies or the aid measure was notified to and approved by the Commission.

Notice on the Notion of Aid

Some of the Centres asked about conducting a specific service to municipal authorities by way of a direct request. The answer to this question depends on a number of factors, including on the existence of a market, i.e. since an activity is economic only when there is market for it,[62] as well as on the exercise of public authority – i.e. as a function of the state in the implementation of its public policy.

Mixed economic and non-economic activities

As explained above, the primary activities of RO's and/or RI's are non-economic in nature and the State Aid rules do not apply to these. However, most RO's and RI's will indulge in some sort of economic activities to complement their primary activities. The responses to the questionnaire show that some of the Centres expect such economic activities even to reach the maximum percentage of 20 per cent that is allowed under the Grant Contracts[63], while others expressed concerns that they would easily exceed this limitation.

[62] For more information, see Commission Notice on the notion of State Aid as referred to in Article 107(1) of the Treaty on the Functioning of the European Union C/2016/2946.
[63] The founding partner organisations have committed to observe the 80-20 rule in the Grant Contracts with the Managing Authority.

There is a general misunderstanding in many of the Centres' partner organisations that non-economic and economic under EU State Aid rules equals for-profit and not-for profit as understood in the common sense. This may, in part, be due to wrong translation of the documentation. It is of utmost importance that the practitioners in the research organisations partners in the Centres build internal knowledge and capacity not only to distinguish between economic and non-economic activities from the conceptual point of view and avoid exceeding the 20 per cent limitation, but also when negotiating and structuring various relations with industry clients and industry partners.

Economic activities cannot, in principle, be financed by the Member States, directly or indirectly. From this, it follows that these economic activities must not be mixed up with non-economic. Financing as well as accounting must be clearly separated to prevent cross-subsidisation of economic activities by public means that were dedicated for non-economic activities. Especially in the field of RDI, it is often quite difficult to distinguish between both types of activities as often the same input factors are used. Such input factors may be personnel or equipment and facilities used. It is therefore of paramount importance that the Centres have an adequate accounting system that allows for correct bookkeeping of economic activities. Where common input factors for economic and non-economic activities are used, e.g. overhead components, ***analytical accounting should be used***, i.e. that overhead costs can be attributed to and allocated with the project or assignment that makes use of such overhead components and charged downstream to undertakings that make use of the centres' capacity or the results of its economic activities. As we will see later, this implies that the Centres must track the use of equipment and facilities that are also used for economic activities.

To sum up, **State Aid rules require mandatory separate accounting for economic and non-economic activities for all research organisations conducting economic activities. Failure to maintain separate accounting would make all public funding subject to staid aid.** We note that not all partner organisations in the Centres have implemented this yet and, although many of them are still in the process of establishment and procurement, at the moment when these start to operate and engage with industry they need to have already implemented separate accounting systems. **The costs, funding, revenues must be accounted separately for economic and non-economic activities respectively**, in a clear and distinct manner in the organisation's balance sheets and income statements, in line with the Bulgarian national and international accounting standards.

Capacity usage, Relevant Entity and Ancillary Economic Activities

The RDI Framework gives further guidance on the confluence of economic and non-economic activities in point 20. If the economic use is only *ancillary*, then the funding in its entirety falls outside of the State Aid rules:

> *"Where a research organisation or research infrastructure is used for both economic and non-economic activities, public funding falls under State Aid rules only insofar as it covers costs linked to the economic activities. Where the research organisation or research infrastructure is used almost exclusively for a non-economic activity, its funding may fall outside State Aid rules in its entirety, provided that the economic use remains purely ancillary, that is to say corresponds to an activity which is directly related to and necessary for the operation of the research organisation or research infrastructure or intrinsically linked to its main non-economic use, and which is limited in scope. For the purposes of this framework, the Commission will consider this to be the case where the economic activities consume exactly the same inputs (such as*

material, equipment, labour and fixed capital) as the non-economic activities and the capacity allocated each year to such economic activities does not exceed 20 per cent of the relevant entity's overall annual capacity. "

Ancillary nature of economic activities. An economic activity can be qualified as ancillary if it uses the same input factors (exactly the same inputs) as the non-economic use, i.e. the same facilities, equipment, personnel. For example, the activity would arise as a by-product of a non-economic activity, or it is necessitated as a consequence of excess input or capacity – such as when an equipment has to operate for a fixed time period before it can be switched off, without having to expand operations by introducing additional input. As we see, one of the aims of the ancillary use exemption is the commercial use (or utilisation) of existing surplus capacity.

- If the "same inputs" requirements cannot be readily satisfied, there are also **two additional options** for an activity to be ancillary, for which however the evidentiary threshold may be higher to prove:
    - the economic activity is limited in scope, directly related to and necessary for the operation of the RO, or
    - the economic activity is limited in scope and intrinsically linked to the main non-economic use of the RO.

Capacity usage. In addition, it must not exceed 20 per cent of the relevant entity's overall annual *capacity*. Most of the 14 Centres and the partner organisations already know and understand that this concerns capacity and not turnover, revenues or profits. Some of the partner ROs continue to be unsure whether they can make more than 20 per cent of their revenues from economic activities. In principle, there is no limitation for the revenues generated as long as the overall annual capacity usage of the infrastructure does not exceed 20 per cent.

How to measure capacity usage? Depending on the nature of the activity and the type of resources required, the capacity could be measured on the basis of time accounting (in man/hours - human resource capacity in employee working hours, time of use), the total amount of inputs on a yearly basis (such as material, equipment and fixed capital), and other elements relevant to the specific activity of the relevant entity of the research organisation. We have observed that most Centres (their partners) resort to using time accounting for the usage of the equipment and it is recommended to also look into other elements, including the above listed, if these are considered relevant for the specific type of activity.

Relevant entity. Furthermore, some Centre/RO representatives and staff expressed it is not clear to them what constitutes the "**relevant entity**". What should be the granularity of this criterion? Does it apply to a single lab, an institute, the legal entity, or perhaps the organisation taken as a whole? The relevant entity is defined in the following way:

"*that is to say every individual entity (such as a laboratory or department) that, with the organisational structure, capital, material and workforce that it effectively has at its disposal, could alone perform the activity concerned.*"[64]

This is usually translated as having reference to the "smallest administrative unit". Thus, the capacity the research organisation allocates to economic activities should be equal to or less than 20 per cent of the organisation's overall annual capacity at the level of the **entity that actually**

[64] Presentation: *State Aid rules for RDI: Key issues / Questions identified by practitioners in Member States*, Directorate-General Regional Policy, 2018, https://ec.europa.eu/regional_policy/sources/conferences/state-aid/rdi_2018/presentation_rdi_avgoustidou.pdf

carries out the economic activity in question. Usually research organisations have several departments, sections, so it should be at the level of the **relevant department or section.**

For example, where one institute of a given RO is performing economic activities by using essential resources of another institute of the same RO, the "smallest administrative unit" should encompass both institutes and their combined annual capacities. However, the exact boundaries are dependent on the nature of the activities. In this respect, we suggest the Centres to not overly focus on legal constructions as the State Aid case law shows that economic factors and effects are mainly looked at while legal and organisational constructs may give a shape to and may influence the former. We advise the Centres to seek advice from a local chartered accountant when in doubt as to how to apply this rule in the local context.

Where the State Aid for RDI is given in the context of structural funds like the ERDF, it is up to the MA first to ensure that aid is granted in full compliance with State Aid rules and second, to monitor the obligations enshrined in the Grant Contract (incl. for example the use of this 80/20 rule). However, the GBER and RDI Framework do not impose a specific measurement method for this. Therefore, it is up to the MA to require the fulfilment of appropriate accounting standards.

Even where the economic activities are and remain purely ancillary, separate accounting is mandatory. The Centres/ROs must be able to prove that such economic activities are indeed ancillary, i.e. use the same input factors (or one of the other alternative options listed above) and remain below the 20 per cent threshold.

What if capacity usage exceeds the 20 per cent threshold? The overall annual capacity share of economic activities measured against the non-economic activities is decisive. From this, it follows that a simple yearly financial statement is not sufficient to demonstrate the ancillary character of the economic activities.

If in a given year a research organisation's economic activities exceed 20 per cent of its overall annual capacity, then these activities cannot qualify as "ancillary" and any public support granted for these economic activities has to comply with compatibility conditions defined under State Aid rules for RDI. In this case, the RO should contact the national State Aid authority for further guidance on how to ensure that the public support for economic activities of this RO is in line with the general block exemptions or other applicable State Aid rules; or the RO should ensure to effectively claw back the excess without undue delay (more on the claw-back in the section on research infrastructure below).

Bear in mind that in principle, the full cost of economic activities must be covered solely by the commercial revenues, also for commercial assignments that were completed (in the same year) before the moment on which the threshold was exceeded. Such calculation must take into account the pro rata depreciation costs of the infrastructure used.

To prevent exceeding the 20 per cent threshold, the RO or RI may try to "convert" or "renegotiate" potential contract research/research services assignments into effective collaboration projects. This should in no case be a disguised research on behalf of undertakings (!); what we mean here is that **the research organisations should build internal capacities to negotiate collaborative agreements with industry, which are by nature "effective collaborations", i.e. activities that qualify as non-economic.** In these joint projects, the RO should aim to obtain the maximum advantage and will have higher chances to keep part of the research results created.

As this usually requires co-funding by the RO, it is therefore advisable that the Centres reserve some funding to this end. Please note that for such "converted" project to be considered under

point 28 (d) juncto Point 29 RDI Framework, there must be a genuine share of input factors, responsibilities and results. The multi-factor test suggested in this chapter to identify the nature of the activity in question should clearly be applied.

UNDERSTANDING "EFFECTIVE COLLABORATION"

We should start by saying that contract research, research services and renting of equipment to undertakings are clearly economic activities. Independent and internal research clearly is not. Agreements for collaboration or joint projects or initiatives, depending on their provisions and consequences, may or may not qualify as "effective collaboration", provided the minimum conditions for the latter are fulfilled. Where ROs or RIs engage in collaborations with one or more undertakings the terms of the collaboration must be sufficiently clear to ascertain that the activity in question qualifies either as economic or as non-economic (effective collaboration) under EU State Aid rules.

It is of great importance for the partner research organisations in the Centres to be able to structure correctly more complex agreements with industry partners.[65] Effective collaboration activities are not limited by capacity of the research infrastructure and belong to the primary activities of a research organisation.

During the meetings held and visits conducted by the independent experts of the various partner research organisations representing the Centres, the experts concluded that the research organisations need to **build further knowledge and capacity to effectively distinguish between economic and non-economic activities in all their engagements with industry** as well as in effectively protecting the interests of the research organisation, including in keeping part of the research results of such collaborations.

The definition is contained in two provisions in the RDI Framework. Firstly, the section on definitions provides that (we marked in bold the essential elements):

> *'effective collaboration' means collaboration between at least two **independent** parties to exchange knowledge or technology, or to achieve a **common objective** based on the **division of labour** where the parties **jointly define the scope** of the collaborative project, **contribute to its implementation and share its risks**, as well as its **results**. One or several parties may bear the full costs of the project and thus relieve other parties of its financial risks. Contract research and provision of research services are not considered forms of collaboration."*

This topic is again covered by the RDI Framework in Par 2.1 and 2.2:

Point 27 provides that:

> *"A project is considered to be carried out through effective collaboration where at least two independent parties pursue a common objective based on the division of labour and jointly define its scope, participate in its design, contribute to its implementation and share its financial, technological, scientific and other risks, as well as its results. One or several parties may bear the full costs of the project and thus relieve other parties of its financial risks. The terms and conditions of a collaboration project, in*

[65] Note that we use "partners" here and not clients, since clients is more suitable for undertakings for which the research organisation perform agreed services or deliver requested products and which is an economic activity. Using partners in the context of "effective collaboration" better reflects the necessary minimum degree of division where the industry partner will also have to perform certain activities to achieve a common objective.

particular as regards contributions to its costs, the sharing of risks and results, the dissemination of results, access to and rules for allocation of IPR, must be concluded prior to the start of the project. Contract research and provision of research services are not considered forms of collaboration."

As you understand, the **nature of the relationship between the RO/RI and undertakings is decisive and brings a number of consequences.**

Please note that one of the parties can cover the full costs for the research activity and this fact is not in itself a decisive factor in determining the character of the activity. This is a common misunderstanding and the partners in the Centres should remember that even if the industrial partner pays the full costs (in other words sponsors the research) the activity can still be qualified as non-economic effective collaboration provided the minimum conditions for this are fulfilled. This principle is clearly mentioned in point 27 of the RDI Framework providing that the efforts of the RO in an effective collaboration may be funded (sponsored) for up to 100 per cent by an undertaking.

What are the risks of an incorrect qualification of the nature of the RDI activity performed by a research organisation?

- If the research organisation incorrectly qualifies/considers/counts activities as non-economic which however are in their nature economic, then it risks to exceed the capacity of the infrastructure used for economic activities above the 20 per cent threshold leading to further consequences (one is the claw-back/recovery of the excessive funding).
- If the research organisation incorrectly qualifies/considers/counts activities as economic which in their nature are however non-economic, then it risks to reach too soon the threshold of the 20 per cent and then unnecessarily stop conducting economic activities risking to compromise its sustainability due to refusal to accept new requests from industry.

WHEN TO QUALIFY AN ACTIVITY AS NON-**ECONOMIC**?

Considering the definition provided for "effective collaboration" describing as much as possible the nature of this activity, below the independent experts present one practical assessment method[66] for helping research organisations to establish with increased certainly whether a particular activity can indeed be qualified as "effective collaboration" under EU State Aid rules.

In relation to the research organisation's joint activities, projects and partnerships with independent parties (*"independent parties" in this context includes only entities engaged in primarily economic activities, such as companies or industrial partners regardless of their legal form*):

Question 1: Is there a common objective established between the parties with mutually agreed intended research outcomes? Is there a division of labour so that each party to the joint activity in question performs its particular share of the work?

[66] This assessment method is based solely on the experience and opinion of the independent experts i.e. it comes from their practical experience and does not represent any official position.
A dedicated **Guidance in the form of a Decision Tree** "*State Aid Rules in Research, Development & Innovation: Addressing Knowledge and Awareness Gaps among Research and Knowledge Dissemination Organisations. Decision Tree*" was published by JRC in late 2020 and would also be useful for the Bulgarian research organisations. It can be downloaded at: https://ec.europa.eu/jrc/en/publication/state-aid-rules-research-development-innovation.

a. Answer is YES to both of the above two questions: this means the activity may be qualified as "effective collaboration" provided a minimum number of other conditions is fulfilled. Continue below to questions 2 to 6.
b. Answer is NO to one of the above or to both: this means the activity is likely NOT effective collaboration but rather research on behalf of undertakings and is economic. More information in the section on Understanding Research on behalf of undertakings below.

Questions 2 – 6 (only if you answered positive to both of the sub-questions in Question 1):

Question 2: Is the scope of the joint activity jointly defined, meaning that the work programme or technical specifications are designed jointly and iteratively between the parties taking into account the respective interests?

Question 3: Do the parties contribute to the joint activity's implementation, meaning that each devotes resources, equipment, capacity, knowhow, background IP or similar elements necessary for the effective implementation of the project?

Question 4: Do the parties share their respective risks, meaning the risks associated with the project regardless of research outcomes, for example any losses, liabilities uncertainties or potential negative effects, in case the joint activity results in failure?

Question 5: Do the parties have effective access to each other's results and share the IPR in a manner that adequately reflects their work packages, contributions and respective interests in the joint activity?

Question 6: Is it the true that the other party cannot unreasonably prohibit the research organisation from publishing or otherwise disseminating the research results of the latter (unless there are overriding IPR considerations, such as patentability, exploitation rights over IPR-protected creations)?

Answers and results: If the research organisation answered YES to at least three out of the above five questions (questions number 2-3-4-5-6) in addition to the positive answers to both of the sub-questions in Question 1, then the activity in question is likely to be "effective collaboration" and therefore non-economic.

UNDERSTANDING RESEARCH ON BEHALF OF UNDERTAKINGS

How to understand which activity is research on behalf of undertakings (*contract research*, *research services*)?

The RDI Framework stipulates that in research on behalf of undertakings, the undertaking (which in most cases is a private party - client from private sector) "*typically specifies the terms and conditions of the contract, owns the results of the research activities and carries the risk of failure*".

Another multi-factor test[67] has been developed by the independent experts, including based on their work on previous projects, which may help to give an indication regarding the character of the RDI activity in question and whether it is likely a research on behalf of undertakings.

[67] This assessment method is based solely on the practical experience and opinion of the independent experts i.e. it does not represent any official position, guidance or instruction. The method should serve only as an indication to help research organisations better understand the nature of an activity.

To **assess whether a joint activity with an undertaking qualifies as *research on behalf of undertaking*** according to point 25 of RDI Framework – which means an economic activity according to State Aid Law, answering the following questions may be helpful:

- Are the technical specifications imposed by industry without iterative and bilateral discussion?
- Does the RO relinquish IP ownership to the industrial company?
- Can the participating undertaking totally prohibit any publication or other wide dissemination of non-IPR results (scientific publications, conferences, other disseminating activities, collaborative standardization, training)?
- Does the undertaking totally outsource its RDI need within the project without having its own work package?
- Are the expected research results described in terms of an *obligation of results*?
- Are there other items indicating that there is no actual risk sharing?

Answers and results: According to the expert-authors entrusted to prepare this chapter of the report, if the majority of the six answers is YES, then the RDI partnership is in all likelihood research on behalf of undertaking and consequently an economic activity.

Indirect Aid in Collaborative Research

The aid given by/through the state to a Research Organisation (RO) or Research Infrastructure (RI) makes these ***recipients* of aid.**[68]

We already covered the State Aid effects of economic and non-economic activities (only regarding research organisations as recipients of aid!) and concluded that only economic activities of the Centres/the partners are covered by the State Aid rules. In the following sections, we will discuss situations/scenarios in which the research organisation acts *as a grantor of aid*.

Thus, in their various engagements with industry **RO or RI may pass on such aid to an undertaking (act as a *grantor* of aid).** That situation is called *indirect aid*.

- Even if the research organisation's economic activities are ancillary and below 20 per cent of the overall annual capacity, the organisation still needs to conduct all its activities in a way that avoids passing on undue advantage to third parties (essentially private/industrial partners and clients). This is valid for all kinds of engagements with industry, both economic and non-economic: effective collaboration, research on behalf of undertakings, renting of equipment, licensing, creation of spin-offs, supporting startups in incubators, etc.

Specifically, for collaborative research, the conditions that research organisations or research infrastructures have to fulfil in order to avoid passing on indirect aid to third parties (essentially industry) are contained in points 28, 29 and 30 of the RDI Framework; below we only list the first point.

> *"Where collaboration projects are carried out jointly by undertakings and research organisations or research infrastructures, the Commission considers that **no indirect State Aid is awarded to the participating undertakings** through those entities due to favourable conditions of the collaboration if one of the following conditions is fulfilled:*

[68] Some practitioners use the phrase "direct aid" to refer to the situations where research organisations act as recipients of aid. However we would discourage this denomination as it could be wrongly assumed that there is a connection with other, different mechanisms, which also use this phrase.

(a) the participating undertakings bear the full cost of the project, or

(b) the results of the collaboration which do not give rise to IPR may be widely disseminated and any IPR resulting from the activities of research organisations or research infrastructures are fully allocated to those entities, or

(c) any IPR resulting from the project, as well as related access rights are allocated to the different collaboration partners in a manner which adequately reflects their work packages, contributions and respective interests, or

(d) the research organisations or research infrastructures receive compensation equivalent to the market price for the IPR which result from their activities and are assigned to the participating undertakings, or to which participating undertakings are allocated access rights. The absolute amount of the value of any contribution, both financial and non-financial, of the participating undertakings to the costs of the research organisations or research infrastructures' activities that resulted in the IPR concerned, may be deducted from that compensation."

Transfer of IPR resulting from effective collaboration with undertakings. According to point 28 (d) RDI Framework no State Aid is passed on to an undertaking where the RO receives a compensation that is equivalent to the market price for the IPR resulting from the research performed by the RO and assigned or licensed to a participating undertaking. In this case, the value of any contribution, monetary as well as in-kind, may be deducted from the required compensation.

Further provisions are contained in points 29 and 30 that clarify or expand on point 28. Please note that point 30 RDI Framework stipulates that if none of conditions in point 28 are fulfilled, and none of the other exemptions apply, then the full value of the contribution of the research organisations or research infrastructures to the project will be considered as an advantage for the collaborating undertakings, to which State Aid rules apply and must be clawed back from the receiving undertaking.

Point 28 requires some explanation. Where a RO is involved in an effective collaboration, the Commission considers that no State Aid is conveyed to the participating undertakings if at least one of the conditions of point 28 RDI Framework is met.

Most of these conditions set by point 28 are clear. Condition (c) is not and often leads to questions. It is not uncommon for ROs to accept assignments from undertakings, where the RO defines larger parts of the research due to its surplus of knowledge, not charge for the use of its background know-how and IPR, while accepting the assignment under its general terms and conditions (GTCs). It is not uncommon that such GTCs stipulate that the RO owns the IPR generated and only grants a license to the undertaking.

In one of the main scenarios, the research organisations will keep part of the IPR (the one resulting from its own activities) or the IPR resulting from the project as well as the access rights would be allocated adequately among the partners proportional to their work packages, contributions and respective interests. In those cases, as well as in cases where the partner entity (e.g. from industry) bears the full costs of the project, the research organisations likely does not pass on undue advantage to the partner.

- However, there might be **cases where the IPR will be allocated to the partner entities** (from industry). It is essential to remember that there are **conditions also in effective collaboration** (not only in research on behalf of undertaking - as we should see below) to be fulfilled. Thus, when assigning IPR resulting from the collaboration to the

partner entity (from private sector/industry), the research organisation needs to receive compensation equivalent to the market price. There are four alternative options given to determine this. The compensation should be determined by either of the following: an open, transparent and non-discriminatory competitive sale procedure, or by arm's length negotiation; or by an independent expert or by matching the highest third party offer.

- Bear in mind also that the absolute amount of the value of any contribution, both financial and non-financial, of the partner entity to the costs of the research organisation's activities that resulted in the IPR concerned, may be deducted from that compensation.

INDIRECT AID AND COMPENSATION EQUIVALENT TO THE MARKET PRICE FOR ECONOMIC ACTIVITIES

Economic activities may be the performance of contract research, the provision of research services, or the renting out of equipment or capacity by the RO. In all these cases, State Aid may be conveyed to an undertaking, unless operating under market terms – i.e. charging prices that are market prices or the *equivalent* of market prices (see below) to avoid granting selective advantage to undertakings. This is to make sure that any service offered by the research organisation is compensated by the undertaking as if the research organisation was conducting its activities as an independent "market economy operator" (the so called MEO test[69]) when offering products and services on the market. The RDI Framework gives guidance on how this compensation is to be calculated.

Contract research and research services to undertakings

Point 25 RDI Framework stipulates that no State Aid be passed on by an RO to an undertaking, *particularly* where one of the following conditions is met:

> *(a) The research organisation or research infrastructure provides its research service or contract research at market price, or*
>
> *(b) Where there is no market price, the research organisation or research infrastructure provides its research service or contract research at a price which:*
>
> > *— reflects the full costs of the service and generally includes a margin established by reference to those commonly applied by undertakings active in the sector of the service concerned,*
> >
> > *or*
> >
> > *— is the result of arm's length negotiations where the research organisation or research infrastructure, in its capacity as service provider, negotiates in order to obtain the maximum economic benefit at the moment when the contract is concluded and covers at least its marginal costs.*

Point 26 RDI Framework provides that: *Where the ownership of, or access rights to intellectual property rights ('IPR') remain with the research organisation or research infrastructure, their market value may be deducted from the price payable for the services concerned.*

[69] Commission Notice on the notion of State Aid as referred to in Article 107(1) of the Treaty on the Functioning of the European Union, C/2016/2946, Section 4.2.

Please note that these are not closed categories. The word "particularly" indicates that the absence of indirect State Aid can also be shown otherwise. However, in the context of the Centres we can only recommend that they follow these basic rules in order to be on the safe side. The first criterion (market price) is often not of much use in performing R&D services. Quite often, there simply is no transparent market. The Centres should then rely on the options mentioned under (b) by **charging their full costs (integral costs, including direct and indirect/overhead costs) and including a profit margin.**

- However, in dealing with undertakings, the research fee can be subject to negotiation. For this, the RDI Framework acknowledges that a fair market price may be determined by **arm's length negotiations**, provided that these are aimed at maximising the economic benefit for the RO. The negotiated research fee must never be lower than the marginal costs involved with performing the research assignment. If and where the research fee is established by arm's length negotiations, it is important that the negotiation process can be demonstrated, e.g. by means of a paper trail.
    - As a rule, the arm's length negotiation is an alternative to charging full costs plus a margin. However in the context of research on behalf of other entities the experts express a preference for charging full costs plus a margin as a first resort in the absence of an established clear marker price. This comes in part because the arm's length negotiation normally carries a higher degree of burden of proof to demonstrate that the transaction indeed was on market terms.

Licensing contracts or assignment agreements for patents or other IP assets to entities engaged in economic activities (undertakings) should follow the same rules for the formulation of the price.

Where the ownership of IP or licenses thereto, are retained by the RO, then the market value of these rights may be deducted from the research fee calculated above. The topic of IP-valuation will be covered later.

Again, we stress that it is important to keep track of negotiation processes so that evidence of a competitive sales process can be provided if the fee for the IP license or transfer is ever questioned. Where the transfer of IPR is involved, we advise the Centres to make their own assessment of their value and not to solely rely on arm's length negotiations. In the next section, we will cover some IP valuation methods.

4.3 Valuation of IP

Valuation of IP is an important factor to ascertain whether any indirect State Aid has been conveyed/granted to an undertaking. This applies to all IP that is held by the RO and generated with State Aid. As explained earlier, independent research by the RO is considered a non-economic activity and hence, the activity as such is not subject to State Aid rules and may be fully financed with state financial means. The same holds true for the *activity* of technology transfer, even where this is subcontracted (in a transparent way) to an undertaking. However, it does not apply to the actual transfer or licensing of IP to an undertaking. To compensate any selective advantage given to the undertaking, a fee in conformity with market prices must be charged.

In the case of contract research, normally the transfer of IP on research results is part of the assignment and weighed in the research fee. Where this is not agreed in the research assignment, and the undertaking wishes to procure ownership or exclusivity after the fact (IP has been created), then again, a fee in conformity with market prices is required.

In the case of effective collaborations with undertakings, the escape offered by point 28 (d) juncto point 29 RDI Framework requires some form of IP valuation.

BASIC VALUATION METHODS

It is outside the remit of this panel to give an in-depth account of the various methods for valuation of intangible assets that are used in technology transfer. Neither the GBER nor the RDI Framework give much guidance in the methods and standards that should be used and followed. Point 29 (b) RDI Framework seems to hint at "independent expert valuation". It surely is one of the optional, albeit costly routes to assign a chartered accountant or a specialised IPR appraiser. Accountants will generally follow one of the generally accepted accountancy standards, like for example the GAAP or IFRS-standards. Other specialised IPR appraisers have a tendency to follow other standards like the Uniform Standards of Professional Appraisal Practice (USPAP) and the International Valuation Standards Committee (IVSC). The IVSC is a private organisation, but its standards IVS 105 and IVS 210 seem to gain in importance.

However, this is by no means the only way to ensure that a fee in conformity with market prices is charged to an undertaking. The fee may also be determined by arm's length negotiations aimed at maximising the financial returns. Often, the magnitude of IPR transactions by an RO does not justify the costs of involving an independent appraisal. Then, the Technology Transfer office should have sufficient knowledge of the basic methods of IPO valuation. These are as follows:

Cost-based method

This method is based on the principle that there is a direct relation between the historical costs expended in the development of the IPR and its economic value. This method often leads to a lower threshold value as it only takes into account the expenditure and not its creative elements. A potential licensee will usually only be willing to pay the historical costs (minus sunk costs) in case of technology that could easily be redeveloped. In redeveloping complex technology, there might be a risk in developing similar technology (in terms of time or money) that a prospective buyer would wish to eliminate. That situation would justify a higher price.

Market-based method

The market-based valuation method relies on the estimation of value based on similar market transactions of comparable IPR. It could also be based on the price of the cheapest available workaround. This often sets an upper threshold, as few prospective buyers would be willing to pay out more money than the cost of a technically equivalent alternative. This method is often combined with evidence of such earlier transactions from sources like Royalty Source or ktMine.

Income-based method

This method is based on the principle that the value of an asset is equal to the (expected) income flows it will generate. After the income is estimated, the result is discounted by an appropriate discount factor with the objective to adjust it to the present circumstances and therefore to determine the net present value (NPV) of the IPR. This method appears fairly simple but is quite complex in its actual application. Therefore, this method is mainly used for larger transactions. One main advantage of calculating a NPV is that it enables frontloading, that is, a part of future revenues gained by an undertaking are paid early to the RO to finance further research. This method is therefore often used in IPR transactions in the field of pharmaceuticals.

Rules of Thumb

These are not actual valuation methods and should be taken with a pinch of salt. However, we mention these as they are regularly referred to, specifically in IP license negotiations. The first one is the *5 per cent rule*. The median royalty percentage of royalty transactions in various branches is 5 per cent. This often leads to license percentages inclining to this percentage. However, for obvious reasons utmost care should be taken in applying this "rule".

The second rule is the "25 per cent rule of thumb" or the "Goldschneider rule". This rule assumes that no more than 25 per cent of the operational margin of the licensee's product or service can be attributed to the use of underlying IP. The rest of the margin is assumed to be a reward for the business risk taken by the licensee and other factors that should be attributed to the licensee. In the past, this method was used in the USA to calculate the reasonable royalty rate due to a patent owner after a patent infringement had been established in court. The method is no longer admissible in court in the US since the 2011 Uniloc-Microsoft decision by the US Courts of Appeal for the Federal Circuit. As with the other "rules of thumb" it must be used with care and always in conjunction with other valuation methods.

4.4 Research Infrastructures: State Aid-related aspects

Research Infrastructures (RIs) are usually costly facilities like laboratories, specific equipment like clean rooms for microelectronics, or high-performance computing facilities. Such facilities often require (co) funding with public financial means. Here the EU State Aid rules again come into play. In fact, this is a relatively new element of the EU State Aid control. Under the previous set of State Aid rules, infrastructures in general were considered to be within the exclusive competence of the Member States and hence, would fall outside the remit of DG Competition. This changed with the 2011 landmark *Flughafen Leipzig-Halle* decision by the European Court of Justice (ECJ), where the Court decided that investment aid for infrastructure qualified as an economic activity. The lessons of this decision found their way into the new State Aid rules published in 2014.

Several aspects of the purchase, use, and operation of the RI need to be tested against the EU State Aid rules. Where the Member State finances the purchase of equipment by the RO, the latter might be a recipient of State Aid. There can also be indirect State Aid by renting out or making the RI available to undertakings.

First, let us discuss what an RI actually is by quoting the definition as used in both the GBER and RDI Framework of 2014:

> *"**Research infrastructure** means facilities, resources and related services that are used by the scientific community to conduct research in their respective fields and covers scientific equipment or set of instruments, knowledge-based resources such as collections, archives or structured scientific information, enabling information and communication technology-based infrastructures such as grid, computing, software and communication, or any other entity of a unique nature essential to conduct research. Such infrastructures may be 'single-sited' or 'distributed' (an organised network of resources)."*

While this definition seems to be rather straightforward, there are a few elements that stand out. First, this is not only about physical infrastructures such as equipment and lab facilities, but non-physical resources are also covered such as databases or networks. Secondly, it must be "of a unique nature essential to conduct research". And finally, the infrastructure may be "distributed" or even virtual – such as "virtual laboratories".

RIs as recipients of aid and as grantors of aid. As already discussed in the previous sections, RIs can be recipients of aid as well as grantors of aid to other entities by way of their operations. As far as an RI is only used for the primary function of the RO, performing non-economic activities, then investment aid for the RI (as a recipient of aid) is not considered to be State Aid.

Where the RI is used also for economic activities and when these economic activities are not ancillary, only then it must be investigated whether aid for the RI is compatible with the internal market, for instance under GBER. In the case of the 14 Centre projects, the research organisations undertook to keep their economic activities ancillary and up to a maximum of 20 per cent of the overall annual capacity.

The conditions under which Member States may grant investment aid for RIs that are used for economic activities (in part, and more than ancillary), are primarily set out in the GBER. In this respect, it should be noted that the GBER allows for both investment *schemes* as well as *ad hoc* aid. Aid for RIs often takes the form of *ad hoc* aid because more often than not specific investment arrangements are made, usually involving both public and private parties. Such State Aid can be either a direct financial contribution or may also be made "in kind", such as by granting a building plot, by providing favourable treatment (e.g. permits) or by granting a tax break.

During the meetings held by the expert panel with public stakeholders in Bulgaria, it became clear that the planned Regional Innovation Centres (RICs) as of February 2020 were to be led by private companies. Thus the RICs are designed to operate under Article 26 of the GBER: "Investment aid for research infrastructures" which provides that the eligible costs shall be the investment costs in intangible and tangible assets and that the aid intensity shall not exceed 50 per cent of the eligible costs. Although this situation will not apply to the 14 Centres (*if they stick to their commitment to keep their economic activities ancillary and under 20 per cent of the overall capacity)*, it is important to understand the possible implication of the Art. 26 GBER. This is connected with the requirement for separate accounting for economic and non-economic activities, which the 14 Centres/participating ROs undertook to implement as well as for situation where the 20 per cent capacity usage for economic activities is exceeded.

Art. 26 of the GBER sets out the specific requirements under which such investment aid for an RI, *including RIs which conduct economic activities exceeding 20 per cent of their capacity and are not ancillary*, is compatible with the internal market:

1. The aid is limited to aid for the *construction or upgrade* of research infrastructures, up to (typically) 50 per cent of the eligible costs. Eligible costs are limited to investment costs for both tangibles and intangibles such as required patent licences. Please note that operation or exploitation costs (e.g. personnel, support and maintenance) are not considered eligible under the exemption for investment aid to RIs. The aid may be granted up to an overall ceiling of 20 Million Euro per RI.

2. Where a research infrastructure pursues both economic and non-economic activities, the financing, costs and revenues of each type of activity shall be accounted for separately, using justifiable cost and capacity accounting principles.

    - **As we previously explained the 14 Centres/the partner ROs** should also implement separate accounting if they conduct economic activities. It is recommended that the Centres keep track of the usage of machinery and equipment on a "per project" basis so that the use of equipment for economic activities can be measured as a percentage of its overall available capacity.

3. **The price charged for the operation or use of the infrastructure shall correspond to a market price.** This provision in essence aims to avoid that ROs and RIs pass on indirect aid to other entities. But what happens in case a market price cannot be established?

    - In the absence of an established market price, either the price should reflect **full cost plus a margin** or the price should be the result of an arm's length negotiation covering at least the marginal costs (see below more on the arm's length principle)

4. Access to the infrastructure shall be open to multiple users and be granted on a transparent and non-discriminatory basis.

    - Undertakings that have financed at least 10 per cent of the investment costs of the infrastructure may be granted preferential access under more favourable conditions. In order to avoid overcompensation, such access shall be *proportional* to the undertaking's contribution to the investment costs and these conditions shall be made publicly available.

5. Where a research infrastructure receives public funding for both economic and non-economic activities, Member States shall put in place a monitoring and **claw-back mechanism** in order to ensure that the applicable aid intensity is not exceeded as a result of an increase in the share of economic activities compared to the situation envisaged at the time of awarding the aid. Dependent on the rules and procedures as adopted by Member States certain obligations in respect of monitoring and clawing back may be imposed.

The claw-back mechanism is necessary to ensure that the aid intensity is not exceeded as a result of increased share of economic activities compared to the situation envisaged at the time of awarding the aid. The RI needs to:

- Measure the capacity used for economic and non-economic activities, and
- Have an established process or method to identify when the percentage of economic activities exceed the envisaged share, and
- Have a procedure to recuperate the exceeded amount and return it to the State (either in the form of a reduction in future aid due, a direct transfer, or another modality agreed with the State).

If the answer to any of the above questions is no, then the claw-back mechanism is likely to be ineffective or insufficient.

Importance of separate accounting. If there is an **effective separation of accounts** between economic and non-economic activities, then the amount to be clawed back is proportional to the public funding received corresponding to the overall percentage of the economic activities. If however, there is no effective separation of accounts, then the public funding received for both economic and non-economic activities must be clawed back to the maximum amount of aid intensity under State Air rules.

Apart from the specific criteria of Art. 26 GBER please take note that the GBER also contains general requirements. For instance, Art. 6.1 requires that the measure must have a demonstrable incentive effect. In the field of RDI, this means that the incentive effect must be measured against the EU innovation ecosystem and to the benefit of EU competitiveness. Also Art. 1.5 (c) stipulates that aid measures may not restrict the possibility for the beneficiaries to exploit the research, development and innovation results in other Member States.

The principle of "arm's length negotiations" as defined in RDI Framework point 1.3 (f) in short means that the parties have negotiated in the same way as undertakings would have negotiated (open, transparent and non-discriminatory methods and procedure must govern the negotiations). This requires a high burden of proof that can be provided by, for example, documentation of the duration of negotiations, the number of meetings, minutes of those meetings, and a proper assessment of each other's proposals. In short, it requires a paper trail. It must be possible to demonstrate that the price was negotiated in a manner as close to market conditions as possible to extract maximum achievable economic benefits from the transaction.

4.5 Final Words and Recommendations

Requirements and Expectations

The 14 Centres funded under the current Bulgarian Operational Programme Science and Education for Smart Growth have to adhere to certain requirements. A general requirement for the instruments and facilities acquired is that these are managed as "research infrastructures" (RIs), meaning that the beneficiary/owning entity must be willing and organised to allow and support their access and use for users coming from outside the owner institution. Secondly, the Centres must be set up to act as "research and knowledge dissemination organisations" (ROs) and the beneficiary organisations have declared themselves as being ROs under their Grant Contracts with the Managing Authority.[70]

This requires that the structures and their management should be able to support both a non-economic scientific access/use as well as possible economic use by (or on behalf of) undertakings (possibly more limited for the CoEs, more extensive for the CoCs). Where the RO or the RI becomes active on any market, i.e. partakes in economic activities by itself or on behalf of undertakings, the EU State Aid rules come into play.

As we have shown in this chapter, the EU State Aid rules offer some leeway for public funding bodies to support ROs and RIs for non-economic activities. Although some of the partner organisations were not convinced that they are allowed to engage in economic activities, under EU State Aid rules the partners in the 14 Centres have a degree of freedom to collaborate with undertakings in performing research assignments and collaborative R&D projects. Conducting economic activities should not be a major limiting factor for the research ecosystem as long as basic rules and principles are adhered to. In the experience of the expert panel, over-interpretation of the State Aid rules can be counterproductive. This is why the ROs should build internal capacity and knowledge on this topic in order to avoid excessive aid at the level of the RO as well as passing on indirect aid to other entities.

Recommendations as per requirements

a) The exemptions to the EU State Aid rules are usually not a limiting factor to the normal activities of research organisations such as the Centres and their constituting institutes/universities/other partners and the research infrastructures utilised by them, as long a certain basic rules are adhered to.

b) Aid given to research organisations for non-economic activities is not subject to EU State Aid control. However, the Centres (incl. inter alia institutes, universities and other partners

[70] This may not be applicable to the few private partner associations that do not receive funding for infrastructure but mostly provide services within the respective partnerships.

receiving funding for infrastructure) should adopt adequate measures to prevent the passing of indirect State Aid in their operations and engagements with undertakings.

c) This means that the Centres (namely the institutes, universities and other partners receiving funding for infrastructure) must have an adequate financial administration that allows for separate accounting of economic and non-economic activities. Preferably, this should enable analytical costing, i.e. allocating the costs of overhead factors to its utilisation by the various activities. Cross-subsidisation of economic activities by public financial means must be avoided;

d) Knowledge Transfer including Technology Transfer (TT) is considered a non-economic activity if the revenues from it are reinvested in the main non-economic activities. If the revenues from knowledge transfer activities offered on the market are not re-invested into non-economic activities, then these activities are considered as economic. If the reinvestment practice is applied, then TT activities may be fully financed with public financial means.

   - However, this only pertains to the activity itself, not to the actual transfer. If IPR or other research results are transferred/licensed to undertakings, a fee in conformity with market prices must be charged (or what can be reasonably accepted as an equivalent of it - as we have seen above).

e) The State Aid rules do not impose any specific mandatory method to calculate the value of IP. However, the Centres and/or participating partner organisations are advised to employ skilled TT personnel that has experience in IPR appraisal and license negotiations. As often the fall back of determining the license fee or purchase price by "arm's length" negotiations is chosen, it is imperative to keep track of and document the negotiation process;

   - Even where this method for determining the price is chosen, the Centres are advised to make their own preliminary value-estimation ("ballpark"-estimation), before entering into the licence or sales negotiation.

   - The well-known basic valuation methods of cost-based, market based and income-based approaches often give useful insight into the market value of the IP from the acquirer's perspective.

f) If the economic activities of the RO or RI do not exceed 20 per cent of the overall annual capacity and the same input factors are used[71], then such activities are considered "ancillary" and the State Aid rules do not apply in their entirety. Normally, in the presence of stable and sufficient public funding for independent R&D, it is hard to come close to that percentage of economic use.

g) However, care must be taken[72] to not exceed the threshold especially where some of the Centres could start acting as outsourced R&D centres for industry on a continuous basis. This in particular concerns the ones that are heavily oriented towards applied research for

[71] The evidentiary threshold may be higher in case the RO intends to prove that its economic activities are ancillary by demonstrating that the economic activity is limited in scope, directly related to and necessary for the operation of the research organization or that the economic activity is limited in scope and intrinsically linked to the main non-economic use. See above in the subsection on ancillary activities.

[72] At any given moment, measures can be taken to avoid crossing that threshold, e.g. by allocating remaining capacity to collaborative R&D instead of allocating that to contract research. However, this requires (ex ante) planning of the utilisation and continuous measurement of the actual use that has been made of that capacity.

industry. To avoid such a situation, the total available annual capacity must be determined, measured, and monitored. An annual capacity-budget must be allocated for economic utilisation especially of costly equipment, e.g. in a utilisation plan.[73] The use of the capacity of the whole research infrastructure and equipment must be monitored and preferably be stored in an immutable register.

h) A utilisation plan should also set out the conditions that govern the access and use of the RI to external users, including which users may take precedence or have preferential access to facilities.

i) The Centres are all set up as research organisations (the partner organisations receiving funding for infrastructure are research organisations themselves) as defined by the GBER and RDI Framework. This status allows, as a rule, higher aid intensities to be supplied by the Member State.

NON-EXHAUSTIVE LIST OF LEGISLATION AND RELEVANT ACTS RELEVANT TO STATE AID IN RDI

The up-to date acts can be found on the following page:
https://ec.europa.eu/competition/state_aid/legislation/legislation.html

- Articles 107 and 108 of the Treaty on the Functioning of the European Union (TFEU).
- Commission Notice on the notion of State Aid as referred to in Article 107(1) of the Treaty on the Functioning of the European Union, 2016/C 262/01 (OJ C 262).
- Communication from the Commission — Framework for State Aid for research and development and innovation, 2014/C 198/01 (OJ C 198).
- General Block Exemption Regulation: Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty (OJ L 187).
- Commission Regulation (EU) No 1407/2013 of 18 December 2013 on the application of Articles 107 and 108 of the Treaty on the Functioning of the European Union to de minimis aid (OJ L 352).
- Commission Directive 2006/111/EC of 16 November 2006 on the transparency of financial relations between Member States and public undertakings as well as on financial transparency within certain undertakings (OJ L 318/OJ L 348M).
- Communication from the Commission — Guidelines on State Aid to promote risk finance investments, 2014/C 19/04 (OJ C 19).
- Case law: Case C-349/17, Eesti Pagar AS v. Ettevõtluse Arendamise Sihtasutus (2019), C: 2019:17, Judgment of the Court (Grand Chamber) of 5 March 2019.

ADDITIONAL STUDIES, GUIDES AND LITERATURE

The following guides or explanatory documents could also be useful for research organisations:

- JRC's Competence Centre on Technology Transfer published Guidance in the form of a Decision Tree for research organisations (Q4 2020).[74]

[73] Each use of scarce resources needs management decisions with regard to the allocation and utilisation of such resources.
[74] Kebapci, H., Von Wendland, B., Kaymaktchiyski, S., State Aid Rules in Research, Development & Innovation. Addressing Knowledge and Awareness Gaps among Research and Knowledge Dissemination Organisations.

- EARTO Note on EU State Aid Rules for Research & Innovation, 2018[75]
- Een staatssteunkader voor het VLIZ voor diensten ten behoeve van de blauwe economie, Vrije Universiteit Brussel & PN Advisory Services (pp. 52-107 in English), 2018[76]
- Study on the enforcement rules and decisions of State Aid by national courts for the European Commission, Directorate-General for Competition, 2019[77]
- State Aid Uncovered Blog, http://stateaidhub.eu/ - a platform with useful articles and explanations

5. RESEARCH INFRASTRUCTURES

5.1 Requirements and Expectations

A general requirement for the instruments and facilities implemented in the present programme is that these are managed as "infrastructures", meaning that the ownership must be willing and organised to allow and support their access and use for users coming from the outside of the owner institution.

The availability of infrastructures to third parties should not be at the expense of CoCs' and CoEs' own Research and Development programme. Therefore, following the detailed mid and long-term business plan proposed in the sustainability section as well as the segmentation of types of equipment by various criteria, the availability to third parties would need to be determined in detail in terms of time as well as valuation method.

This requires that the management is able both to drive a healthy and competitive in-house research programme and to provide support for scientific access and use by external researchers, and develop the possible commercial use of that research (which will be more limited for the COEs, but more important and extensive for the COCs). This double requirement, as well as the proportion to be reached between the two, will reflect on the choice of governance structure of each Centre and the qualification of its leadership.

The management is then expected to be able to have resources allowing combining both of those activities that ensures:

- The capability to compete internationally in the scientific arena (thus driving the quality of staff and equipment) and,
- The development of those activities capable of responding to industrial/applied needs (in particular offering support to the development of marketable products and services).

Several Centres have asked the experts to provide the definition for a RI, in European context. Below we give a short answer to this question.

Decision Tree, Kaiser, L. (Ed.), Neu, M. (Ed.), Teernstra, F. (Ed.), Nicolaides, P. (Ed.), EUR 30436 EN, Publications Office of the European Union, Luxembourg, 2020,ISBN 978-92-76-25081-4, doi:10.2760/675525, JRC122304, https://ec.europa.eu/jrc/en/publication/state-aid-rules-research-development-innovation.

[75] https://www.earto.eu/wp-content/uploads/EARTO-Note-on-EU-state-aid-rules-for-RDI-final.pdf.

[76] Een staatssteunkader voor het VLIZ voor diensten ten behoeve van de blauwe economie, Buts, Caroline; De Cock, Wout; Joris, Tony; Nicolaides, Phedon; Dooms, Michael, Vrije Universiteit Brussel, 2018, available online at: http://www.vliz.be/. The document's content is partially in English and contains several decision trees.

[77] https://ec.europa.eu/competition/publications/reports/kd0219428enn.pdf.

Table 7. Research Infrastructure in the EU context

As defined in Commission Staff Working Document: Sustainable Research Infrastructures: A Call for Action[78]	**As defined in Framework for State Aid in RDI[79]:**
✓ Facilities, resources or services of a unique nature that have been identified by European research communities to conduct top-level activities in all fields of science. ✓ This definition includes the associated human resources, covers major equipment or sets of instruments, in addition to knowledge-containing resources such as collections, archives and data banks. ✓ RI may be located in a single site (for example, large telescopes, Synchrotrons, High Performance Computing) or can be distributed across even large number of sites working jointly (for example, biobanks, archives, marine stations).	✓ Facilities, resources and related services that are used by the scientific community to conduct research in their respective fields and covers scientific equipment or set of instruments, knowledge-based resources such as collections, archives or structured scientific information, enabling information and communication technology-based infrastructures such as grid, computing, software and communication, or any other entity of a unique nature essential to conduct research. Such infrastructures may be 'single-sited' or 'distributed' (an organised network of resources).

5.2 Recommendations

Management of the Infrastructure, Access, and in-house Research

At present (Q1 2020), most Centres are still strongly focused on the procurement process. Centre representatives have highlighted the difficulties encountered by the application of procurement rules and the corresponding legal aspects. However, in most procurements there is a well-designed period of maintenance support by the providers included. This is a well-designed approach.

Moving forward, it is strongly suggested to prepare for when the maintenance contracts expire or become too costly. Centres will need to provide, as early as possible, training of the personnel needed for operations and maintenance. This, in turn, will allow acquiring an effective technical capability during the start-up period that will also ensure early success in reaching the operational specifications.

The transition to the operational period shall ensure that the management evolves to become Science/Technical based. Ideally, top management will be selected with international level leadership and quality experience. This management should have the mandate and the capability to hire and retain appropriate technical and scientific staff motivated and trained in supporting the double mission of driving an in-house research programme and the commercialisation of research outputs.

The administration should also evolve from the current contractual procurement focus towards supporting management in the operational phase. In particular, the need to develop and enhance

[78] https://ec.europa.eu/info/sites/info/files/research_and_innovation/research_by_area/documents/swd-infrastructures_323-2017.pdf.
[79] Communication from the Commission: Framework for State Aid for research and development and innovation, (2014/C 198/01).

functions to support access of users, both scientific and commercial, is highlighted. Administration and management in general should be light and flexible, based on international best practices and oriented towards problem solving.

The quality of the infrastructure and of its technical/scientific staff should be maintained by ensuring a sufficient amount of in-house research activity within an international context. A good measure, as per best practice, is to have about 20 per cent of the time of the research allowed for in-house research, also based on competitive project funding.

Access rules and costs should be user-oriented and as a guiding principle full cost based (see chapter on State Aid for all requirements as to the formation of the price). For basic research, management can be allowed to offer a quota of access 'free of charge' to exceptionally attractive proposals which may contribute both to the technical qualification of the staff and to the scientific visibility of the Centre. Thus, payment for this will be "in-kind" based on the acknowledgments in publications and/or in co-authorship by the staff. In the case of commercial access, the costing should be clearly referred to market costs. Where appropriate, a possible allowance of (lower cost or free) test runs and collaborative development of the modalities of access and use may facilitate longer term access and should be considered.

Communication and outreach must be clear and concise. Applications should be straightforward. Similarly, selection processes should be standardised and transparent. Application documentation and relevant vademecum for applicants that wish to use the facilities should be available. Evaluation procedures and an external referee group to process applications should be in place. There should be easy access to the needed documentation describing the offer and the technical specifications of instruments and of available technical support. The possibility of direct contact and exchange with dedicated staff helping to define specific requirements is generally an important aspect to attract users.

Based on the above last two suggestions we further propose to elaborate an availability and utilisation plan connecting several Centres organised in groups of Centres active in similar or complementary thematic areas, as follows:

- To develop an inventory, ideally within a horizontal platform among CoCs and CoEs of major research facilities, infrastructures and key scientific equipment, that are acquired through the current programme. This will be useful for transparency, avoidance of duplications, and will facilitate synergies between research infrastructures.

- It is advisable to cluster research infrastructures and equipment in categories according to a set of uniqueness, commonality, and method of operation criteria.

  Indicatively:

  - Complex research infrastructure which is implemented by integration of several scientific and technical equipment that are of National or even European excellence and applicability;

  - Individual "rare & high quality" research equipment performing specific analytical tasks and bought from international manufacturers, that could be of wide research interest;

  - Custom-developed research facilities for performing very specific research/tests with little potential for generic use or use by outside researchers, but demonstrating the technical capability to develop custom-oriented instruments;

- Various types of ICT/Mechatronics/Computer-based facilities with wide possibility of uses but also with shorter life cycles due to quick technology evolution in microprocessors than more conventional analytic scientific equipment;
- Test/demo/proof of concept labs that could be of more immediate use for the private sector.

Each one of the proposed types of infrastructures above have different needs to support their operation by third parties. An experienced researcher can operate analytical scientific equipment with little guidance, however, both dedicated technicians and scientists are needed to conduct an experiment in a complex infrastructure. This will carry different costs and assistance necessary when in use by /providing research services to external R&D third parties.

The clustered research infrastructures should be accompanied by an availability platform and rules. These can include basic CAPEX and OPEX structure analysis for the specific lifecycle of the equipment, as follows:

- Cost of acquisition and commissioning for operation, including training of scientific and technical personnel, insurance and maintenance, depreciation for replacement, hourly / daily costs of running the equipment, utilities, consumables, personnel;
- Differentiation of charging rules to various users (i.e. public universities and institutes as one main group and other organisations which can be non for profit and private for profit entities) and basic distribution of per cent time and priority between
    a. The core group of the Centre: use at no additional cost within the project period. After the end of the project, charge overheads on each project that core members bring to the Centre (percentage of research programme budget that research partners yield as overhead to the Research Institution or University they belong to, ranges typically vary between 8-12 per cent);
    b. R&D third parties (other universities, public institutes): charge project research overheads, rates for use of equipment, and other expenses when in use by third public parties;
    c. The private sector: charge private sector at appropriate price, which is generally a market price for economic activities or the equivalent of it (actual full cost of use and depreciation, plus a margin). Different rules apply in the regime of effective collaboration i.e. activities which qualify as non-economic (see chapter on State Aid in this report for all requirements);
    d. Individual PhD researchers: allow a small amount of time for free use of infrastructure by PhD candidates, whose affiliate institutions will have to cover basic consumables and operation costs. It was observed in the rules of operation that several centres don't allow the access to their RI to physical persons. This contradicts with the wider national scope of Centres of Excellence and Competence and should be amended and allow the access of individual researchers and PhD students irrespective whether they participate in a project that the Centres are involved or they apply for access for completing a part of their research thesis.

Each Centre can develop its own parameters fitting the proposed principles and segmentations based on the specific equipment and project, but this definitely will evolve with time once a platform is available to the research and business public, and real market and research institutes'

demand will be recorded. This, in turn, will allow that at a mid and long term the viability and business plan numbers of each Centre will be based on actual market feedback.

5.3 Plans for Utilisation

The plans for utilisation of the infrastructure should be, according to best practice, drafted along with the yearly budget and based on a clear schedule. It should include all types of usage and the required periods of maintenance, while taking into account the different requirements of the different users (e.g. the need of rapid and specific response by industry, or the need to plan for a series of experiments for basic research).

Plans for possible modifications and upgrades should be based on an analysis both of the effective market (users requirements) and of the competitive edge to be maintained or reached both in research and in service activities.

Currently, plans of utilisation presented in the proposal of each Centre are still at a theoretical level and plans that are more practical must be developed at a later stage based on the actual demand and/or the need to promote the use by third parties. This can be assessed following the open communication of available equipment, availability pattern, and rules of utilisation to be implemented as suggested above.

5.4 Monitoring Mechanisms and KPIs for RIs

To ensure success, effective mechanisms and procedures to assess the implementation and performance of the Centres both are an indispensable. CoCs and CoEs globally have followed individual patterns with different procedures, but with a number of basic common principles:

- An **independent panel of experts**, including "peer competitors" (i.e. avoiding having only nice friends as experts). Typically, if the response by the Centre management to the criticism is also strong and convincing, the attitude becomes one of strong support to the management with more positive advice. This kind of advice may be a determining factor during the transition period between the setting-up and the operation of the Centre (the start-up period), because it may be helpful in avoiding repeating mistakes which have been costly to others and may reverberate in the long-term.
- Advisory Committees with high level experts are, however, often difficult to assemble and tend to be available for plenary meetings only once or twice a year. Therefore, there is the need to have instruments, e.g. **Key Performance Indicators (KPIs) and procedures** allowing the management to realise a more continuous self-check and implement "in flight" adjustments. These instruments also provide useful data for reporting to different stakeholders (i.e. funding institutions, investors, etc.). The Advisory Committees should be involved in the definition of these instruments and give advice on how to use them.

We are now still in the "construction" phase of most Centres, which will be followed by a transition to a start-up phase, then to a fully operational phase. At present, assessments made by the experts and the Implementing Authority are still based on data related to the progress of setting-up (spending and procurement of resources or setting-up of the legal frame), or to the past-achievements of partners. The need is, therefore, to have a set of instruments allowing to monitor both the present situation and its evolution to the next phases.

Currently, the proposed KPIs in Centre documentation are a mix of "performance" and of "impact" indicators. Most Centres have listed a number of KPIs linked to the declared scope of the Centres when in operation. However, the procedures for the use of these KPI has not been defined with the same detail, and the real scope and use of the KPI may be unclear. However, in practice, the difference between impact and performance will become clearer when the transition to full operation is completed.

ESFRI has recently discussed the use of KPIs for RIs following the invitation by the Competitiveness Council of 28 May 2018 and has developed a proposal for a comprehensive set of KPI taking into account the most commonly held objectives of the Pan-EU RIs[80]. The report gives the following message:

> *"A number of recent studies have aimed to establish a set of parameters to describe or quantify the performance, and in some cases also the impact of RIs. It is important to establish from the outset that KPIs concern the former and provide a means of monitoring the performance of a RI with regard to progress towards its stated objectives from inputs, through activities and outputs to outcomes. Indicators may be defined for various points in this chain for the different objectives of the RI. When monitored on a regular basis (typically annually), such KPIs provide valuable information both for the operators of RIs and for their stakeholders to optimise progress towards the objectives through changes in inputs and activities. Evaluation of the impact of a RI in various areas generally requires an in-depth evaluation, usually by external experts after an appropriate time lag during which such impacts may become more clearly apparent. The European Commission co-funded RI-PATHS project is developing a framework for socio-economic impact of RIs.*
>
> *The ESFRI WG notes also that although KPIs are the most often used method to monitor progress towards objectives, they are often poor proxies of progress towards objectives. A move towards enhanced inclusion of narratives, such as theory of change and storytelling has been observed lately, not only in the case of evaluations, but also monitoring. The methodology proposed within the ESFRI study therefore requests that the RIs accompany the agreed KPIs with a context and develop also their own narratives".*

A strong warning is that KPIs should not be used to compare different RIs but should be used as the instrument measure to compare and improve the performance of the infrastructure.

[80] See https://www.esfri.eu/sites/default/files/ESFRI_WG_Monitoring_Report.pdf

6. TECHNOLOGY TRANSFER AND COMMERCIALISATION

6.1 Overview

A functional Technology Transfer (TT) Ecosystem requires a strategic objective to transfer new knowledge and technologies, with the relevant infrastructure allowing testing and validating of inventions and clear rules and processes for the implementation of TT activities, and coordination among different stakeholders within the system.

The successful creation of the TT value chain will be directly impacted by two main elements: (i) scientific results and (ii) entrepreneurial culture. To achieve this, the following activities will be of clear value:

1. Creating inclusive grassroots community of researchers - entrepreneurs engaging across the scientific populations and regional community.
2. Strengthening the industry funded research and licensing of research Centres - owned technologies.
3. Establishing a commercialisation agenda reflected in the policies, mission, budget allocations and incentives.

The TT process itself consists of several phases and is a complex mechanism, requiring scientific and market knowledge as well as the skills necessary to manage the TT process from beginning to end. Below is a diagram presenting the TT value chain and this chapter of the report will look into various elements and capacities needed for successful completion of this process[81].

6.2 Existing Technology Transfer Ecosystem

The legislation in Bulgaria allows the inventor to participate in the commercialisation of research results, while the IPR remain at the university or institute respectively.

There are several relevant policy documents identified in relation to the TT ecosystem in Bulgaria, also described in the legal chapter of the report:

[81] Diagram copyright: Oxford University Innovation

- The **National strategy for development of scientific research in the Republic of Bulgaria 2017-2030: Better science for better Bulgaria**: is the main overarching policy document on research that defines the basis for future development.
- **Law on Higher Education**: provides universities the right to conduct commercialisation activity that is connected to their primary purpose and orientated at the realisation of scientific research results and other IPRs.
- **Law for Promotion of Research Activities**: states that TT is one of the priorities to be promoted alongside the dissemination of scientific research results.
- **Law on Patent and Utility models registration**
- **Law on the Bulgarian Academy of Sciences:** provides that the BAS can conduct commercial activities connected to its research and the application of its scientific research results. The BAS and its independent institutes can own rights in properties, patents, and hold equity in commercial companies or associations.
- **Statute of the Academy of Sciences**: provides that the budget of the BAS cannot be used to sustain commercial activities. The units of the BAS that conduct commercial activity must ensure the application and utilisation of the research results are economically beneficial/efficient for the Academy, including the benefits obtained through the financing of scientific projects of the independent scientific units. The Statute confirms that the Academy can take an equity stake in commercial companies.
- **Framework and Example rules of the Academy of Sciences on the protection and utilisation of IPRs (2009):** the respective employer institute is the owner of the created IPR. The general rule is that 50 per cent of the income from the commercialisation goes to the inventor, 30 per cent for the institute and 20 per cent for the BAS.

The Labour Act may also have some relevance regarding the ownership over the research results (whereas it stipulates that the employer owns the IP created by employees and employees are entitled for compensation).

Beside the above-mentioned laws and regulations, some universities in Bulgaria have implemented their own rules and policies related to IPRs protection, management, and commercialisation. Examples are:

- IP Rules Academy of Sciences BAS, 2009, General Rules
- IP Rules Sofia University
- IP Rules Technical University Sofia
- IP Rules University of National and World Economy Sofia (UNWE)
- IP Rules Plovdiv University
- IP Rules Plovdiv Medical University
- IP Rules University Hospital Plovdiv

In general, these rules tend to be similar, the main difference being in terms of income sharing arrangements from commercialisation activities between relevant parties. However, some of the Universities in Bulgaria still lack of their own IPR policies and guidelines or in many cases, there are only drafted on paper and have not been applied in practice.

In Bulgaria, several offices for transfer of technologies have already been established, some of which are operational and slowly gaining experience in technology transfer. The community of

researchers is yet to be 'educated' on the benefits technology transfer may create for the society and the economy. Various strategies on IP exploitation also exist, however technology transfer activity is still relatively limited.

CURRENT STAKEHOLDERS

Several players were identified in the TT system, described below:

GIS-Transfer Centre Foundation

The GIS-TC, established in December 2000 in Sofia by 14 founders, most notable of which are the BAS and the Technical University of Sofia. GIS-TC is an independent structure for the transfer of scientific and research competitive results and technologies constituted as Non-profit Bulgarian Corporate Body for social benefit with a two-tiered control structure.[82]

GIS-TC is the first and only one in Bulgaria. Its organisation is structured as a national network of 29 Centres[83], which cover the main sectors of economy and science, and supports the process of TT of research competitive products, know-how, advice and expertise with an emphasis on SMEs. Since 2003, through the franchise contract, GIS-TC has worked closely with the Foundation "STEINBEIS" (Germany), which is among the founders. The core team of the GIS-TC combines the knowledge of associated professors, engineers, economists and lawyers, each with more than 20 years proven experience, with the enthusiasm of young trainees, researchers and experts.[84]

GIS-TC's mission is:

- To realise the transfer of scientific results and technologies obtained and developed by public funded scientific & research teams, laboratories, institutes, universities and related Bulgarian structures.
- To support and promote scientific research related to the creation of competitive research products and innovation.
- To commercialise competitive research products and processes by an independent network of transfer Centres, keeping the principles of market-oriented economy.
- To provide an effective link between the scientific & research structures, economic subjects and governmental bodies and institutions.[85]

GIS-TC currently employs 15 permanent staff while more than 60 external experts and consultants are involved on a contract basis.

Bulgarian TT Network (BgTTN)

The Bulgarian TT Network (BgTTN) was formally established in April 2013 in Sofia by 22 TT Centres. Today there are 29 TT Centres in the network, coordinated by the GIS-TC:

The mission of the BgTTN is to support the development of innovative enterprises and the commercialisation of research results and technologies in Bulgaria. However, it is not clear how functional all these institutional TTOs in the network are.

Joint Innovation Centre – Bulgarian Academy of Sciences

[82] https://www.gis-tc.org/history
[83] https://www.gis-tc.org/centers
[84] https://www.gis-tc.org/about-us
[85] https://www.gis-tc.org/mission

The Joint Innovation Centre (JiC), established in 2005[86], is a coordination unit for implementing the policy of BAS – in the fields of innovation and patent activities, and project competence. JiC collaborates with institutes and laboratories of BAS, with universities and with similar units across the EU as well as with other local agents (the Bulgarian Chamber of Commerce and Industry, the Bulgarian Industrial Association and their regional branches, and other NGOs with similar objectives). JiC belongs to the "Enterprise Europe Network" that assists business and science in the development of their innovation potential. JiC is also co-founder of the Technology Transfer Office PROINNO.

Most of the administration around the IPR filing is dealt with at central level at the "JiC" for the Academy according to the Rules of 2009. However, some institutes operate completely independently and do not need to resort to the JiC but the administration on IPR protection is actually done by the employees of the institute. Hence, it may be concluded that where no separate rules are enacted the general Framework rules remain valid.

Institutional Technology Transfer Offices (TTOs)

The system of TTOs in Bulgaria is formed by 22 units. A first group of 8-10 TTOs were established under the EU PHARE Programme in 2006-2007; later when Bulgaria joined the EU and the first Competitiveness and Growth Programmes and Grants another 10 - 12 offices were established.

There are several functioning TTOs at different universities identified during the expert missions to Bulgaria, which either are an individual structural unit or a part of other units within the university:

- TTO of the University of Sofia

  The expert panel was able to have a one-to-one meeting only with the representatives of one university TTO in Bulgaria and this is the TTO of the University of Sofia. The impression of the experts is that out of the TTO that they were able to meet, very few have built experience in TT activities and are operational. The TTO of the University of Sofia was established within the PHARE Programme in 2007. Since 2009, the TTO has been a part of the Scientific Research Centre (SRC) of the University of Sofia and is fully independent from the University budget receiving own income from the national and EU funded projects, and industry. There are two full-time staff members, one part-time IP consultant and a TTO manager who is also the Director of the SRC.

  The mission of the University of Sofia's TTO is to act as a mediator between research departments and industry partners supporting the transfer of the scientific knowledge and technology; the unit also encourages an innovative and entrepreneurial culture among scientists and researchers by establishing a positive business culture within the university.

- TTO of the University of Plovdiv

  The TTO of the University of Plovdiv was established in 2013. The stated goal of this TTO is to expand the University of Plovdiv activities in the field of TT by providing the accessible R&D services to the companies in the region and worldwide, and to provide legal, marketing, and logistic support for commercialisation of the research results generated

[86] JiC was established in 2005 as CI, restructured in 2010 and renamed to JiC. https://www.jic-bas.eu/index.php/en/mission

within the university.[87] There are three full-time staff at the TTO. Key activities of the University of Plovdiv's TTO are preliminary assessment of innovative projects developed within the university; support for innovative projects at an advanced stage; and establishing relations with companies in the region and nationally.[88]

- TTO of the University of National and World Economy

  The University of National and World Economy's TTO is a part of the UNWE Institute of Creative Industries and Business. There are five full-time staff at the TTO: two technology managers, one IP lawyer, and two marketing and searching specialists. The TTO has established procedures regarding the overall management of TT process.

- TTO of the Technical University

  The TTO at the TU-Sofia is an integral part of the R&D Centre existing for more than 15 years (according to representatives of the TU) and operates with a degree of independence from the university.

Sofia Tech Park

Sofia Tech Park Sofia (STP) is a Joint Stock Company or "АД" subject to commercial law and to the rules for the exercise of the rights of the state in Bulgaria. The shareholders are the Ministry of Economy, with the majority share, and the State Consolidation Company, whose single shareholder is also the ME.[89] The research complex within the park has 11 labs.

The vision of STP is to contribute to and increase the competitiveness of science and entrepreneurship in Bulgaria through improvement of the transfer of knowledge between the academic and the business communities, catalysing the process of commercialisation of research results.[90] The main goal of STP is to strengthen the competitiveness of science and entrepreneurship in Bulgaria and to improve knowledge transfer between academics, education and business.

Challenges in Technology Transfer in Bulgaria

The lack of dedicated financial resources for TTOs and the lack of adequately skilled staff to conduct the TT activities are some of the most challenging issues to be resolved. Most TTOs were established and financed within various EU funded projects but, in many cases, their financial and operational sustainability came into question when those projects ended. As a result, only those that were recognised by the host universities as adding value have remained functional today.

As the university mission usually does not include research, the academic career development of the faculty focuses on education and less on research and TT.

Among the main weaknesses identified are:

- Lack of formal structures, human resources, skills and procedures of effective commercialisation of research results;

[87] „The Four Steps" Concept/2030 of the University of Plovdiv to European Integration at the High-Class R&D and Transfer of Technologies
[88] Ibidem.
[89] https://ec.europa.eu/knowledge4policy/sites/know4pol/files/report_reshaping_the_functional_and_operational_capacity_of_sofia_tech_park_2018.pdf
[90] Ibidem.

- Low level of interaction among players within the current TT infrastructure;
- No dedicated financial instruments available for implementation of TT activities exist for PROs and universities (i.e. there is no Proof-of-Concept (PoC) programmes for either academia or industry, etc.). PROs and universities cannot benefit from the existing programmes designed to bridge the gap between science and business, e.g. the Technology Transfer Fund (TTF).
- Lack of professional training schemes to strengthen TT management capabilities

A functional and operational national TT system requires both infrastructural and regulative preconditions, staff skilled in implementation of TT activities, and, above all, the support in implementation of these activities both on the government level and within PROs' and universities' management structures.

Some of the challenges summaries above were also identified as major obstacles to commercialisation in the assessment of the status of knowledge transfer in Bulgaria conducted by WIPO. They further stipulates that the knowledge transfer activities in the country are focused on research collaboration agreements, provision of research services and consultancy contracts, but not focused on the strategic management of intellectual property. The lack of IP awareness and the almost non-existent knowledge in the country for licensing of intellectual property and spin-off creation have been highlighted as well by the authors of the present report commissioned by the JRC.

6.3 Proof of Concept

Proof of Concept (PoC) is required to demonstrate that a certain method, concept, theory or idea is technically feasible, or has some practical potential.[91] PoC is best defined as "the stage during the development of a product when it is established that the product will function as intended".

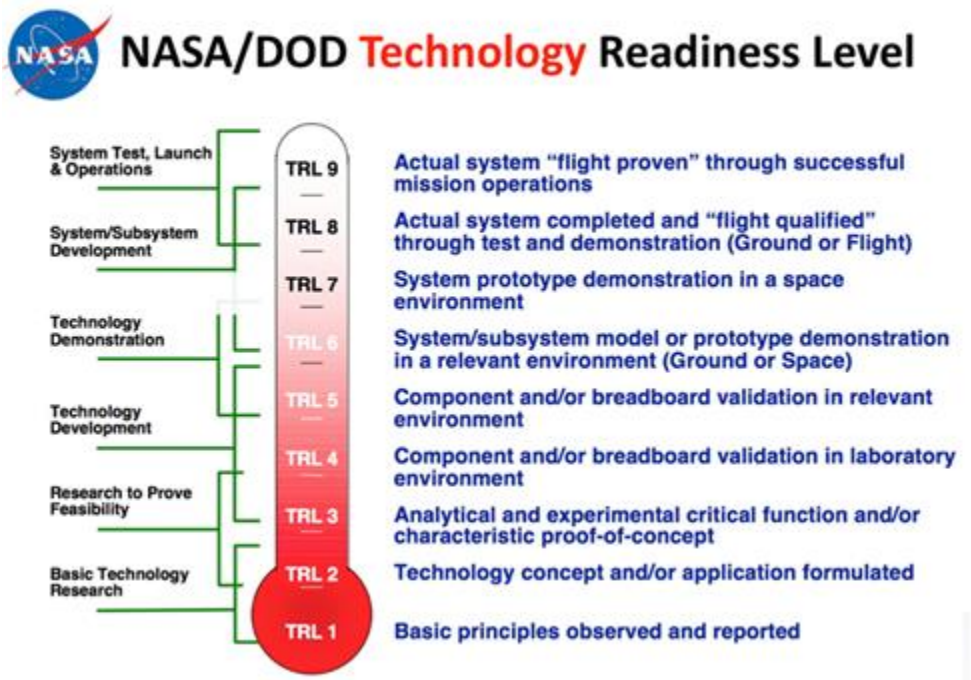
Often PoC has a more specialised meaning, linked to the development of a technology or know how across the Technology Readiness Level (TRL) Index, initially set up by NASA to evaluate early stage technologies according to their readiness level and vastly utilised as a 'barometer' of PoC development.[92]

Proof of Concept is also characterised by the need for dedicated resources (outside research funds) to help close the so named 'Valley of Death'. This is referred to as 'translational funding' or 'proof of concept funding'.

The below diagram explains the Technology Readiness Level Index (TRL) and the associated perceived product development.

[91] https://en.wikipedia.org/wiki/Proof_of_concept

[92] JRC Science for *Policy* report: Proof of Concept – Rationale and Role



Activities that constitute PoC include:

- Technical feasibility studies
- Prototyping
- Specialist testing and/or demonstration testing
- Market research
- Market testing and competitor analysis
- Intellectual property protection
- Intellectual property landscaping and analysis
- Investigation of production and assembly options

To define the development stage of research outputs many organisations use accepted industry scales such as Technology Readiness Levels (TRLs). This approach is also recognised and used in Horizon2020.[93] The PoC stage is crucial to validate the invention and thus improve the chances for commercialisation or alternatively, if the invention has not been validated, to discontinue with it.

A recognised feature of advanced innovation ecosystems is their awareness of the importance of TRL advancement and the extent of substantial resources for PoC support. For instance, across the UK, 25 national and 14 regional PoC funding sources actively investing in new projects were identified in 2015. There was a growing number of specialised PoC funds, which only individual academic organisations or groups of organisations can access. This latter group of funds is mostly managed internally by the eligible organisation(s) and is usually supported by public funding, though in a very few cases these funds operate using their own or private funds.[94] The PoC support programmes always include financial support, with the majority of PROs' projects being awarded between €10K – 25K and in some cases exceeding €100K. Matched funding is an important requirement as it demonstrates commitment from the recipient of the funding.

[93] Elaine Eggington, Rupert Osborn: Review of UK proof of concept support, 2015
[94] Elaine Eggington, Rupert Osborn: Review of UK proof of concept support, 2015

In the less developed economies, the financial support should be accompanied by "soft" support intended to approximate the academic mind set to the industry needs and modus operandi. Typically, this would involve coaching on business model development, value chain analysis, building skills for academia to business interaction.

The links between public sources of PoC funding and next stage private sector seed/VC funding are also important. Activities such as networking events and access to online data on funded projects help strengthen these links, and private sector funders support this.

Available PoC support

The National Innovation Fund runs a financial scheme to support innovative enterprises and SMEs, offering matching grants for "scientific and research and development projects and projects for technical feasibility"[95]. Annually €2,5M is available for the development of prototypes. So far, 110 companies have been awarded funds based only on the written applications. PROs can be partners in the application, but not the beneficiaries. No soft support is included in the programme.

There is a funding scheme under the operational programme "Innovation and Competitiveness" (OPIC) under Priority Axis 1 launched in 2017 that is intended for the development of product and process innovation in enterprises (€35M). PROs cannot be beneficiaries but may benefit from being partners e.g. as technology providers.

In the period 2018 -2019, the Bulgarian Fund of Funds (FoF) conducted consultations with a view to launch a call to select a financial intermediary with respect to a new TT Fund (TTF). As of Q1 2020, the public funds envisaged to be contributed amount to BGN 56.3 M (€28.8 M), and with the additional funds to be raised from private investors the funds under management are expected to increase to BGN 75.5M. The TTF will provide equity and quasi-equity investments in Bulgaria by means of supporting TT and innovations developed in cooperation with research institutions and private organisations. The eligible support for businesses covers start-ups, small and medium enterprises (SMEs) and large enterprises, but the PRO's themselves will not be the beneficiaries.

Adequacy with regard to supporting CoEs & CoCs

It is evident that the PoC support in Bulgaria is still at a very early stage. There is some funding available for PoC activity, but it is not applicable to Centres in its current state for various reasons such as:

1. These programmes are intended for companies only and to support entrepreneurship projects rather than support research commercialisation.
2. The announced TTF is not applicable for the Centres as instead of research funding it will provide equity and quasi-equity investments, which is not acceptable for Centres constituted as partnerships or separate legal entities.
3. Conditionally, the Centres could use current programmes indirectly by applying via a spin-off company, but to create a spin-off just to test a technology in a very early stage is not necessarily practical and the decision to form a spin-off should follow the PoC stage, and not be a pre-requisite. Additionally, spin-offs can only be created by universities according to the conditions stipulated by the recent Council of Ministers Decree providing that universities can create companies only for the purposes of exploitation/commercialisation

[95] https://www.mi.government.bg/en/themes/national-innovation-fund-19-287.html

of their research results/IP whereas some additional requirements have to be followed (e.g. initial capital, form of company, specific mandate and activities etc.).

4. Existing programmes do not have any type of soft support. On-going supervision and mentoring is missing, with support reduced to administrative reporting.

Case: NICKI – Internal POC support of the Slovenian National Institute of Chemistry (KI)[96]

The KI has 351 employees[97], of which around 292 carry out research work in nine departments and two infrastructure Centres; 149 of these have doctorates of science degrees. In 2018/2019 the institute launched the first Slovenian PoC support for innovations called NICKI.

The reason for establishing NICKI is that most inventions resulting from research are not the result of collaboration with industry partners. Commercialising these inventions is very difficult. Particularly, as there is no data on the interests and needs of industry, the push principle prevails, leading to low chances of successful commercialisation. To avoid this, it was essential to create industry links and increase the TRL level of marketed technologies, reducing the risk to potential customers so KI established an internal support PoC fund of €40K under management. NICKI also secures resources for external services, such as additional material testing, collecting market information and industry requirements, increasing production capacity, etc. and provides mentoring and coaching support for selected projects.

The mechanism supported three projects (out of seven applications in total) that are now working on commercialising their results. The fund's €40K are now fully allocated.

6.4 Incubators and Accelerators

Accelerators and incubators offer support for early stage start-up team to grow their businesses, access opportunities, and improve their chances of attracting a venture capital (VC) firm to invest in their start-up. Accelerators "speed up" growth of an existing company, while incubators "hatch" disruptive business ideas by building a business case. Therefore, accelerators focus on scaling a business while incubators focused more often on innovation.

Accelerator programmes usually have a set timeframe in which individual companies spend a few weeks to a few months working with mentors to avoid common problems while scaling up. Accelerators use an application-based process and the top programmes are typically very selective. Early stage companies accessing accelerator programmes are typically given a small seed investment, and access to a large mentorship network, in exchange for a small amount of equity. The mentor network, typically composed of start-up executives, VCs, industry experts, etc., is often the largest value-added for the resident companies. At the end of an accelerator programme, it is common for the start-ups from a particular cohort to pitch at a demonstration day ('demo day') attended by investors and media. At this point, the business has typically been further developed and vetted.

Start-up incubators work with companies (or even single entrepreneurs) that may be earlier in their development stage and do not operate on a set schedule. If an accelerator is a greenhouse for young plants with the optimal conditions to grow, an incubator matches quality seeds with the best soil for sprouting and growth. While there are some independent incubators, they can also be sponsored or run by VC firms, angel investors, government entities, and major corporations, among

[96] https://www.ki.si/en/about-the-institute/knowledge-transfer-office/our-projects/
[97] On 31. 12. 2019

others. Some incubators have an application process, but many only work with companies and ideas obtained from trusted partners. Depending on the sponsor, an incubator can be focused on a specific sector or vertical. For example, an incubator sponsored by a hospital may only be seeking health technology start-ups. Within the incubator, a company will refine the idea, build the business plan, work on a product-market fit, identify IP strategy, and network. A typical incubator has shared space in a co-working environment, a monthly lease program, additional mentoring, and connections to the local community.[98]

Offering of the Main Actors in Bulgaria

Currently, most Bulgarian incubators and accelerators are located in the main Centres of the Bulgarian start-up ecosystem which are around the cities of Sofia and Plovdiv, Varna, Burgas and Tarnovo. According to the strength of its start-up ecosystem, Sofia is ranked 88th globally, where other cities play much less important roles[99]. In Sofia, the strong start-up community has been developed predominantly in the ICT sector[100].

The start-up support ecosystem includes the following most active incubators and accelerators [101] [102] [103]

- Incubators: Start It Smart Sofia, STP Incubator, Groworking space Sofia, Incubator Plovdiv
- Accelerators: Eleven, Founders Institute, Start It Smart, Equinox Partners Accelerator

Table 8: *Most active incubators and accelerators in Bulgaria (as of Q1 2020)*

Incubator/ Accelerator	**Description**	**Location**	**Type of support**
Start It Smart	Start It Smart is an entrepreneurship organisation founded in 2009. Today Start It Smart is one of the leading start-up organisations on a national and European level.	Sofia, Burgas, Tarnovo and Plovdiv	It is most well-known for its pre-acceleration intensive 10-week training and mentorship programme for first-time entrepreneurs. The programme contains trainings, mentorship sessions and offer coworking space to provide the necessary knowledge and skills for an early product launch, joining an accelerator, or finding initial investment. The resource is intended for teams with unique business ideas from predominantly IT industry, able to work full time to developing their business.
Incubator of STP	The Incubator of STP provides innovative start-up businesses with support to develop	Sofia	Besides office space and access to educational events, the start-ups have access to services that support their development i.e. legal, accounting, marketing, administrative,

[98] https://www.techrepublic.com/article/accelerators-vs-incubators-what-startups-need-to-know/
[99] www.startupblink.com
[100] Reshaping the functional and operational capacity of Sofia Tech Park, Report by an Independent Panel of international experts
[101] https://angel.co/bulgaria/investors, https://www.f6s.com/, https://fi.co/insight/sofia-startup-resource-list-300-accelerators-incubators-investors-and-more, https://www.11.me/, https://www.launchub.vc/, http://www.neveq.com/en/index, https://ceoclub.bg/angels/
[102] Reshaping the functional and operational capacity of Sofia Tech Park, Report by an Independent Panel of international experts
[103] The Peer Review of the Bulgarian Research and Innovation system from 2015

	products, services and prototypes. The three main focal areas of the science and technology park are information and telecommunication technologies, life sciences and green energy.		advertising and assistance in applying for funding in acceleration programmes and public calls. The STP provides start-ups access to 11 high-tech modern laboratories, as well as partnership with leading universities and scientists.
Groworking Space	The Groworking Space is an evolution of the Incubator of the STP especially intended to support science-based innovation. Its aim is to stimulate and facilitate the exchange of knowledge, ideas, concepts and experiences between business and academics who develop their projects based on activities in applied science.	Sofia	The programme supports projects of innovators, inventors, researchers, entrepreneurs, and students with business ideas that established small start-ups or work within developing technology teams. There is range of services available such as consulting, training, mentoring sessions, free access to STP events, programmes and investment opportunities as well as laboratories and an innovators community. The resource offers a financing scheme for very early stage high technology start-ups of €75K per project.
Founder Institute	Founder Institute offers the world's largest pre-seed accelerator. The programme is offered biannually in 65 countries all over the world. The selection process is focused on founders versus ideas and aims to identify star founders using aptitude and personality tests	Sofia	The programme is intended for founders and teams all throughout the pre-seed stage, including aspiring founders with a full-time job, solo founders, teams, and founders of established companies that are pre-funding. In-person programme includes a series of challenging growth sprints, in addition to Weekly Feedback Sessions where founders receive constant feedback on the progress from experienced Mentors and Investors. Start-ups pay US$549 course fee to cover the costs of running the programme. This fee is fully refundable if founders decide the programme is not right for them.
Eleven	Eleven is pre-seed and seed VC based in Sofia with 150 collective investments into start-ups over five years. Eleven run an acceleration programme that is well known across South-East Europe and is comparable to major global start-up accelerators.	Sofia	The investment focus is on technology companies from South-East Europe with global potential[104], early traction and proof of concept. Eleven invests predominantly into B2B software SaaS, Hardware, Insure Tech, Med Tech, Clean Tech sectors. It does not offer 'one-size-fits-all' acceleration programme, but custom support for individual start-ups based on their requirements, development phase, industry, team, progress, etc. However, all start-ups receive capital, mentorship, access to the community, and a tailored learning programme.

[104] https://www.11.me/

			Start-ups also are granted office space where they must relocate for at least 6 months, and preferably for 12.

It is evident that incubation and acceleration support is growing in availability and is already well established especially in Sofia in the ICT sector. However, in contrast to strong innovation economies, successful entrepreneurial hubs in Sofia act as isolated examples and are almost completely unconnected to the Higher Education and research ecosystem[105].

CoEs and CoCs current demand of incubation and acceleration services

Centres will require incubation and/or acceleration support when their management and researchers are enabled and willing to commercialise the research output through the creation of spin-offs.

Not all partners within the CoEs and CoCs are regulated under the same legal framework with regards to the possibilities to create spin-offs. Partners under the umbrella of the BAS as well as higher education institutions (universities) are generally allowed to create spin-offs and participate in the shares capital of other companies but only for the purposes of exploitation and application of their research results (see comparison table below). If BAS institutes and universities create jointly a spin-off universities will be under more detailed regulation (Council of Ministers Decree of 2020 setting specific provisions). The partners under the jurisdiction of Ministry of Health as well as the regional museums and libraries operate under a different legal framework and are limited in co-founding new spinoffs.

The recently enacted decree by Council of Ministers should be enforced with the adoption of suitable up-to-date internal policies for all public universities and HEIs in the country that conduct research activities. Centres' ability to commercialise their research results is greatly dependent on the management, including the management of the partner organisations' decision to create and fund potential spin-off companies. The new rules should give more certainty to potential investors about the operating nature and objective of these academic initiatives and their IP position and make spin-offs more attractive for incubators and, especially, accelerators.

***Table 9**. Overview of the rules for economic activity of the major partners in the Centres (translation may not be accurate, please refer to the original documents in Bulgarian!)*

Academy of Sciences (BAS)	**Universities and higher education institutions**
Law on the Bulgarian Academy of Sciences states that the Academy can conduct commercial activity connected to its research and the application of its research results. The Academy and its independent institutes can hold ownership rights in properties, patents, equity participation in commercial companies or associations ("sdrujenie").	**Implementing Rules for creation of Spin-off companies by Universities (Council of Ministers Decree No 61/ 02 April 2020)** Universities may set up limited liability companies and joint stock companies in accordance with the Commercial Act, as well as take part in the shares capital of such companies only for the purpose of the commercial realisation of their research results and created IP. The involved companies may only have the following

[105] The Peer Review of the Bulgarian Research and Innovation system from 2015

Statute of the Academy of Sciences provides that its institutes can conduct commercial activity connected to the application of the research results. The budget of the Academy cannot be used to sustain commercial activities. The Statute confirms that the Academy can have equity participation at commercial companies.	business activity: ✓ Sale of research results and of objects of IP registered at the university as intangible assets; ✓ Giving of licences for the exploitation of research results and of IPR; ✓ Carrying out marketing, information, publicity, etc. necessary for the realisation of the sale and/or licensing of the results of research and IP; ✓ Provision of advisory/consultancy services and assistance for the effective implementation and/or exploitation of results; ✓ Determination of the need to obtain legal protection for the research results and IP objects in the country and/or abroad, the maintenance during the period and the protection against infringements; ✓ Market research, maintenance of a database of potential users and markets, key competitors and their positions in the relevant markets **Further conditions:** ➢ The business activity needs to be linked to the research results of the scientific activity in the field of for which the university has received national accreditation; ➢ The University may participate in the share capital of the above-referred companies with monetary or in kind contributions. ➢ The maximum monetary contribution can be 10,000 BGN, using only own resources. ➢ The non-monetary contribution may only be objects of the IP of the university. ➢ A mechanism for distribution of the company profits in favour of the universities/HEI shall be laid down in the Statute or the Articles of Association whereas the Commercial Act applies.

Based on the interviews conducted with the management of most Centres, the willingness to commercialise via the creation of spinoffs seems to be a more critical issue. Several partner organisations within Centres are still unaware of the benefits of research commercialisation, which might have to change after the enactment of the new implementing rules for economic activity and spin-off creation (and provided the understanding of the application of EU State Aid rules and principles be improved). Consequently, the internal procedures for commercialisation have not been adopted, leaving Centres without internal frameworks and much needed institutional support. Most Centres have prepared, as part of the documentation & application package, rules and strategies on commercialisation, which look very similar to each other and appear to be too general. In some cases, the Centres decide to use the commercialisation strategies and rules of only one (e.g. the

leading) partner in the consortium, without substantial adjustment to the Centre-specific activities. Therefore, it follows that if no action is taken the chances for spinoff creation will remain reduced (as university staff tends to follow the internal rules of the university first), and so is the immediate need for incubator and accelerator support.

The entrepreneurial willingness of researchers is also low. According to Peer Review by European Commission[106] the main challenges concerning the entrepreneurial behaviour and mindset in PROs are:

- The significant uncertainty for PROs in behaving in a more entrepreneurial manner linked to their Not-For-Profit status.
- PROs are not embracing well-established good practice in knowledge exchange activities and knowledge exchange is not yet part of their core-strategy or the metrics of their assessment.
- A strong need for more mission-oriented research in Bulgaria and the introduction of institutional models to promote this.

During the JRC field visits no significant evidence of *motivational levers* that would encourage scientist and researchers to engage in commercial activities in terms of spinoff creation was found. While scientists do not need to leave the security of the research lab, their participation, and engagement for example as an advisor to the newly created spin-out is crucial. The lack of activities aimed at improving entrepreneurial behaviour and mindset can negatively impact the quantity of potential spinoffs and, thus, the need for incubator and accelerator support.

There is evidence of spinoff creation by several institutes within the BAS and in some universities, e.g. the Medical University of Plovdiv, but at most Centres this activity is still in its infancy. The success of these endeavours will at the end depend on the capability of the Centres' management to streamline the process and the capability of researchers to create inventions and further develop these into innovations to benefit the society and economy. It is absolutely crucial that the researchers are aware of their rights to revenues arising from the commercialisation activities. Typically, the inventor (or team of inventors) will receive between 30 and 50 per cent of the equity in a spin out company and percentage of royalties in a licensed technology when developed. Below is an example from Oxford University Innovation[107] and how the inventor is compensated financially in a licensing deal, a structure transparent and equal for all licensing deals.

Table 10. *Revenue sharing example*

[106] The Peer Review of the Bulgarian Research and Innovation system from 2015

[107] Oxford University Innovation is the whole own technology transfer company of the University of Oxford

Table: Revenue sharing from licensing

Total net revenue	Inventor(s) total	General fund	Department	Oxford University Innovation
to £72k	60%	10%*	0%	30%
£72k to £720k	31.5%	21%	17.5%	30%
over £720k	15.75%	28%	26.25%	30%

The lack of managements' capability in terms of spinoff creation was evident during interviews and the project proposals reflect this. According to the Global Entrepreneurship Monitor[108] there are two indicators demonstrating poor capability of research institutions with regards of entrepreneurial activities[109]:

- *Poor Formal Entrepreneurial education* with lack of entrepreneurship subjects and low effectiveness in building entrepreneurship skills and values (in the last 1/4 of EU countries).
- *Poor R&D transfer* (only ahead of two EU countries) from universities and research Centres to the business sector. This indicates a low proportion of engineers and scientists who are willing and able to commercialise research results.

Typically, one or two out of ten spinouts survive the ten-year survival benchmark. To increase the chance of having good quality spinouts who become sustainable companies, it is suitable that:

- Research projects and the new technologies created should follow market needs and clear demand.
- Spinouts should be created where it is clear that a series of new products can be created.
- Focus should not be exclusively on technology but also take business development and market traction into account
- Spinouts should involve good founder teams and be also well capitalised
- The misalignment of industry sectors with the preferences of incubators and accelerators, with an exception of the ICT Centred inventions

Adequacy with regard of supporting CoEs & CoCs. In terms of territorial coverage, the incubation and acceleration programmes are mainly located in Sofia and Plovdiv. This corresponds with the geographical concentration of investment into Centres (90 per cent of resources and 12 out of 14 leading organisations are located in these two regions). Two Centres, CoC "Smart Mechatronic, Eco- and Energy Saving Systems and Technologies, Gabrovo" and CoC "Personalised Medicine, 3D and Telemedicine, Robotic-Assisted and Minimally Invasive Surgery" have the leading partners in cities with no incubation and acceleration programmes support, however they have major partners in Sofia. It can be concluded that currently there is adequate territorial coverage of incubation and acceleration support available to Centres adequate with expected demand.

[108] Global Entrepreneurship Monitor, 2018/2019 Global Report
[109] Global Entrepreneurship Monitor, 2018/2019 Global Report

With regard to the start-up development phase, incubators offer support in developing unique ideas, but the ideas must include a clearly identified market application or social benefit, not just a product or technology. Incubation and pre-acceleration programmes are intended to validate and develop the idea as a scalable business model. Accelerators do not work with ideas "per se" but invest into technology start-up companies with global potential that have early traction and proof of concept. Centres will only receive support from incubators when the technology idea is developed into a viable business proposition. In addition to that, accelerators require a proof of concept or a proof of market.

In terms of start-up team composition and an established business entity, the founder institutes offer the programme equally to teams, founders with full-time job and solo founders, however, incubators and pre-accelerators prefer to work with established start-up companies, or at least developing teams. For true accelerators, an established company with a fully competent and fully devoted team is a requirement. Centres will eventually have to found start-ups with competent team and motivate crucial researchers to take active parts in their development.

Regarding the desired industries and sectors, available programmes all seek innovative technology start-ups. Similar to the broad Bulgarian start-up ecosystem they are all focused primarily on ICT. The Eleven is more specific, stating they support B2B software SaaS, Hardware, Insure Tech, Med Tech, Clean Tech sectors. The Incubator within Sofia Tech Park supports information and telecommunication technologies, life sciences and green energy. The new Groworking Space programme seems to be sector agnostic but focuses on innovation coming from research. Sector wise, the support is currently available predominantly for IT and hardware spinoffs coming from Centres with "Informatics and information and communication technologies" and partially also "Mechatronics and clean technology" components. For spin-offs from other sectors, the support could be available within Groworking Space, but their offering still needs to be developed more precisely.

Incubators and accelerators generally do not guide researchers through the commercialisation phase, as Tech Transfer offices do. Their main role is to support venture building, for example breed CEOs for newly created academic spin-offs or support the business planning phase. Therefore, their role is important in the process of commercialisation, albeit not as a primary investor, funder or founder.

6.5 Early Stage Investment and Investor Readiness

On average, it takes two years for a university to progress any type of opportunity from initial disclosure to readiness for investor or corporate scrutiny. Many exciting technologies fail because their business proposition is not adequately validated to attract investment. Early stage investment opportunities are generally deemed 'high risk'. Investors therefore make their selections carefully to keep these risks to a minimum and so naturally, they seek solutions with the greatest demonstrable value. As a result, many innovations are rejected and goalposts are frequently moved, usually with requests to reapply when the work is more fully developed. Early stage financing remains hard to obtain even for the most innovative tech entrepreneurs.

Furthermore, the funding available to universities to seed early stage spin-off companies themselves is limited. Cost constraints can hamper their ability to make their own experience-guided decisions to invest in 'upstream' and early-stage projects. Potentially impactful projects go no further than the laboratory or workshop, and even fewer reach the stage of proven principle to

be able to pitch to investors or corporate in-licensing executives[110]. Although TT seed investments in Europe are on the radar of some investors, academic research is often considered 'too new' or 'too high-risk' to be transferred out of the research laboratory and financed by traditional investors. New discoveries and technologies may fail to realise their potential unless they become attractive to industry or downstream investors[111].

Investment readiness support aims to get projects or promising enterprises to a stage where traditional investors can make investments.[112] A non-exhaustive list of investment support activities would include[113]: market analysis, strategic positioning, offer definition, value proposition, business model planning, exit planning, investment pitches and business plan authoring, review and refinement.

AVAILABLE EARLY STAGE INVESTMENT AND INVESTOR READINESS IN BULGARIA

The Bulgarian Private Equity and Venture Capital Association (BVCA) has twenty three members and includes private investors, venture capital funds, some later stage investment companies, law offices and international consulting firms[114]. The main early stage investment schemes can be divided into[115]:

- **Seed and VC hubs**: LAUNCHub Ventures, Empower Capital, Black Peak Capital Ventures, NEVEQ Capital Partners, Post scriptum, Eleven, BrightCap Ventures, Morningside Hill Venture Capital, 3TS Capital Partners, Vitosha Ventures and Innovation Accelerator. Several of the above listed are funded through the Fund of Fund of Bulgaria.
- **Business Angels**: CEO Angels Club, Bulgarian Angels.

Seed and VC Hubs

LAUNCHub Ventures has been investing in seed and series A start-ups since 2012 and manages a portfolio of over 100+ investments. This VC invests primarily in digital businesses but also considers health-tech, e-commerce, mobile, IoT, and other sectors. Investment criteria include initial traction and strong founding team.

NEVEQ Capital Partners is a venture fund active since 2006 and is currently managing their portfolio of 14 companies in growth, early and seed stages in which they have invested €15M to date. The focus is on enterprise applications software, infrastructure software and industry vertical applications, as well as on mobile businesses. Also considering opportunities in health, education and energy efficiency[116].

Eleven also acts a pre-seed and seed VC based in Sofia with 150 collective investments into start-ups over five years. Eleven invests predominantly into B2B software SaaS, Hardware, Insure Tech,

[110] https://octopusventures.com/insights/tech-transfer-where-education-meets-the-market/
[111] https://www.eif.org/what_we_do/equity/technology_transfer/index.htm
[112] https://www.socialinnovator.info/ways-supporting-social-innovation/market-economy/social-finance/investment-readiness-support
[113] https://gbfstrategy.com/invest-ready
[114] https://bvca.bg/en/
[115] https://angel.co/bulgaria/investors, https://www.f6s.com/, https://fi.co/insight/sofia-startup-resource-list-300-accelerators-incubators-investors-and-more, https://www.11.me/, https://www.launchub.vc/, http://www.neveq.com/en/index, https://ceoclub.bg/angels/
[116] http://www.neveq.com/en/index

Med Tech, Clean Tech sectors. Investment focus is currently on technology companies from South-East Europe with global potential[117] that have early traction and proof of concept.

Business Angels

There is a strong community of angel investors with over 200 investments where the most active individuals are mainly coming from above mentioned VC funds and accelerators[118]. There are also some very successful entrepreneurs such as the Telerik founders, who set up the Telerik Academy and few foreign business angels, particularly targeting seed stage start-ups in Sofia.

Other sources of early stage investments

EIT Digital, the Digital Community within European Institute of Innovation & Technology (EIT), signed a partnership agreement with BVCA, which will facilitate the BVCA members to invest into Bulgaria-based start-ups with high growth potential (scaleups), especially in deep tech[119]. EIT Digital already supports Bulgarian scaleup companies actively. In 2018, health-monitoring scaleup Checkpoint Cardio joined the EIT Digital Accelerator. In 2018, EIT Digital supported start-up EasyDoc, a platform helping patients to select and make appointments with doctors, dentists or clinics, through its Venture Program.

The TTF mentioned previously has an early stage sub-fund with a budget of BGN4.9M, which targets primarily start-ups at the PoC stage, acceleration stage and early growth stage offer with investment size in the range of BGN30K to 391K.

ADEQUACY WITH REGARD OF SUPPORTING CoEs & CoCs

It is evident that there is early stage financing available in Bulgaria, however it is generally limited to start-ups in seed or later stages. There is no funding to support knowledge and technology development or transfer trough other channels beside spin-off creation. Consequently, the investment funding for Centres' commercialisation activities will only be suitable for spin-off creation as commercialisation route, which typically is the more risky and less preferred technology commercialisation strategy. The pipeline of projects suitable for spin out is hard to develop in the environment with low level of entrepreneurial activity and mindset, poor institutional and policy support.

In addition, there are several points to note:

1. **Technology readiness is not investment readiness**: PROs use the TRL for ranking the technologies by maturity. Most frequently, the technology development within PRO does not exceed the level of technology validation in laboratory environment (TRL 4). This is not sufficient to reach investment readiness, as the whole business side of the potential venture needs to be developed as well as the technology. The technology must be further validated and de-risked (at least TRL 5-6) and the business case of the potential venture needs to be developed.
2. **In general TT offices do not have procedures to proactively identify and pre-screen market potential** of research results and IP.
3. **Low level of understanding of academia about contemporary start-up** development methodologies, global marketing and sales and early stage investments.

[117] https://www.11.me/
[118] https://angel.co/bulgaria/investors
[119] https://www.eitdigital.eu/

4. **CoE and CoC outputs must be aligned with the investor demand**. Projects originating from PROs usually do not provide:
    - Simple robust solutions with low technological risks.
    - Market traction – investors invest in business, not (just) technology. To have a business, a start-up needs to prove they have a market, i.e. paying or interested customers.
    - Existence of adequate start-up team – having technology and market potential is still not enough without a competent and motivated team that will explore the potential and drive the start-up forward. Early stage investors support a business case with dedicated high quality teams locked in for a two to five years period.
5. Investors in middle-income countries prefer fast growing sectors where scaling is straightforward, investments in additional R&D and integration are low and exits are frequent. This explains the popularity of the digital among Bulgarian investors.

To summarise, investment readiness support programmes are present in Bulgaria. However, all these programmes are intended to support creation of future start-ups and not necessarily to support knowledge and technology development or TT. They target start-up funders not research groups. Apart from the STP Incubator and its Growoking Space, all other programmes are largely oriented toward digital ICT and digital start-ups. Other sectors where the majority of Centres operate are not widely supported. Neither is robust Venture Capital available in the country, despite more efforts in this space in the past few years.

The Case: From "Entrepreneurial researchers" Ljubljana University[120] to Oxford University Entrepreneurship Centre[121]

To approximate the general investment readiness programmes to the needs of the academia, The Ljubljana University incubator developed a new compact programme for researchers and professors who wish to commercialise a technology or a prototype. The 2-day intensive programme Entrepreneurial Researchers includes, among basic TT education, the 'sources of funding' and 'Investor deck and pitching' modules. The programme is very well received as it deals with crucial doubts and fears associated with change of focus from research to entrepreneurship. It also acts as an important channel of ideas and teams leading to the University incubator.

The influence of such programmes on the culture of the university is profound. Similar open programme run in the University of Oxford in late 2000s has since led to the establishment of the Entrepreneurship Centre, which has developed and enhanced this initial offer to several high impact initiates including Venture Lab, Creative Destruction Lab, Intrapreneurship Lab, BioEntrepreneurship Lab, and Student Entrepreneurs' Programme (StEP) specially designed to engage groups of student entrepreneurs in creating new spinouts. The university made its IP available to student groups for the purpose of putting together investable business cases. The groups received a small stipend, a place to work, mentoring from TT staff and free access to intensive training programmes tailored to their sector.

6.6 Industry-Academia Interactions

PROs are usually the beneficiaries of public investments in R&D. The pace and effectiveness through which academic knowledge is transformed into industry, in form of new or better products

[120] https://lui.si/novice/seminar-podjetni-raziskovalci
[121] https://www.sbs.ox.ac.uk/research/Centres-and-initiatives/entrepreneurship-Centre

and processes has a substantial impact on the contribution of those public investments to economic development. By improving the industry-academia collaboration, national economies can increase innovation to raise productivity, create better job opportunities and address societal challenges. All economies are actively developing new ways to improve these interactions and optimise knowledge transfer.

Knowledge transfer from academia occurs both formally and informally[122]:

- Informal channels include the transfer of knowledge through:
    - Scientific publications
    - Dissemination of knowledge via conferences, seminars, meetings with industry, and others.
- Formal channels include:
    - Training and education
    - Hiring students and researchers from universities and PROs
    - Joint industrial research, extension services, joint research Centres
    - Consultancy, contact research, extension services (adoption, certification, engineering services)
    - Technology licensing to established firms and new start-up companies
    - Creation of spin-offs
    - Use of research infrastructure.

In high-income countries, TT is characterised by licensing, spin-offs creation, and research collaboration between science and industry. In mid-income countries, contextual conditions such as the general mindset and traditions of (non)collaboration, scientific and innovation competences, institutional and market failures prevent high entrepreneurial activities in academic institutions. Thus, other mechanisms of knowledge transfer are more widespread. In this context, TT will be more oriented to the provision of basic technical and engineering services (extension services) and supporting incremental innovation, which is mostly based on adoption, adaptation, and assimilation of foreign technologies. In developing countries, setting up intermediate organisations such as TTOs is generally challenging. Instead, light, specialised programmes and support schemes that help match the supply and demand for ideas/technology and help develop other forms of science-industry collaborations, are more effective.

In all countries, however, the success in TT is the result of sustained efforts to bridge the gap between science and industry, and the commitment by research institutions to contribute to economic and social development.

6.7 State-of the Art in Bulgaria

During interviews with the Centres it was reported there exist established long-lasting collaborations between Public Owned Enterprises (POE) and PROs in some sectors. There are cases when the transfer is formalised, but often the collaboration happens in an informal manner

[122] Correa, Zuniga: Public Policies to Foster Knowledge Transfer from Public Research Organisations, 2013

between POE and individual researchers, based on personal contacts and without involving the research organisation. There are very few successful cases of contract research with international corporations, and even less with domestic SMEs. The number of patents sold, or licencing deals, is very small. It is evident that academy – industry collaboration is in the nascent stage of development.

There is still a strong bias against research commercialisation and broader collaboration between science and industry. This situation is typical for the innovation ecosystems in the Balkan region that is heavily marked by the transition, when collaboration between academy and industry decreased due to political and economic structural changes. Today, ecosystems are characterised by distrust that leads to innovation silos, where actors from academia, industry and government refuse to collaborate, which further deepens the gaps among them. The management of PROs are frequently reluctant to change, thus maintaining the status-quo.

By definition, numerous TTOs mapped in the previous chapters were intended to support academia in its cooperation with industry. Through interviews, we have identified few TTOs that perform better, but in general the performance of TTOs in supporting academia and industry collaboration is poor.

As previously mentioned, several public programmes aim to support collaboration between academy and industry:

- The National Innovation Fund runs a financial scheme to support innovative enterprises and SMEs, offering matching grants for "scientific and research and development projects and projects for technical feasibility"[123].
- Funding scheme under the operational programme "Innovation and Competitiveness" (OPIC) under Priority Axis 1 launched in 2017 that is intended for the development of product and process innovation in enterprises.
- The new TT Fund (TTF) that will provide equity and quasi-equity investments to support TT and innovations developed in cooperation with research institutions and private organisations.

ADEQUACY WITH REGARD OF SUPPORTING COES & COCS

There are public programmes to support collaboration between academy and industry however:

- PROs cannot be beneficiaries, and can only be partners in the application. They can only benefit from being partners e.g. as technology providers (*some university representatives expressed dissatisfaction from their participation in the Innovation Fund projects with companies 1) due to the fact that they have to co-fund up to 30 per cent and 2) they claim that they don't keep sufficient part of the research results*).
- No soft support that would facilitate collaboration between actors from academia, industry, and government is available within public programmes

In line with experience in developing countries, setting up successful TTOs has been a challenge and has not had the impact seen in developed industries. Instead, light, specialised programmes and support schemes that help to match supply and demand for ideas/technologies and develop other forms of cooperation between science and industry have proved more effective.

[123] https://www.mi.government.bg/en/themes/national-innovation-fund-19-287.html

There are some successful models of Industry-academia Interactions in the region. These successful cases involving PROs started as small-scale pilots under the radar of the "safe-guards" biased to academia-industry collaboration and were developed bottom up by engaging early adopters e.g. a few highly motivated researchers and a few progressive companies. In this sense, the Centre managed by an independent single leader could be an ideal platform for a similar approach e.g. piloting light, specialised programmes and support schemes.

Evaluations of similar programmes like CoE and CoC in the Balkan region showed that progress in the performance of research and innovation ecosystem is only visible in the long term. The main reason for that is the huge gap between the academia and industry, but also between academic partners. Centres have the potential to act as *boundary spanners*, provided there is enough time to develop trust among actors.

Case: Green Innovation Vouchers Scheme by EBRD[124]

In Serbia, the European Bank for Reconstruction and Development (EBRD) has launched the Green Innovation Vouchers (GIVs) scheme to boost the innovation capacity of domestic enterprises in the field of green technologies and resource efficiency by linking them to local R&D service providers (R&DSPs) which are often university departments. The resulting cooperation will enable participating enterprises to raise their environmental performance and competitiveness.

Green Innovation Vouchers are grants that help enterprises to cover 90 per cent of the eligible R&D service costs, up to €20K for standard and €50K for mega vouchers. The R&D service will enable SMEs to develop new products, services and processes, or innovate existing ones, in order to improve resource efficiency, thus supporting transition to the green economy. So far, the EBRD has approved 35 projects for development and implementation of green technologies and improvement of resource efficiency in Serbia. The total value of the awarded vouchers is €600K.

Case: Collaborative grant scheme programme of Serbian Innovation Fund[125]

Collaborative Grant Scheme Programme is designed to incentivise private sector companies and public sector R&D organisations to engage in joint development projects with the goal of creating new products and services, as well as innovative technologies with significant future impact and market potential. With this Program, the Innovation Fund aims to provide financial assistance to innovative technological projects with a clear vision of development and defined business model and commercialisation strategy. So far, 25 projects have been approved in the total value close to €7.5M.

Financing: Up to €300.000, or up to 70 per cent of the total approved project budget for projects whose Lead Applicant is a micro or small company, or up to 60 per cent of the total approved project budget for projects whose Lead Applicant is an SME. The rest of required funds must be supplied from other private sector sources, independently of the Innovation Fund.

Eligibility criteria: A consortium of no more than 5 members consisting of at least one micro, small or medium-sized company and at least one public R&D organisation that comply with the eligibility criteria as described in Collaborative Grant Scheme Programme Manual.

CASE: Innovation Vouchers of Serbian Innovation Fund[126]

The aim of the Innovation Vouchers scheme is to financially incentivise SMEs to collaborate with R&D

[124] http://inovacionivauceri.ebrd.rs/
[125] http://www.inovacionifond.rs/programmes/collaborative-grant-scheme-program
[126] http://www.inovacionifond.rs/programmes/innovation-vouchers

institutions thereby engaging in innovation and making their products more competitive on the market. Within the for public calls during the last two years 508 small collaboration projects between SMEs and R&D institutions were supported.

Amount of financing:

- Up to €6.5K, or up to 80 per cent of the total service costs, exclusive of Value Added Tax
- A minimum of 20 per cent of the total approved project budget is to be provided by the enterprise
- One SME can obtain not more than two innovation vouchers, for which the application can be simultaneously submitted, with a maximum amount up to €10K

Eligibility criteria:

- For applicants: micro, small and medium-size companies, legal business entity incorporated under the current Serbia Company Law, registered at Serbian Business Registration Agency with majority private ownership
- For service providers: all public R&D institutions, as well as all other institutions, accredited to do R&D (including the private ones)

Eligible services:

- Development of new or improvement of existing products (related to function and quality), process or a service
- Proof of concept study
- Feasibility study
- Production of laboratory prototypes
- Creation of demonstration prototypes
- Various types of testing (in the lab, at the pilot plant)
- Technology validation
- Validation of new or improved products, processes or services
- Innovation advisory services
- Development and implementation of specific product- or process-related software
- Specific coaching in connection with the developed solution

The Innovation Fund will make its decision and inform the company about the decision within approximately 7 working days from the date of submission of the application.

6.8 Identified Challenges and Needs

Technology Transfer

On the **ecosystem level**, the identified challenges and needs are:

- Lack of structures, human resources, skills and procedures for effective commercialisation of research results. This translates into a need for capacity building initiatives such as

training and career development programmes or actions to provide TTOs with methodology and operating procedures.

- Development of tailored instruments to upgrade technology transfer: PoC funding instruments, industrial challenge programmes, joint labs between firms and research institutions are all lacking.
- The lack of coordination and communication between relevant stakeholders in the overall TT ecosystem.

On the **level of Centres**, the identified challenges and needs are:

- Lack of strategic vision: TT actions are planned on the project level (similar to the exploitation of results sections in R&D projects), most of the projects outline diffusion and TT actions but lack plans for building sustainable TT capacity.
- Lack of market-oriented approach in TT plans.
- Centres do not have clear rules and guidelines regarding the implementation of TT activities.
- Funding is available for TT ranging between very little (20k BGN) to over a 1.5 million BGN with an average of approx. 150-200k per Centre for the period of 6 years project time (2018-2023). It is not clear how the Centres will conduct effective TT activities unless they rely up to 100 per cent on the human resources of the partner organisations.

COMMERCIALISATION, ENTREPRENEURSHIP ECOSYSTEM AND EARLY STAGE INVESTMENT

Although the start-up ecosystem in Bulgaria is well developed, especially in Sofia in the ICT sector, it has developed around private initiatives and is detached from PROs. The main challenges concerning the entrepreneurial behaviour and mindset in PROs are[127]:

- A significant uncertainty for PROs for behaving in a more entrepreneurial manner linked to their Not-For-Profit status - caused from misbelief that they cannot have revenues from commercial activities.
- PROs are not embracing well established good practice in knowledge exchange activities and knowledge exchange is not yet part of their core-strategy or the metrics of their assessment.
- There is a strong need for more mission-oriented research in Bulgaria, and the introduction of institutional models for its promotion.

CREATION OF SPIN-OFFS AT PROS [128]

- At universities: Despite the fact that the amendment to the Law on Higher education introduced the possibility of universities conducting commercial activities, the universities

[127] The Peer Review of the Bulgarian Research and Innovation system from 2015.

[128] Observations based in part on summaries, links and extracts prepared by the coordinating team to inform the expert panel and facilitate the panel's research and analysis activity. This includes extracts from relevant parts of Bulgarian legislation on economic activity of Public Research Organisations (PROs including the Academy of Sciences and Universities) and on the IPR management and protection rules of the Academy of Sciences. Relevant media articles from Bulgaria have also been collected.

have not really taken the chance to implement internal provisions and processes aimed at allowing this to happen. A number of them have been waiting for the adoption of the so-called Implementing Rules (see above). In the words of Prof. Kostadinov across the media, as of August 2019, none of the universities had incorporated effective internal rules on the IPR management and exploitation, e.g., through the creation of spin-offs. After the expert team has acquainted itself with the internal IPR and exploitation rules of numerous universities in the country, these appear to mostly regulate the relations with the inventor and the procedures for filing for patents, only a few have provision on spin-offs (Plovdiv Medical Uni for instance has clearly stipulated this). The provisions on industry liaison are very brief across these rules or almost non-existent. In addition, at the time of the meetings in February 2020 some universities still considered that the adopted law is not enough (this is resolved after the adoption of the decree /implementing rules on 2nd of April.

- It is believed that the practice of creation of spin-offs has declined, from an already low level, due to the lack of internal "implementing" rules of some of the institutes of the Academy of Sciences – rules that implement the Framework Rules on IPR protection and utilization of 2009 (solved in April 2020 as with the new rules).

- Low level of understanding in academia of contemporary spin out development methodologies, global marketing and licensing and early stage investments.

- Technology readiness is not investment readiness and the TRL levels normally achieved within PROs are not sufficiently high for external investors.

The main weaknesses of the entrepreneurial framework hampering the entrepreneurial activities and performance are[129]:

- Cultural and social norms not encouraging entrepreneurship, not accepting, neither supporting entrepreneurial activities.

- Low support and relevance of entrepreneurship among policy makers, low exposure and interest to improve conditions for the self-employed and SMEs.

- Inadequate provision of government entrepreneurship programmes, including subsidies, incubators, and agencies that assess and advise entrepreneurs.

- Poor formal entrepreneurial education with lack of entrepreneurship subjects and low effectiveness in building entrepreneurship skills and values.

- Poor R&D transfer from universities and research Centres to the business sector.

- The competences in higher education, R&D and innovation policy have been clearly divided between the Ministry of Education and Science (oriented towards the public segment) and the Ministry of Economy (dealing with the private sector). Similarly, policies are devised and implemented separately, whilst funding and support primarily depend on the type of beneficiary, not the R&I field or the opportunities for joint projects and initiatives. The most serious challenge for the country's R&I system thus is the continuous lack of integrated policy instruments.

On the level of Centres, the identified challenges and needs regarding commercialisation, entrepreneurship ecosystem and early stage investment are:

[129] Global Entrepreneurship Monitor, 2018/2019 Global Report

- Several partner organisations within Centres, predominantly universities, are still reluctant to adopt commercialisation as the third part of their missions. Universities were never prohibited from licensing of their IPR but lacked the framework for spin-off creation until March/April 2020. The Plan for the implementation of the national strategy stipulates that research and TT will be put on equal footing with education (this was planned to happen together with the strengthening of the TT offices in years 2020-2022 as stated in the Plan).

- In-existence of motivational levers that would encourage researchers to engage in technology transfer activities.
- Possible misalignment of CoE and CoC output with the demands of investors or commercial partners, often related to lack of market potential, robust technology or transparent IPR position.

- Although it was reported that some initial contacts between certain Centres and potential buyers from industry were not readily monetised, some Centres do not seem to be considering capturing the market demand as an important way to facilitate TT and commercialisation.

- All Centres have the key performance indicators set, but the great majority only use those that are determined by the public call rules, thus the indicators demonstrating the effectiveness of activities for commercialisation but also the final financial results are missing.

6.9 Recommendations

TT Arrangement for the Centres (Strategy, Policy and Process)

Firstly, as elsewhere in this document, it must be stressed that there is a great difference between carrying out technology transfer activities on behalf of a specific institution or with regard to the results of a single research project, and performing systematic technology and knowledge transfer activities for a Centre of Competence or a Centre of Excellence. The latter requires that the professionals involved be incentivised to perform the technology and knowledge transfer activities in the interests of the CoC/ CoE and not just of any single partner institute. This means a balanced approach that minimises conflicts of interest.

Secondly, TT and industrial collaboration strategies should be developed according to demand needs and future opportunities including contract research, joint laboratories, POC, licensing and spin-off creation. This can be addressed using the following recommendations:

- First and foremost, patent budget (for PCT) need to be made available, possibly by the Government if the universities and institutes cannot afford it.

- As a rule of thumb, the Centres should try to avoid filing for patents only on the national level and should aim to file for protection in the leading developed economies (or in those geographies where there are potential markets). The Centres should exploit various patent strategies to balance optimally the costs and the benefits in seeking registered protection.

- **Creation of industrial and innovation advisory boards** by the Centres at the national level with the function of advising the governing bodies of research institutions in the

development of the TT strategy and providing knowledge and information about market needs will be highly beneficial.

- **Development of the unified protocol and guidelines (rules) for implementation of TT activities (protection and commercialisation of the research results) within Centres.** This should include the preparation of all necessary templates for implementation of steps required to make the implementation of TT activities smoother, define and introduce the step-by-step protocol (in a form of guidelines) for researchers in managing their research results for potential protection and commercialisation, etc. These rules should not be based on 'copy-pasting' the best practices from TT leaders but on developing a solution appropriate for the local conditions, legal framework, the state of industry readiness, and established culture.

- **Development of robust procedures for quantitative project evaluation for commercialisation** based on industry need, commercial potential of the technology, capacity of the research team to deliver results, and the strength of the business strategy. The procedures used by early stage funds to evaluate projects for investment would be a useful collateral material.

- **Establishing effective communication**. Ensure that the IP policy and other relevant laws concerning their rights and obligations related to their research results are clearly communicated with researchers within all partner institutions of all Centres. This activity should be repeated frequently as bi-annual workshops/seminars covering the basics initially and then the relevant changes occurring within evolving legislative framework.

- **Establishing a dedicated budget for technology transfer activities**. The Centre and/or the partner institutions within each Centre are advised to consider establishing a dedicated technology transfer budget ring fenced for IP valorisation, IP protection, marketing and commercialisation activities, etc. This will allow the Centre to operate efficiently and use the available economies of scale. Extraordinary cases that fall outside of the established budget could be decided on a case-by-case basis based on the size of the opportunity, potential commercial and economic/ social benefit, and TTO recommendations.

- **Definition of tailored programmes in TT**, in particular Valorisation or PoC, joint research units, industrial doctorate programmes.

- **A dedicated patent budget,** made available to the eligible institutions as grants, should be established under the Ministry of Science and Education. Both Centres and PROs should be able to apply for these grants with the aim of increasing the availability of patent protection to their inventions, especially, to grow internationally protected portfolios.

- **Internal PoC funds**, which only individual Centres or groups of Centres can access, should be established. Institutional PoC funds could also be formed within PROs where the funding received by the institution allows, which research groups could apply to with the aim of increasing the technology readiness level of significant research outputs. These PoC funds would be managed internally by the eligible institutions but supervised by independent expert panels and the Ministry of Science and Education.

- Considering the current scope of PoC support in Bulgaria and the local context, the PoC funds within CoC/CoE should be the focus of the short-term effort. All Centres should

reallocate part of the public funding they receive to PoC activities for selected R&D projects/results and should provide the following:

  - Initial funding up to €60K (up to €100K in exceptional cases) conditional on applicants demonstrating their commitment. The eligible activities should not be too prescriptive to allow flexibility in line with arising needs and opportunities.
  - Matched funding up to €60K (up to €100K in exceptional cases) provided by external donors.
  - Soft support including coaching on business model development, value chain analysis, and skills for academia business interaction.
  - On-going case-by-case mentoring and supervision.

- **Capacity building of the current TTOs staff**. This activity should include continuous education of the TTO staff leveraging the available resources, including the home-grown expertise of the most successful performers. The particular focus should be on effective TT procedures and established TT channels, sources of translational funding, contemporary business development methodologies, incremental spin-off development, and fundraising for early stage technologies (crowdfunding, early stage venture, etc.), business planning, compliance, control and contracting functions, and procedures for monitoring of the use of the research infrastructure.
- **Possibility of outsourcing the TT activities** for which there is currently no expertise during the project implementation should be considered. However, this solution should only be used in the short-term and the Centres and/or the partner organisations should deploy the "learning-by-doing" model by use the opportunity of their technology transfer officers working with or alongside the external contractors to learn efficiently by working on real cases.
- **Appointment of at least one TT manager** within each Centre will allow efficient coordination of TT activities between the Centre and partner institution's TTOs. Networking and matchmaking events with industry and investors should be initiated by the Centres' TTO and effective coordination would be highly beneficial.
- **Monitoring and measurement of KPIs** should be established in accordance with the recommendations of the Report from the European Commission's Expert Group on Knowledge Transfer Metrics - Towards a European–wide set of harmonised indicators[130]) and used by all Centres in their annual reports. This will allow benchmarking the Centres by performance, which in turn will enable timely interventions and corrections of strategy throughout the duration of the Project. In addition, external assessment schemes providing qualitative information and counselling on the Centre performance can be a powerful tool for continuous improvement.
- **Develop soft skills training programmes on TT and entrepreneurship** aimed at PhD and post-doctoral researchers. These programmes will increase awareness about TT among the scientific community and will open job opportunities in TT for those who do not wish to pursue a pure academic career.

[130] https://publications.jrc.ec.europa.eu/repository/bitstream/JRC120716/kt_metrics_report.pdf

SUPPORTING COES AND COCS

In addition to regulating the legal issues that are a prerequisite to enable an organisation to set up spin-offs (done in March/April 2020), we propose the following measures to the Centres:

- Centre management should **build capacity to create a favourable internal framework and streamline the process of spin-off creation** that will encourage scientists and researchers to leave the security of laboratories and engage in commercial activities in terms of spin-off creation. Develop your own custom arrangements based on the local context, considering inhibitors and motivators of local researchers and the drivers for local industry and investors. Where required, with the support of international experts.
- Engage in **campaigns to promote entrepreneurial behaviour and mindset** by promoting the best cases and champions from Bulgarian academia that succeeded also as entrepreneurs.
- Develop series of customised events (like innovation sprints) to stimulate creativity and innovativeness of researchers aiming to develop technology-based business ideas.
- Stimulate **networking with the innovation community** and allow non-researchers to be spin-off managers when this proves to be the best approach.
- Building on Centre partners, i.e., clusters that are associated partners and develop **mentoring programmes** with industrial managers to help spin-off promoters with the process of ideation, business model and planification.
- **Appointment of at least one technology scout/broker** within each Centre whose task will be to work on the services portfolio definition by:
    - Creating a list of companies working within the focus area of the Centre, particularly paying attention to the companies with innovation-based growth strategy.
    - Approaching the companies to identify current needs and requirements of each potential partner and make this information available to all partner institutions of the Centre, ideally via a specially designed 'Industry Partnerships' repository listing opportunities and requirements in real time. This should repeat bi-annually for each company on the list.
    - If the solution that satisfies the requirements of an industrial partner is already available or ready to develop, create a technology offer/technology opportunity to pitch to the industrial partner. This will be easier to achieve for the Centres where the partner institutions already have historic links with industry. Less experienced Centres should seek the methodological support from these partner institutions and the knowledge disseminated through workshops.
    - Collecting information on open innovation challenges and other similar initiatives and alert, the relevant research groups of the opportunities advertised.
    - Maintaining a comprehensive understanding of the research capabilities and strengths of the partner institutions and have access to their technology register or maintain Centre's own technology register combining all the innovative technologies with high commercialisation potential available within partner institutions. This happens through obtaining and filing detailed Invention Disclosure

Documents as well as keeping a spreadsheet containing basic technology information such as TRL, ownership, title, implementation areas and USPs. The Centre could share its technology register with the BgTTN who might provide valuable insight to the Centre on the potential interest in the technology from innovative enterprises in Bulgaria and the regionally competing technologies from the third parties.

- Exploring the possibility of collaboration with regional innovation Centres and the companies working with them, and with local start-up and innovators communities.

Investor Readiness & Early Stage Investments

Investor readiness programmes in Bulgaria should also be improved and adjusted to the needs of the research and deep-tech oriented funds, but to the particular characteristics of researchers. In general, these programmes **should be developed in a bottom-up manner by the Centres in close collaboration with existing successful vendors** of similar programmes, always rooted in the local-context. We propose the following adjustments:

- Segments dedicated to motivating and creating more entrepreneurial behaviour towards researchers becoming a start-up entrepreneur.
- Segments dedicated to improving the understanding of industry needs and "modus operandi", which is often a critical cultural barrier.
- Explain different channels of knowledge and technology transfer and accompanying processes.
- Deep-tech programmes should have sector specific tech support.
- Programmes should be short and compact to fit into the schedule of full-time researchers.
- Coaches and mentors could come from academia to be better accepted by young researchers.
- There should be hands-on practical work on the development of ideas, business models, investor decks and pitching.

Early stage investments are characterised by high market risk. When new knowledge and technologies are to be commercialised the overall risk is further increased. Although TT seed investments in Europe are on the radar of some investors, they often consider academic research as 'too new' or 'too high-risk' to transfer out of the research laboratory and receive finance by the traditional private investors. Bringing both sides closer together can reduce this gap:

- Providing riskier investments strategies with available sources of funding.
- Improving collaboration with already existing international sources of TT seed investments.
- Improving the investment readiness of knowledge and technologies coming from academia.
- Creating tailored investment vehicles (i.e Unirisco[131], formed in November 2000 as part of a University of Santiago de Compostela initiative, UNIRISCO Galicia is a venture capital group promoting the creation of companies making use of university knowledge. The fund was

created to fulfil the lack of funding and know how in business development for university spin-off).

While it is difficult to influence the investments strategies of private funds, it is recommended to steer the publicly financed national funds

Collaboration with Industry: Main Models & Relevance

The biggest challenge regarding academia-industry collaboration within the Bulgarian innovation ecosystem characterised by innovation silos is how to bridge gaps between industry and academia. Collaboration with private sector has different potential for the different centres. Some variables that can affect collaboration include the dynamics of industry in a specific sector, existing cooperation between centre partners and private sector entities as well as the existing industry-specific context.

Another characteristic is that collaboration in the case of CoCs may be slightly more intensive than for CoEs, as the latter are more applied.

Centres should address this complex challenge in stages:

Stage 1: Develop mindset, toolset and capacity and start interacting regularly

- Listen to the market. In a systematic way prospect out market needs and social trends that can fit in with the Centres' strategy and can inform the Centres' scientific and technological offer.
- Present best cases of academy-industry collaboration to motivate staff. Promote value chain partnerships if these do not already exist.
- Focus on industry sectors that absorb inventions and approach companies known for growth strategy based on innovation. Approach potential early adopters for feedback.
- Establish agreements with international agents and technology scouts within these industries to enhance the commercialisation performance.
- Build capacity of researchers on academia–industry interaction and contemporary business development methodologies. Current guidelines within both the Centres and the PROs on provisions of industry liaison are very brief, almost non-existent in some cases. The most effective way is to create a position of an Industrial Liaison Officer within the TTO of a Centre that will regularly meet with industry and match technological needs with Centre competencies, which may lead to new IP creation within the Centre arising from industrial collaboration. This practice is particularly widespread in healthcare and biotech sectors, where known positions such as Medical Science Liaison (MSL) Officer whose role is to build relationships with key opinion leaders and health care providers in the industry, national and regional societies and socially and politically important organisations, providing critical windows of insight into the market and competition. Industrial Liaison/ Medical Science Officers also provide the necessary skills required to negotiate contracts with industrial partners.
- Develop systematic and supported "networking" practices to identify potential partners. This includes the development of marketing activities that align with the TT strategy: for instance, organise regular technology update / technology foresight workshops with the

participation of centre researchers and invited Bulgarian and foreign investors and technical directors, as well as technology "demo-days".

Stage 2: Know the needs of the industry and build trust

- Collaboration should develop based on industry needs, identified though primary market research for every technology accepted for commercialisation, and trust.
- Identify and characterise the **centre-specific market** in terms of both: final users and clients. Also, analyse your research outcomes profile in terms of TRLs, type of results (know-how, IP etc.).
- The most reliable way to build and develop trust is through traction i.e., by successfully delivering a number of services to the industry. "Low hanging fruit" with existing industry contacts (regardless of potentially being small in value) will build traction and the Centres brand.
- Be flexible in finding simple solutions using all channels of knowledge and technology transfer, including education and training of company workforce, collaborative research or unpaid pilot projects, as mentioned in our meetings with industry.
- Develop TT and industrial collaboration strategies according to demand needs and future opportunities (contract research, joint labs, PoC projects, spin-offs).
- Liaise and establish structural cooperation with the relevant business cluster(s) and/or commercial/trade associations, and promote the creation of a cluster or of a value chain partnership if it does not already exist.
- Develop, along with industry, MSc and PhDs research projects based on specific future technology products or specific problem solving needs of industry.

Stage 3: Expand collaboration with support of policy interventions

- The TT mechanisms that are of high value for PROs are technology consultancies, contact research and extension services. However, there are high costs associated with industry-academia collaboration due to lack of trust.
- To bridge this gap, the government could develop policy interventions that reduce costs and thus risk for industry when collaborating with academia. The programmes should be developed bottom up, adjusted to the local context. The most effective types of interventions in the region proved to be "lightweight" innovation vouchers and collaborative grants scheme programmes (see cases from other countries above).

Template Agreements for Collaboration that could be useful to the Centres, after being adapted to the local and centre-specific context include:

- The Lambert Agreement. Developed with ASTP participation (openly published on gov.uk website). They seem to offer several models where consortium partner participate (and how IP is shared and used among partners).[132]
- Sample agreements for research and development cooperation, German Federal Ministry for Economic Affairs.[133]

[132] https://www.gov.uk/guidance/university-and-business-collaboration-agreements-lambert-toolkit

OTHER RECOMMENDATIONS

- **Creation of additional revenue streams from the use of IP** deploying all available angles and perspectives, e.g.:
    - Grant schemes that could finance fundamental research to be carried out on the research infrastructure and which could contribute to covering a portion of the fixed costs as well as a contribution to overhead. This is especially important for the Centres that plan to use their equipment mostly for scientific research.
    - Collaborative research projects with co-financing at the local, national or international level.
    - Commissioned research projects for other public or private sector organisations.
    - Development of proprietary IP for future commercialisation.
    - Valorisation of research results through:
        i. Further collaborative research with industry with shared IP.
        ii. Licensing IP to industrial partner or partners.
        iii. Creating spin-off or start-up companies with ring-fenced risk and high scalability and growth potential aiming at fast growing markets.
- **Creation of additional revenue streams from the use of the equipment.** Explore the opportunity to create additional revenue streams from leasing the equipment and highly qualified personnel to third parties for external R&D projects.
- **Future industry development**. Collaborate with the government on creating industry guidelines and best practices, and regulatory support.
- **Closer involvement of industry representatives** for those Centres that have not yet established industrial advisory councils. Finally, it would be beneficial to the short- to mid-term development of Centres to include industry representatives as equal partners to enable a more active role of the entities in promoting the understanding of the benefits of innovation within relevant industry sectors, assisting adoption and integration, and ensure the industry feedback on current solutions and future requirements.
- **PR and brand building.** Create a strong brand for the Centres built on trust, consistent engagement, agreed budgets and strong communication. During the meetings with clusters and industry representatives, it became clear that the brand value already associated with the Centres is rooted in the trust of SME representatives that the partner universities can provide satisfactory service in education and training of companies' workforce. Similar values should be built regarding high quality of research results, timely delivery, straightforward processes, and efficient knowledge and TT to the industrial partner. This can be done by engaging in technology and R&D consultancy, contact research and extension services on a wide scale. Furthermore, the creation of an additional legal entity may have, as one of its main roles, the provision of a common branding.

[133] https://www.bmwi.de/Redaktion/EN/Publikationen/sample-agreements-for-research-and-development-cooperation.html.

7. CENTRE SUSTAINABILITY

7.1 Requirements and Expectations

National Scope of Centres' Development and Relevant OP Programme SESG

The Centres of Excellence (CoEs) and Competence (CoCs) are expected to bring a new era in the Bulgarian basic and applied research scene, improving the potential towards international technological cooperation by creating modern research infrastructures and bringing together critical masses of excellent Bulgarian researchers around technology and scientific areas of national and European importance. The centres should also encourage market orientation of the research effort, primarily serving the technology transfer needs of the Bulgarian market but also aiming to offer competitive collaborative and contracted research partnership solutions at an international level.

The centres should assist with advancing the innovation entrepreneurship potential of Bulgarian researchers and young scientists and contributing to economic growth as well as attracting young talent to stay in companies created in Bulgaria with international technological appeal.

The centres are expected to complete a programme of investments and research activities within the 2014-2020 programming implementation period, i.e., by 2023, and become sustainable during the next 5-year period (2023-2028) by offering added value research and technology services, commercialising their research results incl. through licensing to existing corporates and the creation of spin-offs and start-ups, and generating usable intellectual property at the national and international levels.

Research Teams: Requirements and Expectations

Discussions with the research teams and document reviews highlighted several discrepancies between the Programme and national expectations with individual teams' expectations, as well as many common needs and requirements for the effective development of the CoCs and CoEs.

The major discrepancy is that not all the teams abide by, or have a common understanding of, the vision of a strong Centre with its own identity and a coherent structure, clearly differentiated from the original partner institution, university or laboratory. In addition, not all Centres have a realistic strategy, business, and action plan for implementing that vision. Instead, some teams are aligned towards an independent and strong centre but lack the analysis and the plan of how to achieve goals and focus mostly on the approved project procurement, research, and other complementary activities programme. Others are quite specific in promoting the autonomy of the individual laboratories participating in the projects, leaving little room for consolidating the network of research infrastructure and activities at the end of 2023.

The 10-year and multiannual financial plans presented in the proposal project documentation of all Centres do not serve as realistic strategies or business plans for centre sustainability. They present income sources (from market, patents, spinoffs, licenses, international collaborative research, consulting, etc.) **without having performed robust analysis** on internal capabilities, technology foresight – especially in emerging technologies such as Cleantech, Mechatronics, AI, Big Data etc. – competitors and market needs. Consequently, the centre sustainability analysis was not (or not sufficiently well, not thorough) done at the proposal stage. As of now, even in the implementation phase, centre partners have not yet elaborated their strategies and plans for future centre sustainability. This gap must be addressed now.

There is a lack of several core skills to achieve long-term sustainability within the CoC and CoE teams. At the moment, there is a focus on single discipline laboratories, Work Packages usually led by one partner with the participation of one or several others, and project management skills within most centres.

In order to achieve long-term success, and as mentioned in this report – see Chapter 3, a governing and strategic management body (Management Board) is needed. This body will not only define the scientific agenda with **multidisciplinarity and multi TRL approaches**, but also guide talent acquisition and development, as well as directing all aspects related to valorisation and technology transfer (market analysis, technology scouting, IPR, marketing, licensing, R&D services commercialisation, spin-off/startup creation, etc.).

In addition, as has been highlighted throughout this report, most centres currently show some gaps in administrative and legal skills, as well as, have difficulties in attracting young researchers and talents. This is an issue faced more widely by the Bulgarian Research Ecosystem, thus any initiatives, incentives and relevant measures should be taken at central government level and these weaknesses will have to be addressed when dealing with the organisational and performance issues of the centres if these are to become sustainable.

If the aim is to develop international-class, successful, and sustainable CoEs and CoCs the model has to take into account the key elements of best practice of leading scientific institutions. These include a clearly outlined vision and mission, a strategic plan, a business plan, leadership based on excellence, national accountability, and most important of all, nationally and internationally recognisable identity and capacity.

Centre-specific recommendations towards achieving sustainability are presented in the specific part of this report in detail. However, the **sustainability and success of leading scientific institutions are based on the following common pillars**:

- Mission: clearly aligned with relevant socio-economic context with the purpose of producing science to advance knowledge.
- Strategic scientific management: scientific leadership and management skills.
- Effective governance structure with external committees involved in the strategic development of the centre.
- Research agenda focused on the fulfilment of the mission and action programme to support the scientific strategy.
- Diversified funding sources: public baseline (linked to the development of the strategic plan), competitive (public or private programmes), and transfer returns (services, contracts, licenses, spin-off).
- Organisational design and operation in line with objectives.
- Assessment-scheme based on institutional assessment, Scientific Advisory Board Assessment and Research Impact Assessment.

7.2 Centre Development and Sustainability Best Practice

One of the main concerns of the scientific policy in the past decades has been to find ways to get better value from the work of the country's research organisations in favour of social and economic development. With this purpose, several countries have shifted their scientific policies from schemes essentially based on funding research centres to developing and consolidating research centre systems.

These policies are based on the following pillars:

- Clear definition of the characteristics of the Centres in terms of mission, governance, leadership, critical mass.
- Multi-year funding within the framework of a strategic plan and ex-post supervision.
- External institutional assessment processes with a double goal: to monitor the evolution of the Centres and their progress to their strategic goals and to serve as a tool to support continuous improvement, by providing information and recommendations to advance towards the fulfilment of its strategic plan.

Four good practices are highlighted below, which aim to provide achievable targets and development frames for the Bulgarian context. These practices may not all be directly or fully replicable and/or applicable to the situations of each individual centre, but they certainly offer useful insights from which the centres can choose the relevant points.

PROGRAMME CORES (NEW ZEALAND)

The Ministry of Tertiary Education of New Zealand set up a programme for supporting Centres of Research Excellence (CoREs) at the university system in 2001. The objective is to support high-performing researchers in the tertiary education sector, to concentrate resources, and collaborate to produce research that is:

- strategically focused and linked to New Zealand's future economic, environmental, and societal needs;
- of excellent quality;
- supporting high-quality, innovative research and research training environments, and;
- transferable, so that new knowledge is incorporated and applied in teaching programmes.

The main goal was to lift the research performance of New Zealand's universities by tackling weaknesses linked to a widely distributed university system in a small country. There was a clear need to **concentrate research efforts** and to improve linkages between tertiary providers, industry, other research users, and the wider community.

The programme was based primarily **on building networks to connect high-performing researchers in the university system and, hence, to create critical mass in chosen fie**lds of research. In a first funding round in 2002, five CoRES were selected. In 2020, the programme supports 12 CoRES[134].

Centres of Research Excellence (CoREs) are defined as **inter-institutional research networks**, with researchers working together on commonly agreed work programmes. Each CoRE is hosted by a university and comprises a **number of partner organisations which can include other universities as public research institutes**[135] [136].

[134] https://www.tec.govt.nz/funding/funding-and-performance/funding/fund-finder/centres-of-research-excellence/current-cores/
[135] Crown research institutes and wānanga.
[136] See also www.acore.ac.nz

The main characteristics of the CoRES are defined in a mission statement[137] that sets out the expectations in terms of research carried out, collaboration, engagement with end-users and stakeholders, roles at the tertiary education system and at a national and international level. In addition, to monitor CoRES' progress towards achieving the outcomes stated in their Outcomes Statements, a Performance Measurement Framework has been designed to collect standardised data at all centres[138].

The CoRES fund distributed around NZ$260 million in operating funding and NZ$50 million in capital funding between 2001/2 and 2011/12. This public fund initially funded each CoRE for a period of six years. There was a **mid-term review after three years, with funding for the remaining three years to be confirmed on the basis of a performance assessment**. Towards the end of the six-year period, a new expert panel was convened to assess new CoRE proposals and to determine if the seven existing CoREs would have their funding renewed for a second six-year period.

In 2013, an impact evaluation was carried on seven of the eight centres that have received funding since 2002 with the following key findings:

- The work of the CoREs has had wide-ranging impacts on New Zealand's society and economy: commercialisation of results, education, to public health initiatives, improved biosecurity, better management of New Zealand's natural environment, and social change (i.e. increase of interest in science among young people and have influenced national debates).
- Improvement in research performance: increase in the quantity and quality of research outputs in each CoRE, evidenced by improvements in bibliometric measures, and increase in collaboration between researchers, as evidenced by growth in co-authorship networks.

CERTH

The Centre for Research and Technology Hellas[139] in Thessaloniki is one of the 11 Applied Research Centres under the auspices of the General Secretariat of Research at Ministry of Development Greece. It was formerly under Ministry of Education and Science and moved to the Ministry of Development to underscore the relation with market and higher levels of TRL and differentiate from basic research institutes.

The Centre was based initially on a Chemical Research Engineering Institute, created next to Chemical Engineering department of Aristoteles University of Thessaloniki back in 1987, with a core team of high level researchers/professors that were invited to come back, as professors in Greece, primarily from US Universities and Research labs. The core team of five professors and five Phd researchers grew up to a 60 person research team in 10 years. In the beginning of 2000, the Institute was transformed, by attracting additional professors researchers and teams, into a multidisciplinary Research Center (one legal structure, ownership of equipment belong to CERTH) with five distinct institutes (not legal structures but with a very coherent management and operational structure). The operations-related units like HR, Finance, Contracting, Legal etc. function at central CERTH level, support all Institutes and report to the President and BoD where all Institute

[137] https://www.education.govt.nz/further-education/policies-and-strategies/centres-of-research-excellence-cores/mission-statement-for-the-centres-of-research-excellence-cores/
[138] https://www.tec.govt.nz/funding/funding-and-performance/funding/fund-finder/centres-of-research-excellence/performance-measurement-framework/
[139] www.certh.gr

Directors participate. The Center includes the original one on Chemical Processes and RES, on ICT (incl. AI, IOT, BD), Transport and Telematics, Bioagro, Health Biotech. The Center today employs approx. 1.000 researchers, out of whom only 70 are permanent staff and the rest are contracted researchers paid by projects. The contracted researchers receive pay at competitive (and equivalent to private sector) levels while extra bonuses are paid for bringing in contracted research projects. *In principle, researchers are compensated better than their peers at university laboratories mainly due to the fact that the income of CERTH is not coming from the State budget (see below).*

Governance and Management

The President of CERTH is elected following an international competition, based on scientific /applied research and industry experience excellence and leadership skills (open to non-Greeks). The Board of Directors (BoD) is comprised out of the Directors of Institutes and other government and economic stakeholders. The Directors of Institutes are also selected by competition and not necessarily among CERTH staff.

Sources of income

Incomes are based only by 10 per cent from the state budget and the rest is shared among competitive research (Horizon, Bilateral country research programs), contracted research with multinationals and SMEs, and incomes from spinoffs, technology services to industry. Annually, it has a turnover of €50 million and ranks no 13 in the Horizon top 20 list of Research institutes. The sustainability path started form an 80/20 state-competitive EU research budget in 1990, reached 50-50 state vs. contracted and competitive R&D in 2000 and the last 10 years is 85-90 per cent independent of state budget (which pays the permanent researchers only).

Relation with the Universities

Other University professors can work with the Institutes in their scientific sector on project basis (they could lead proposals based on research infrastructure of CERTH combining with the University infrastructure) and there is a great osmosis between Aristoteles University STEM and Engineering Schools and CERTH Institutes. The balance between University and CERTH in the TRL scale, in the relation with Industry, towards competitive calls took several years and effort but finally it has been achieved (with dynamics of course).

THE ARGO SYSTEM (TRIESTE, ITALY)

An open innovation system based on Research and Innovation to enhance economic growth and development.

In early 2018 Area Science Park, a National Public Research Body operated by the Italian Ministry for Education, Universities and Research was tasked with developing and testing a new and innovative model for economic development to be piloted in the Autonomous Region of Friuli Venezia Giulia and then rolled out on a national scale. The programme, which comprises the development of four main pillars, each with its own challenges, complexities and opportunities, was authorised by an agreement between two national ministries (the Ministry for Education, Universities and Research and the Ministry for Economic Development) and the Regional Government of Friuli Venezia Giulia with an initial budget of 8 million euros. The four pillars of the ARGO System address four separate but interdependent elements of the Innovation Ecosystem:

- Innovative industrial settlements based on a circular economy model to attract direct investment to revitalise an area ripe for industrial redevelopment.

- Process Innovation – a programme dedicated to assisting companies with the digitalisation of their industrial processes to better equip them to be competitive in the digital age.

- New Business Creation – a programme to enhance the creation and internationalisation of startup and spin-off companies

- Technology Platforms and Open Labs – a programme to invest in Scientific and Technological research infrastructure to be made available to a plurality of sectors, both public and private for basic and applied research

The Argo System seeks to optimize previous investments, drive process innovation and industrial development through, research activity and advanced training and the attraction of talent, companies and capital.

Governance model and activities

The first challenge was to set up an appropriate governance model at the high level and then to design appropriate partnerships and governance models for each of the pillars. After an assessment of the public and private partners that needed to be involved in each pillar it was clear that a one-size-fits all approach would not work so a hub and spoke approach was used.

At the high level a governing body was formed with representatives of the funding ministries, the regional government. This Strategic Board determines the Argo System Strategy and approves the individual pillars' plans and budgets. Each pillar then has its own governance that reflects the key stakeholders, both public and private, involved in that pillar. This flexible approach has enabled different methodologies to be adopted for the different pillars, reflecting the degree to which the activity is driven by a public sector mission or considerations that are more commercial.

- In the case of the innovative industrial settlements pillar agreements were entered into between Area Science Park and the Port Authority (public-public) and between Area Science Park and key stakeholders in the area to be developed (public-private) and then new companies were targeted to be assisted through the process of industrial settlement by a "One Stop Shop". Five Partners were involved and the first industrial settlement of an international company has taken place.

- In the case of Process Innovation a hub and spoke model was used with four territorial nodes set up, each with its own specialisation, infrastructure, personnel, and business plan but each connected and interacting with the other nodes. Each node has a separate consortium agreement but following a standardised model and each is subject to the Steering Committee, which authorises all operational plans and budgets.

- The Generation of new businesses is an activity which was already ongoing in a number of actors so the decision was taken to avoid duplication of the incubation activities and instead to focus on the standardisation of startup incubation methodologies, the provision of an internationally qualified think tank and specific programmes to assist startups with participation in international events. The most appropriate vehicle for this activity under Italian legislation was determined to be a Foundation, which is currently in the process of being established. This legal form will allow the participation of both public and private sector actors in a non-profit activity with a variety of sources of funding.

- Finally, for the fourth pillar, the Technology Platforms and Open Labs, investments have been made in research infrastructure, for instance and Next Generation Gene Sequencing

Platform and collaboration agreements entered into with public research organisations, research hospitals and private companies for collaborative research projects and for the provision of services.

In each of the four pillars specific partnership agreements have been entered into with stakeholders but all are under the umbrella agreement of the ARGO System and therefore under the supervisory control of the two ministries and the regional government.

The ARGO System has already generated interesting results and will continue to grow, but it will also continue to require some stable institutional funding to fulfil its mission. The objective was never for the ARGO System to be economically self-sufficient at the point of use, but rather for the system to contribute to the economic development of the territory to an extent that is greater than the cost of the public sector support the system continues to receive. Initial results suggest that the system is already yielding positive results and that the public sector investment is leveraging matching funding from other actors in the innovation ecosystem. Further details on the ARGO System, the specific governance structures and the formats of the various partnerships (public/public, public/private) can be supplied but some documentation is currently only available in Italian.

PROGRAMME CERCA

Programme CERCA[140], launched in 2000, is a redefinition of the existing Catalonian Government policy to support public research centres. At the time, those centres showed common weaknesses with an impact in their research performance, including: **excessive bureaucracy, complex governance with many numerous committees involved in the decision-making process, limitations for hiring researchers**, lack of necessary skills, among others[141].

The new policy was based on defining and providing support to a new model of centres with outstanding capacities for excellent research, built on critical mass, and successful researchers leading these institutions.

The characteristics that define the CERCA centre model are the following[142]:

- The centres are independent bodies with their own legal identity (foundation or consortium)[143] in which the Government of Catalonia has a holding.[144] Their main purpose is to carry out top-level scientific research. Centres have to be established by the Public Administration together, if applicable, with one or more Universities and Public Research Organisations or private institutions[145]. Partnership members, such as universities,

[140] https://cerca.cat/
[141] Rovira, LL. (2016) CERCA Centres: The awakening of Catalan Research. CONTRIB SCI 12(1):1-3 (2016) doi:10.2436/20.7010.01.237
[142] https://cerca.cat/en/general-characteristics/
[143] According to their Resolution, CERCA centres can be both foundation or consortium. There is a list of centres indicating the regime: foundation or consortium. In this sense, the establishment of the CERCA Centres was not just launching a programm for support, but included legal reforms to allow the creation of independent Centres. Chapter IV of 2011 law established the legal regime to become CERCA centers. https://cerca.cat/en/applicable-law/
[144] Thus, CERCA are new joint institutions formed by the Government of Catalonia and public or private research institutions.
[145] A complete legal framework has been developed to enable this model.

participate at the board of trustees. Collaboration in other activities - doctoral programs, research activities, access to university facilities or services, among others, is regulated in agreements[146].

- The management model is totally flexible and self-monitored, based on multi-year activity programmes within the framework of a strategic plan and ex-post supervision that respects the autonomy of each centre.
- Effective and hierarchical governance, based on a management team with broad powers devolved to it from the centre's governing body, to which it reports.
- Research staff selected to ensure an international impact, divided into research groups headed by internationally renowned scientists from different fields, with a high turnover of post-doctoral researchers.
- The centres' shared mission is to develop frontier research intended to have a major scientific and economic impact and to improve the wellbeing of societies and individuals.
- The Government of Catalonia provides significant and stable structural (not to be confused to EU structural funds) funding through programme contracts. It also applies a policy of attracting highly qualified scientific talent, in accordance with the specific features of each field and the recruitment strategies chosen by each centre.
- As an essential feature of the system, the centres receive regular advice and assessment from a top-level international scientific committee. This committee ensures practices and criteria are implemented in accordance with international standards of excellence in research.

In 2020, CERCA is formed by 39 research centres[147] funded in part by the Directorate General for Research, which allocates a budget programme to their structural expenses. These contributions represent the 25 per cent of the centres' budget.[148] The remaining income originates from competitive projects (whether Spanish or EU), private contracts and agreements or philanthropy.

To coordinate, support, and promote this scientific system, in 2010 the institution I-CERCA was created. Its activity involves evaluation, selection of directors, merging CERCA centres, national and international promotion, technology transfer benchmarking. To do so, the agency manages other programmes addressed to CERCA centres: GINJOL – technology transfer-, SUMA -centres merging- WOMEN IN SCIENCE, SCIENCE AND SOCIETY.

GINJOL I-CERCA[149] is a **patents fund** that finance, on a return based model, the services needed to protect, exploit and market the results of research generated by the research projects submitted in the time period established for each funding round. Expenses include advisory services relating to: intellectual and industrial property, technological suitability and market potential assessment. The GINJOL Patents Fund is entitled to a share of the revenues obtained from exploiting the results of the project. I-CERCA will not assume any ownership rights over said results.

[146] See for instance agreements hold by ICIQ: http://www.iciq.org/wp-content/uploads/2017/11/Document-21-Convenis-de-col per centC2 per centB7laboracio-institucional.pdf
[147] https://cerca.cat/en/cerca-centres/
[148] If a centre gets the CERCA label, it can receive funding. On top of that, centres can apply to national competitive programmes.
[149] https://cerca.cat/en/ginjol/

The success of Programme CERCA is significant[150]. As a result:

- Catalonia has doubled its scientific production share to the world in the last 15 years.
- There has been a 5-fold increase in the world share of Highly Cited Papers (HCPs).
- 120 ERC grants have been obtained, in the following categories: Starting, Consolidator, Advanced, Prove of Concept and Synergy.
- 65 per cent centres are coordinating H2020 projects.

The scientific policy regarding CERCA centres in Catalonia has been developed under a framework of political consensus and institutional collaboration, especially with universities[151] and hospitals, seeking win-win synergies for the country.

Institutional Capacity Improvement – examples

Associations of CoEs and CoCs could be used for capacity improvement, working for quality improvement of services and products, promotion, support for international relations, administrative and legal advice and support for initiatives improving the Centres' environment. Some examples are:

- SOMMA[152] the alliance of Severo Ochoa Centres and María de Maeztu Units to promote Spanish Excellence in research and to enhance its social impact at national and international levels;
- BIST[153], a Catalonian CoEs partnership to build new scientific collaborations among these centres or
- CRCA[154] in Australia.

Although the CoCs and CoEs Program is in an initial phase in Bulgaria, to promote this kind of networks can help the Centres to learn from others' experience and to accelerate their establishment. Institutional conditions could differ in most respects from typical project funding, cooperation among CoEs and CoCs will have a positive impact on institutional capacity building.

7.3 Recommendations

Development of a Sustainability Plan

We have looked into the individual situations of all centres and made some concrete suggestions or analysis where relevant. One important element that we noticed is that the plans for revenues of a large part of the Centres are not sufficiently substantiated which could lead to doubts about how realistic they are. Another factor is that, if the same organisational structures are preserved after 2023, the costs for management, equipment maintenance and upgrade as well as independent research are highly likely to continue at a similar level, risking a halt or slowdown in their effective operations post 2023 unless measures are taken to prevent this. Also, we must recognise that during the meetings Centres expressed their hopes for availability of more operational funding in the new EU Programming Period starting from 2021 - 2027.

[150] 2016
[151] The relationship between a centre and its founding members is regulated under agreements.
[152] https://www.somma.es/
[153] https://bist.eu/about-us/
[154] https://crca.asn.au/

Centres must develop a Business Plan for the 3-5 year post-implementation period and a vision and strategy for the 10 years following implementation. The business plan should:

- Identify the opportunities of the market, national and international business partners, and national and international R&D support programmes;
- identify international collaborators for R&D and technology development;
- detail the organisational and governance reporting structures;
- analyse the mix of income sources and their evolution whilst the centre matures;
- present a detailed roadmap towards institutional, scientific, and financial sustainability.

Concerning the various aspects that have to be taken into account when creating the business plan, please refer to Chapter 3 of this report and more specifically - the part on recommendations.

Optimise Public Intervention

As the cases of CERCA and CoRES Programmes show, the role of the government is not only to provide centres with funding but to create conditions for developing a research centres system that can serve as a means of enhancing economic performance. This can be done by:

- Defining the main characteristics of these centres in terms of research orientation, governance, collaborative activity;
- Providing continued funding of operations for a medium-term period (6 years in the case of NZ) together with go/non-go mid-period and final review;
- Establishing in a clear way what are the outcomes and impact that the centres are expected to achieve (by means of performance measurement frameworks);
- Establishing other complementary mechanisms to support and accelerate centres to perform their role. This includes for instance technology transfer programs and schemes for the development of career for researchers. These mechanisms should be tailored according to the CoEs and CoCs main weaknesses[155].

Map out Innovation Potential: Online database of resources and services

Although we already touched upon this in the previous chapters, it is essential to affirm this recommendation again here. To increase collaboration and long-term sustainability, Centres should map their innovation potential (expertise, facilities, services, and research outputs) and promote these to the private sector through modern on-line searchable databases. There should be a clear single point of contact for communications regarding their use. This can be a two-step process: *Phase I* shall be a self- developed and promoted database; *Phase II* would be to be incorporated in a national RI portal.

[155] Galicia (Spain) has recently set out a Centres of Research Excellence Programme. As in the case of the CERCA Programme Centres are expected to adopt a governance and management model that helps to achieve the strategic outcomes. One of the complementary measures has been to develop a tailored Training Programme on strategy and operations management for research units and centres of excellence; up until now only Centre's staff can attend this course (scientific and executive directors, and management staff). https://gesci.es/en/

Establish and Update Key Performance Indicators

The use of a Performance Measurement Framework[156] will be a useful tool to monitor how CoEs and CoCs are progressing towards achieving the outcomes and impacts stated at their strategic and operational plans. It also informs any future optimisation of activities to support centre sustainability.

Assessment criteria have to be defined according the programme goals. For instance, in the case of the CoRES, assessment criteria refers to strategic outcomes, knowledge exchange, public engagement, research excellence, research commercialisation, research output, collaboration, human capital development, research capability and management.

In addition, the implementation of a periodic external assessment is a common mechanism in the world's most advanced and renowned systems[157] [158]. Based on conclusions of self-assessment report analysis and information gathered during visits to the centres, external experts will provide recommendations that are of great value for improving centre progress and sustainability.

[156] See for instance the case of UK https://www.ref.ac.uk/ or the COREs program https://www.tec.govt.nz/funding/funding-and-performance/funding/fund-finder/centres-of-research-excellence/performance-measurement-framework/

[157] See for instance the Max Planck Society Evaluation procedures at https://www.mpg.de/13937966/evaluation-2019.pdf

[158] https://cerca.cat/wp-content/uploads/2015/01/CERCA-Assessment_executive-summary.pdf

8. ROADMAP FOR LONG-TERM SUPPORT

To support the Centres long-term, it is important to develop effective and efficient processes for utilising the operational and infrastructural investments already in place, and those available in the future. These include IP policy development, IPR commercialisation process support, correct application of EU State Aid rules, processes for engagement and negotiations with industry, EU research initiatives and networks, regional funding schemes, and access to the expertise.

8.1 National Context

Enhanced policy and resource allocation mechanisms would help foster the innovation environment in Bulgaria. Below are some proposed actions to consider.

Develop Approaches to Measure and Increase Innovation Impact

Currently, there are two dominant approaches.

- Data/output driven (number of publications, tracking patents, invention disclosures for possible IP, number of licensing agreements, patent applications and others).
- Outcome/impact driven, including assessment of the exposure of scientists by innovation and entrepreneurial skills, creation of new solutions and products to improve society, life and economy; and generally improving the quality of the science and research.

Increased Focus on Young Scientists

More emphasis on training and attracting younger generation of scientists through different policy interventions are needed. The creation of attractive conditions for professional engagement, growth, and retention of scientists is necessary. One clear example is through more competitive salaries and benefits. In addition, it should be considered how to bring Bulgarian diaspora researchers back to the country to share their international experience and knowledge.

Targeted and Flexible Policies to Foster Academic Engagement in Innovation

Traditional technology transfer structures (TTOs, liaison offices) are limited in their ability to foster academic engagement. From a policy perspective, it is important to recognise that different transfer or collaboration mechanisms may require different support structures and incentive mechanisms. According to existing research[159], individual discretion seems the main determinant of academic engagement with industry. Hence, policy measures should address individuals, in addition to influencing university practices and structures. For instance, fostering individual-level engagement skills would appear to be a potentially powerful lever, not only for increasing the volume of university–industry relations but also their quality. In this respect, policy should not implicitly assume that 'more is better' but seek to differentiate the conditions under which engagement generates both academic and industrial benefits, minimise the risk of failure.

[159] Perkmann et al, Academic engagement and commercialization.

Increasing collaboration between different CoEs and CoCs: Critical Mass creation

Overlaps between Centres should be eliminated through a serious analysis of the roles of each institution to eliminate duplication, identify synergies and propose areas of collaboration to optimise resource allocation, performance and productivity of the whole system. In previous chapters of this report it has already been suggested **to "cluster" or to group the Centres according to their fields of activity** (as per the Smart Specialisation sectors for Bulgaria). The grouping/clustering could be based on thematic fields (e.g. Big Data/ICT/High Perm. Comp/Digitalisation).

Inter-centre collaboration opportunities should be further explored and developed including the provision of services to other Centres.

Linking of several Centres with the same TTO mechanism could contribute to creating the necessary critical mass of activities in an ecosystem that that not have sufficient public funding for research and innovation.

8.2 Operational Considerations

Business Plans (Strategy and Operationalisation Plans)

Once the Centres are fully operational, there is the need to develop more comprehensive Business Plans or Operationalisation Plans for the Implementation Period and beyond, which must include a vision and strategy. The business plan should analyse the opportunities of the market. Working with national and international business partners, national and international R&D support programmes; identify international collaborators for R&D and technology development; detail the organisational and governance and reporting structures; analyse the mix of income sources and their evolution; and present a detailed roadmap towards institutional, scientific, and financial sustainability. The business plan should specifically analyse the societal and market needs and create an important revenue line from dissemination / contract research / test bed / demo work packages of also other EU Research and Technology development Institutions and programmes (e.g. HORIZON).

International Partnerships

Similarly, Centres would benefit from defining long-term relationships with international partners and with EU programmes. These will define the technology position of the Centres in the EU value chain, as well as prepare the ground for future partnerships for competitive R&D programmes and for contracted research and demonstration projects.

8.3 Technology Transfer and Commercialisation

TT ecosystem and internationalisation

Use the existing knowledge and collaborate with active TTOs e.g. TTO of the University of Plovdiv; TTO of the University of Sofia; JIC, TTO of the University of National and World Economy, as well as the R&D Centre of the TU-Sofia. Identify the potential collaboration between all relevant stakeholders (researchers, Centre, partner institutions, TTOs, Sofia Tech Park, GIS-Transfer Centre

Foundation, Bulgarian TT Network (BgTTN) within the TT ecosystem. GIS-Transfer Centre Foundation could play a significant role in capacity building.

Beyond that, the Centres should seek active participation in European and International Networks and TT fora, to explore possibilities for internationalising their technology transfer activities.

Internationalisation is also important for the formation of strategic partnerships that can help the Centers commercialise their novel intellectual property abroad and build best practices in the technology transfer process. It is therefore recommended that the Centers or at least some of the Centers enrol[160] in international networks such as **EnoLL**[161] (European Network of Living Labs) and **AUTM**[162] (Association of University Technology Managers), **ASTP-Proton**[163], the **European TTO Circle**[164] and **EARTO**[165] (European Association of Research and Technology Organisations).

"SOFT" SKILLS

Seek synergies with existing incubators and accelerators in co-creating custom support programmes intended for specific target group of researchers where they would acquire a contemporary toolset and skillset needed for successful spin-off development.

More importantly, there should also be possibilities for Centres-focused training and capacity building programmes that not only raise awareness about technology transfer but also train the researchers on all aspects of it. This includes how to identify inventions with market potential. How to protect or defend it, how to create a Proof of Concept or Proof of Market and how to negotiate licensing or investment agreements.

Part of the internationalisation process includes the participation of the Centres in international networks with the goal to enrich their knowledge, improve practices and increase the possibility of peer learning. It is recommended that some of the Centres therefore consider joining the **ETF Network for Excellence**, an EU action, whose goal is to provide a platform for continuous exchange of practice for skills creation among the network members at national or international level.[166]

FINANCIAL ECOSYSTEM

Use the financial support available from: 1) Planned (status Q1 2020) TT Fund early stage pillar/sub-fund (which has up to €5 million for early stage projects), 2) Sofia Tech Park for very early stage technology start-ups, 3) from national Innovation Fund for Proof of Concept and development of prototypes. 4) VCs that act locally or regionally such as Neveq Ventures. Establish relationships with regionally recognised private venture funds and accelerators active within the Centre's focus area. Centres can strategically seek collaboration with existing international sources of TT investments such as EIT Communities' Venture Programmes or the European Innovation Council's Accelarator programme. These programmes are intended for the support of deep tech innovation and business ideas covering the range of sectors in which the 14 Bulgarian Centres

[160] Including enrolment/participation through their founding partner organisations
[161] https://enoll.org/
[162] https://autm.net/
[163] https://www.astp4kt.eu/
[164] https://ec.europa.eu/jrc/communities/en/community/tto-circle-community
[165] https://www.earto.eu/
[166] https://www.etf.europa.eu/en/projects-activities/projects/network-excellence

operate. Programmes are run by EIT Climate-KIC, EIT Digital, EIT Health, EIT InnoEnergy, EIT Manufacturing and EIT Urban Mobility.

Community Support

Stimulate networking with innovators community to allow non-researchers to be hired into spin-offs as business managers or commercial directors.

CoC/CoE Focused Support Ecosystem

Create clusters of associated partners, industrial partners who can help develop mentoring programmes within specific sector and/or offer secondments and partnership programmes for PhDs and researchers to collaborate on value proposition, business modelling and planning.

Whilst it is difficult to influence the investments strategies of private funds, it is recommended to steer the publicly financed national funds:

- Sofia Tech Park, including its Groworking Space, was created in the public interest. As such, accepting the early research from PROs and offering small early stage investments (with its own resources) to spin-off should not be a great challenge for these organisations. What is required is to allow also non-equity-based financing, such as grants, matching grants or other financial instruments through these vehicles (which can possibly act in this way as an intermediary for instance for small PoC grants).
- The proposed FoF Tech Transfer fund 'Early stage' sub-fund could be also suitable, provided the procedure for selection of capable fund managers is completed. Alternatively, there are other vehicles available for early stage financing, including international corporate venture funds. It is important to note that little financing is needed to license a novel technology and therefore, the Centres should try to focus on licensing activities whenever possible.
- It should be carefully considered that the Centres are encouraged to allocate a small amount of funding for PoC activity, whether per Centre or per cluster of thematic Centres. Further support regarding the structuring of such PoC facility can be provided to the Centres. It should be importantly noted that some Centres have already, as part of their funding for TT, the possibility to create such internal PoC schemes utilising the funding under the CoC/CoE projects (it has to be spent until 2023 at the latest).

8.4 Further Considerations

Evaluations of similar programmes in the Balkans region showed that progress in the performance of research and innovation ecosystem is only visible in the long run. The main reason for that is the huge cultural gap between the academia and industry, but also between academic partners. The Centres have the potential to act as boundary spanners, provided that there is enough time to develop trust among the actors.

During the joint meetings with and visits of the Centres and their partners in Bulgaria, it was expressed by representatives of DG REGIO, that in the next programming period the ratio of 75 per cent to 25 per cent for infrastructure and operations respectively may change in favour of operations. This means that it will be essential that the Centres have built operationally sound systems for all their RDI activities, including research collaborations and engagements with industry. As the Centres do not operate in an isolation, the Bulgarian government should continue

its efforts to integrate the various programmes supporting research and innovation in a coherent system.

In addition, it is recommended that the next relevant national Operational Programmes in the period 2021-2027[167] should extend the support for the Centres including the following:

Investments in Capacity Building

Capacity building resources are needed to continue to develop and implement effective processes and enhance a growing innovation ecosystem. Bulgaria must continue to invest financial, human, and technological resources at the national and local levels to sustain priority area activities.

Business Development and Management

Skills in business management are necessary for the long-term sustainability of all Centres and the expansion of innovation processes in Bulgaria. A range of soft and hard skills must be developed and sustained beyond this programming period, including business development, targeted and local networking, marketing and public relations, fundraising and early stage investment management, financial management, strategic international networking to strengthen links with big technology buyers and private sector seed/VC.

Doctoral training programmes in other countries have bene known to strengthen skills and success in commercialising research as well as creating stronger academia-industry collaboration.

Academia–industry interaction as a concept

The Institutes of the Bulgarian Academy of Sciences (BAS), universities and Higher Education Institutions (HEIs) are an integral part of the skills and innovation supply chain to business. However, this supply chain is not a simple linear supplier-purchaser transaction; it is not the acquisition of a single product or service. This supply chain is multi-dimensional, it has to be sustainable, and it has to have quality, strength and resilience. These attributes can only be secured through close collaboration, partnership and understanding between business and universities.

Public research organisations play a major role in innovation, which is not limited to the commercialisation of their research. They also contribute through their role as innovation facilitators, skills providers, innovation investors, knowledge providers, attractors of inward investment in high value-added industries, by participating in science parks, and as civic leaders in their community and economic pillars in regional economies.

To achieve world leadership in academia-business collaboration, all domains in the landscape should strive for research excellence; the strength of the supply chain is defined by its weakest link. Effective joined-up policy in this field, therefore, has to be informed by knowledge of the entire landscape. National policy has to be balanced to ensure that the economic benefits derived from

[167] Decision of Council of Ministers No 495 was adopted on 21 July 2020. The name of the future Operational Programme for Science and Education for the programming period 2021-2027 (OPSE) is changed to Programme for Education 2021-2027. The scope of the programme is changed respectively, so the scientific infrastructure and research funded under ERDF is taken out in a separate programme. A distinction/demarcation must be made between ERDF and ESF+ financing and this should be taken into account as it is related to the recommendations for the next programming period concerning trainings.

investment in one domain are not diluted by underperformance in others. That is both the present and the future policy challenge.

Funding for "Effective Collaboration" projects in practice

Some representatives of the Centres expressed that the research organisations in Bulgaria lack own resources to engage in projects with industry. One example is projects under the Innovation Fund where they have to co-finance up to 30 per cent and do not appear to sufficiently benefit from the research results. From this perspective, it would make sense for the **next operational programme to design programmes for funding joint activities of the type "effective collaboration"** within the meaning of EU State Aid rules between the Centres/their partners (which qualify as research and knowledge dissemination organisations) on the one side and industry – on the other. Effective collaboration is a non-economic activity and provides good basis and opportunities for the research organisations to preserve part of the research results / IPR created, which in turn would help for the future sustainability of the Centres. Public funding for collaborative research activities would cover part of the operational costs incurred by research organisations. At the same time, SMEs could also be incentivised to participate. It is therefore strongly recommended to build internal capacities and skills to properly negotiate "effective collaboration" activities with industry and start engaging in more such activities already from now.

Strategic development of IP and portfolio management

The Centres will benefit from **national fund for patent activities or competition based funding dedicated to patent expenses.**

There can also be Provision of financing for limited number of DEMO projects selected upon proven interaction with industry.

Other venues for IPR advise should also be explored via the European Commission support mechanisms such as the IPR Helpdesk and also the guidelines provided by the Competence Centre on Technology Transfer at JRC[168].

The Bulgarian Patent Office, WIPO and EPO as well as EU IPO are all relevant stakeholders who also provide free of charge materials to improve patentability and IP portfolio management. These resources should be explored and best practices applied in the Centres' operations.

International research and commercialisation

Skills and resources to enhance strategy development, including:

- International collaboration on fundamental research which could receive independent funding.
- International education and training opportunities.
- International expertise that could be attracted to the Centres to enhance their offering.
- Staff exchanges where staff is seconded on a 3-5 months exchange missions to PROs in more advanced research and innovation ecosystems.
- International clients that could be interested in accessing the services of the Centres at market rates.

[168] https://ec.europa.eu/knowledge4policy/technology-transfer/about_en

Innovation Networks

Established to foster better collaboration between science, creativity and business, ideally, they would have specialist teams covering all sectors of the economy that are identified as priority innovation areas. These networks can also help businesses secure funding to drive innovation.

International independent advisory, monitoring, and audit bodies

In connection with external partners in other EU countries and globally, setting up international advisory bodies per sector could help design a step-by step evolution towards a longer-term Institutional arrangement allowing for a longer-term sustainability. These independent bodies could also help monitor and audit the Centres long-term for improved performance and continued evolution.

9. CENTRE-SPECIFIC ANALYSES

Each centre-specific case analysis in the following part of the report should be read in conjunction with the chapters in the first (general) part of the report contained in Chapters 1 - 8.

Although the authors and the editing team has made an effort to synchronise as much as possible the two parts of report, there may be individual, outstanding aspects, which are either very specific for a certain Centre or have to be judged on a case-by-case basis taking into account the particular circumstances.

Materials and Sources: For the preparation of the centre-specific part of the report, the following information was available to the authors and editors (used as a basis for the analyses):

- Full Project Documentation (shared by the Managing Authority)
    - Proposal, Justification, Partnership agreements, IPRs policies, Rules, Access to infrastructure and other relevant agreements
    - Financial plans, costs and expenditures
    - Plan for relations with business and plans for commercialization
- Presentations from September and November 2019 and from February 2020
- Responses to a Questionnaire
- Records from reports from personal meetings and visits: September and November 2019 and February 2020
- Any other relevant information contained in national public registries, national and EU legislation
- Any other official documents and sources that have been considered necessary or useful, duly referenced.

Structure and Contents: The structure of each of the 14 centre-specific analysis (or case studies) follows broadly the same or similar pattern, namely:

- ✓ Summary of the Centre, partner organisations and current status
- ✓ Review of Centre's responses to the questionnaire
- ✓ Long-term vision of the Centre
- ✓ Legal framework
- ✓ Organisational and governance framework
- ✓ Research Infrastructure
- ✓ State Aid rules explanation
- ✓ Technology Transfer and commercialisation
- ✓ Sustainability of the Centre and its future operations
- ✓ Roadmap for long-term support

9.1 Centre of Excellence "Heritage BG"

Summary of Centre

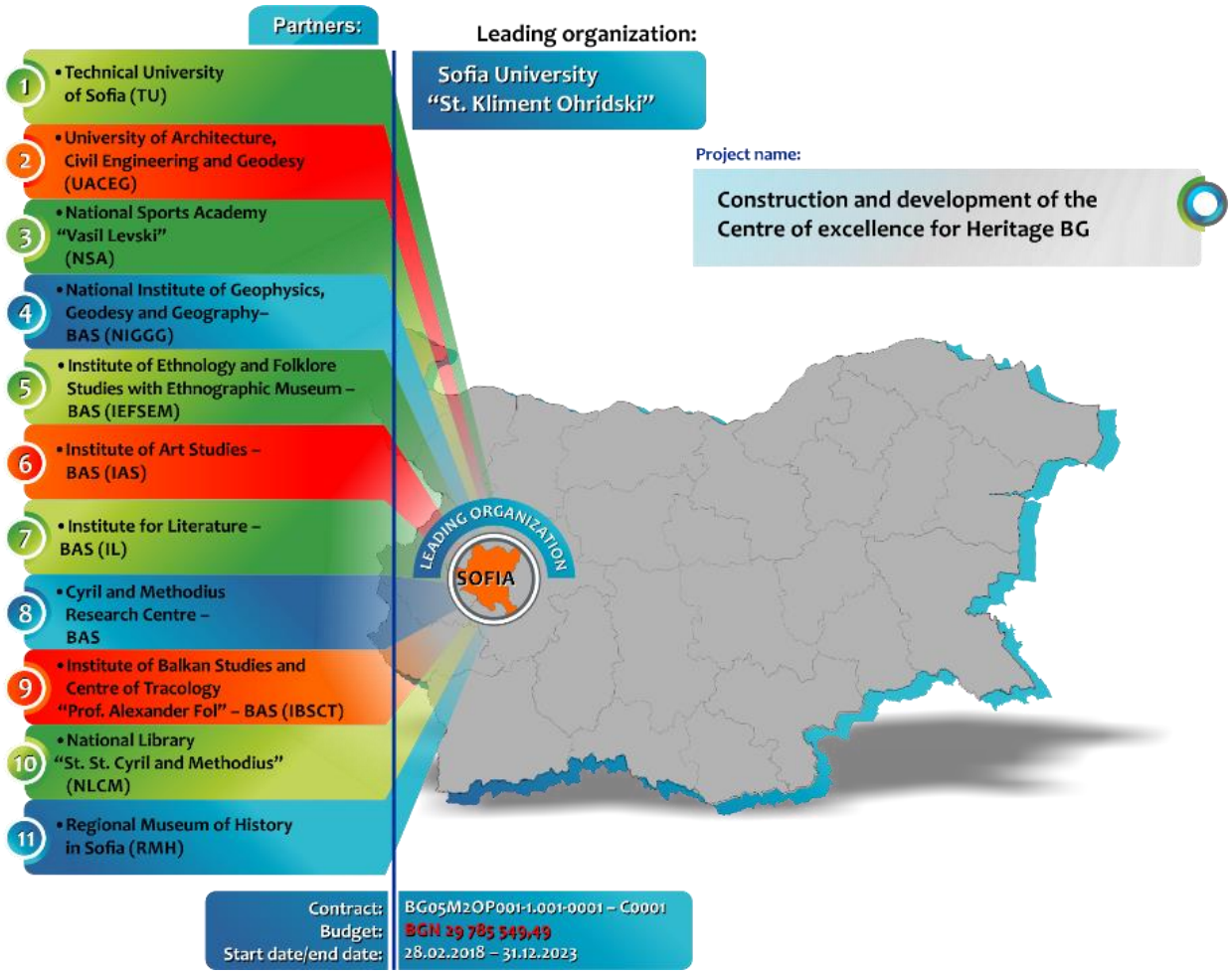
Identification number: BG05M2OP001-1.001-0001

Centre name: "Heritage BG" Centre of Excellence

Budget of the project: 29.3M BGN allocated; verified expenditure 0.3M BGN (as of Q4 2019) with further 11.4M spending planned in 2020

Lead organisation: Sofia University "St. Kliment Ohridski"

Start date/end date: 28.02.2018 – 31.12.2023



Main objective/Specific objectives:

Improvement of the research environment of leading science organisations in Bulgaria as well as improving the capacity to achieve the excellence in new technologies in creative and recreational industries, enhancing the innovation capacity through market orientation of research.

1. Construction, equipment and development of a new distributed research infrastructure within the creative and recreational industries.
2. Development of a CoE to perform independent fundamental research, industrial research, experimental development and a large-scale dissemination of the results of these activities through the development of new products and services, teaching, publications and knowledge transfer.
3. Inclusion of the CoE in the European area of science and innovation in the field of cultural heritage, culture and creative industries, and cultural tourism through mutual exchange and collaboration between partners of different backgrounds.

CURRENT STATUS OF CENTRE

Analysis of questionnaire

The uniform questionnaire, that was sent to all Centres included in this study to collect Centre specific data, was answered by four representatives coming from different partner institutions, and the answers are similar, or often - the same. The outstanding specifics are:

- Heritage BG is a project of a large and heterogeneous consortia which unites social and natural sciences. It is composed of universities, institutes of the Academy of Sciences and also an entity that belongs to the Sofia municipality, which all operate under different laws and regulations. Among numerous associated partners there are 9 tourism associations and several publishing companies.
- The 12 partners together established an independent legal entity in the form of a not-for-profit organisation/association in public interest. We note however that in the Trade Registry it is incorporated as an association in private interest – „*Определено за извършване на дейност в частна полза – Да*“, which is also the more flexible option.
- According to the survey The Centre of Excellence is managed by the “Board of directors”. There are no other details, only a disclaimer that the “CoE is being built in accordance with the terms of the Operational Programme”. The two bodies mentioned are the “Management team” and “Control board”.
- It is envisaged that the Centre will have one leader, who will be largely independent in its management, operation, collaborations with industry and international R&D&I projects preferably through a separate legal entity and who should report on outputs annually to the Individual Partners.
- Equipment and research infrastructure are owned by the individual partners but according to the survey they should be owned by the Centre.
- There is no answer about different profiles and FTE currently employed in the CoE. In the future the CoE imagines having a mix of senior permanent and junior/post-doctoral project researchers.

- CoE believes that there is a sufficient number of skilled financial and legal experts for the business planning, and controlling, contracting and monitoring of the use of the research infrastructure.
- The CoE plans to have a balanced mix of basic and applied research.
- The TT strategy adopted is targeting consulting and training, material sales and valorisation projects (POC projects) as the main channels for commercialisation.
- According to the survey the most significant barriers to successful technology transfer are "business readiness, lack of financing, difficulties in linking scientist and industry and legislative ambiguities".
- Since the establishment the CoE has not managed to engage in any projects with industrial partners. In the future the plan is that 10-15% of its income will come from the private sector.
- There is no dedicated TTO personnel. Also, there is no information on dedicated personnel with competence and experience needed for proactive commercialisation.
- In the view of CoE there is very limited availability of EU grants, private sector sponsorship and angel investors for translational funding. There is no available funding in the form of government grants nor venture capital.
- The activities to better shape the conditions for TT are (re)shaping the research capabilities and orientation towards the market demand, improving intermediation support and shaping framework & business conditions.
- The Centre plans to support setting up spin-offs. It has no access to a startup incubator for spin-out companies. They are also not aware of any support programmes (grants, subsidies, soft support) they could use to facilitate interaction with industry.
- There is a monitoring system in place, but they only monitor the mandatory key performance indicators for operational programme projects.

Identified needs and challenges

The needs and challenges that were identified by the expert panel:

- Poor performance in implementation of the project thus far due to complicated public procurement procedures by each partner separately suggests a lack of experience in collaboration among the partner universities. Most delays in implementation are caused by construction work in buildings that are under heritage protection.
- The details on the decision-making process of the "board of directors" are not known from the questionnaire[169] but judging by the size of the consortia the (too) slow decision-making is almost inevitable, which seemed to be one of the reasons for incorporating the additional not-for-profit association.
- Until the project staff is employed within a newly established legal entity, it is not clear whether IP created by this same project staff belongs to partner universities, BAS Institutes or another partner organisation that are currently the actual employers.

[169] For this, we looked deeper into the national registers (Trade Registry, Bulstat Registry). We checked the Statute of the legal entity (see below in text).

- Lack of dedicated TTO and commercialisation personnel with skills and experience in formal channels of Technology transfer, TT procedures, sources of translational funding and contemporary spin-off development. We checked deeper into the project documentation and the role/function description of the person assigned to be "Knowledge transfer, relationships with businesses" Coordinator is vague, represents neither an industrial liaison officer broadly nor a technology transfer officer in the narrower sense. The role seems to be of purely administrative nature (monitoring, reporting etc.) and the description refers to activities such as "wide dissemination" of the research results, which is typically the case for results that do not give rise to IP.
- They had contact with industry, but so far have only found out that what they offer is not interesting enough to be able to commercialise.
- The CoE wants to be closer to industry but does not plan to start capturing economic development and industry demand nor is it planning activities to better shape conditions needed for tech transfer like improving (internal) entrepreneurial culture and mindset, or improving institutional legal framework and incentives.
- There are plans to support spin off creation, but spinouts are not within the TT strategy, nor are IP licensing and joint ventures with firms.
- Possibility to form PPPs is mentioned once in the project documentation but the Centre does not seem to have a clear idea as to how to create such partnerships.
- Management is not aware about the support programmes (grants, subsidies, soft support) they could use to facilitate spin-off creation and interaction with industry.
- There is a lack of KPIs monitoring the performance in terms of commercialisation and TT and its effectiveness in terms of income.

Long-term vision

Like other Centres, the Heritage's financing plan is projected for 10 years, where financial analysis was projected even 25 years into the future, however the long-term vision is not clear. Management of the CoE, which has already established a not-for-profit organisation/association, declares that they envisage that in the future CoE should be a company under commercial law.

However, the vision of being a company under commercial law is questionable for several reasons. At their core, the CoEs have a mission "to conduct top level research at European scale in the priority areas of the Bulgarian Innovation Strategy for Smart Specialisation". Secondly, a great majority of universities that are partner organisations still have not adopted commercialisation as part of their mission. In addition, the survey and interview results show that based on the current low interest of the industry and the Centre's plans and current approach to commercialisation, the chances of reaching self-sustainability, typical for a company under commercial law, are slim.

Legal Framework of the Centre

Current legal framework

The founding partners have signed a Consortium Agreement (2016-2017) creating a registered civil partnership (grajdansko drujestvo) under contract and obligations law.[170] This civil partnership

[170] Art. 357-364 of the Obligations and Contracts Act of Bulgaria.

is registered under Bulstat Registry but does not constitute a legal entity (or only for some tax purposes). The civil partnership is then implemented by a more specific Partnership Agreement from 2017. Finally, the third existing (and the latest) arrangement between the partners within the CoE Heritage BG is the registration of a legal entity – a legal person that is separate from and additional to the founding partners. The entity is a not-for-profit association incorporated in 2018 and registered in Trade Registry, constituted by the 12 partner organisations.

The Centre explains in the documentation that the envisaged registration of the CoE as a legal entity was done not only with a view to contribute to clarifying its internal structure, defining and refining the controls and operating rules, but also in order to fulfil the obligation of the OP under the Grant Contract to keep the Centre operational for a minimum of 5 years after 2023. During the visit to Sofia University in November 2019, the Centre stated that the NGO was incorporated in public benefit[171]; however, the Trade Registry states that it is incorporated in private benefit. We briefly list below some aspects of the two forms (see more details in the general part of report).

- An association in private benefit is typically the more flexible option in terms of governance (advantage), however
- If the association is not in public interest it may not be fully eligible for some kinds of national funding, which may be disadvantageous for the sustainability especially in the domain of cultural heritage, where public interest and possible monetary contributions, donations etc. play a role. Some national funding programmes are only open to associations in public benefit.
- If in public benefit, the decision-making would be less flexible and publicity and transparency requirements higher, so that the yearly financial records are openly published with a view to exercise stronger public control. Additional requirements are valid for spending the organisation's funds if in public interest. Donations allow the donor to get up to 10% tax reduction if donating to an association in the public interest.

In that context, the Centre should assess:

1. Are there any sources of funding in Bulgaria in the domain of cultural heritage that are *only available* to NGOs in public benefit; and
2. Does the Centre intend to benefit from these sources *using the separate legal entity* or does it have sufficient sources of funding as it stands currently? (able to use the NGO in private interest as well as the original partner organisations as direct beneficiaries of the described funding)
3. Is stronger public control desirable and/or necessary?
4. Would the tax reduction incentivise more donations?

The above questions will help guide the Centre if it truly needs to transform into a legal entity in public benefit, and whether the benefits are expected to outweigh the costs/disadvantages.

Due to the very particular legal structure of this Centre compared to the others, we took the initiative to extract some relevant provisions from the incorporating acts of the legal entity and of the registered "grajdansko drujestvo" to give us a better understanding of the rights and obligations of the partner organisation and the role of the separate legal entity. Below, please find a table comparing the three core acts/documents of engagement and commitments between the partners. In short, it seems that the partners retain the ownership of the infrastructure and equipment

[171] Also translated as in public or in private "interest".

funded under the Operational Programme and commit to make it available for the needs of the Centre. However, a number of issues remain unclear or vague.

For instance, the source of financing for the "grajdansko drujestvo" is indicated as "own commercial activity" in the Bulstat Registry. It is not clear what is meant by "each partner shall carry out activities to fulfil the common purpose in its own name, *but at the expense of all partners*". It also appears that all partners must agree unanimously and approve all contracts with external organisations and all commercial activities. This may not allow for sufficient flexibility in decision-making where only one or two partners take part in a said activity or specific project.

However, looking at the Statute of the legal entity (association) incorporated a year later we note that the decision-making is significantly more flexible. It allows the Executive/Management Board consisting of five persons to manage the activities and assets of the not-for-profit association including with third parties and external organisations, while the decisions in the General Assembly do not require unanimity but only a majority vote (simple or qualified majority depending on subject matter).

***Table 10**. Overview of the existing legal framework of the Centre*

Year	Formal engagements & commitments between the partners in chronological order	Main aspects and provisions relating to decision-making, properties/assets and activities
2016-2017	Consortium Agreement for "drujestvo" under contract law, under Bulstat National Registry, roughly translated into English as "registered civil partnership" and operating as a consortium – based on consensus	**Legal Framework for existence under national law (extracts from the Contracts and Obligations Act):** • The partners may contribute money or assets. • The contributed assets in principle either become common ownership or are made available for common usage. • Everything acquired for the consortium is common ownership of the partners. • The profits and losses are distributed among the partners according to their shares. **Bulstat National Registry** shows that the partnership was registered in 2017 with: • Ownership share for each partner 6 or 7 % without capital • Source of financing: own commercial activity **The Consortium Agreement provides that:** • Each partner shall carry out activities to fulfil the common purpose in its own name, but at the expense of all Partners. The partners shall retain their organisational, economic and legal autonomy. • The legal form of the Consortium shall be a unincorporated civil law partnership. Duration is 6 years. • In relation to the revenues from economic activities of the Consortium, each partner shall be personally liable for the corporate income tax due for the business activities carried out by it under the contracts concluded by the Consortium.

		• The operating activities of the Consortium shall be organised and managed by the Managing Director. The Managing Director it to develop and submit for approval an annual programme. • He/She is to enter into commercial transactions relating to the activities of the Consortium after the approval of all Partners. The conclusion of contracts by the Consortium happens by unanimous vote by partners. • The Consortium shall not distribute dividends to its members for the entire period of its operation. • The partners may not demand the return of any property provided to the Consortium, while its operation is not wound up. • The rights, responsibilities and obligations of each partner in relation to the implementation of the activities for building the Centre of Excellence, including the rights of ownership on the results and the IPRs, as well as the allocation of funds intended for the activities to be carried out respectively by the partner shall be laid down in the Partnership Agreement [..] to be signed until 30.11.2017 at latest. Note: We checked the Consortium Policies for IP (2017) and it seems that these are rather standard and mostly regulate the relations between inventor and employer as well as between third party organisations vis-à-vis the Centre. The relations between the individual partners are not sufficiently covered.
2017	Partnership Contract, 2017 (this is mentioned in the Consortium Agreement above and referred to as a more specific necessary document).	• The Parties (partners) agree to participate jointly in the technical and/or financial implementation of the Project and in the project activities proposed in the "Project Justification". The Parties acknowledge the Administrative Grant Award Contract and accept the obligations arising from it. • The Parties agree to observe the RDI Framework on State Aid and keep their economic activities within 20% of the capacity, as well as to conduct separate accounting if exercising economic activities. • The Parties hereby agree that the rights and obligations of each individual Partner in relation to the implementation of the activities [non-economic and economic activities], as well as the roles, rights, responsibilities, obligations, including ownership rights on the results and benefits of the Project/respective activity and the intellectual property rights arising from the implementation of the Project, of all Partners participating in the implementation of this Project, shall be divided according to the Grant Contract. • The ownership rights over the real estate belong to Sofia University (2 buildings), The Regional Museum of History Sofia (1 building) and the remaining 7 rooms and labs belong to 7 of the partners respectively. • The partners are obliged to submit the real estate/premises for use for the needs of CoE "Heritage BG" for the period of its existence. • The rights over the real estate (building and labs/rooms) belong to the individual partners. The properties shall be used by the Partners jointly as a shared infrastructure for conduct of scientific and research activity, for implementation joint projects, projects with business partners and other organisations. • The rights on the equipment and fixed assets acquired during the

		Project shall be allocated among the Parties as follows: 100% for CoE "Heritage BG" as assets to the allocated scientific and research infrastructure of CoE. • The rights on the equipment and fixed assets acquired during the Project in case of termination of the existence of CoE "Heritage BG" shall belong to the relevant partners to which they were rendered for operation, and the rights on the co-located Data Centre shall belong to Sofia university.
2018	Not-for-profit Association Agreement under the Trade Registry „sdrujenie", 2018	• Established in private benefit of its founders. • Governance: Management Committee mandated for 5 year period, General Assembly and Control Committee In the **Statute of the Association** it is stated that: • This is a legal entity separate from its members • It is not for profit • It is liable with its own assets (its individual members are not held liable for the association's liabilities) • Members pay yearly membership fees • Activities seem to resemble the ones of the Centre – fundamental research, applied research, knowledge transfer as well as the ancillary economic activities (20% or less) • Operating revenues are formed through membership fees, economic activity, project funding. On decision by the General Assembly, members may also provide ad-hoc funding for specific projects. • If the annual balance turns to be negative, the General Assembly may decide to make additional contributions to cover the gap. • The partners retain their full property rights over the real estate and movable assets with which they participate (in particular, the buildings, labs and rooms funded by the Operational Programme). • The Association becomes title holder of all rights in properties, receivables, money, securities and other assets acquired in its name in the course of its activities. • The properties will be used jointly as a shared infrastructure by the founding members to conduct R&D&I activities and projects • The members are obliged to make the properties available for use for the needs of the Centre • The members are obliged to apply the Centre rules on Access to RI • Decision at the level of General Assembly are made either by simple majority or by 2/3 majority • The Executive Board (Management Board) is vested with the management and has the power to dispose of the assets of the legal entity as well as other standard governance powers. • The Board consists of minimum 3 (at present 5) people with equal rights regardless of their internal sub-division of functions. • Decisions are taken by the Board using a majority vote • The Chairman of the Board is vested with "representation" functions vis-à-vis third parties.

Recommendations

In relation to the new legal entity under the law on not-for-profit legal persons, the following issues and recommendations can be listed:

- It is not necessary (and not recommended) that the ownership of the equipment and real estates be transferred to the new entity. The depreciation costs are substantial and would most likely cause negative balance sheets that, as a consequence, closes the access to EU framework financing.

- It is important that this new entity gain rights and sufficient competences to manage the equipment and infrastructure purchased within the project for the purposes of R&D&I. This will enable the new entity itself to be feasible for EU framework financing (i.e. not only through the partners acting together) and become a member of European research networks. Please note that the transfer of equipment and research infrastructures is not per se *required* for the sound operation of the CoE. It is perfectly feasible that the institutes contribute the equipment to the CoE by means of an agreement. We have confirmed the existence of this agreement and commitment of the partner organisations in the founding documents (see comparison table).

- The manager of this separate legal entity should be a single full-time leader with broad mandate needed to achieve ambitious goals. He should also be accountable and responsible for results and periodically monitored by the supervisory board. Now, looking at the existing structure of the association, this person would be the Chairman of the Board.

- Such setup will also enable internationally competitive salaries to attract experienced and skilled international experts needed to increase the Centre's sustainability.

- A single stand-alone legal entity would also facilitate development of the CoE's brand and closure of Technology transfer and commercial deals with industry due to more straightforward administrative processes.

- It is further recommended that the organisation include the active participation of the private sector, both in terms of industry representatives and in terms of potential donors, foundations, charitable organisations etc., both national and international.

- We are not completely sure whether the association is registered in private interest (as the Trade Registry shows) or in public interest as is stated in the meetings. Important here is that there are advantages and disadvantages in both options and we suggest the Centre starts its operations using the present structure and makes a re-assessment after several years.

However, the precondition is that management of partner universities adopt commercialisation as part of their mission, which will facilitate the operations of the joint legal entity.

The current "shares" range between 6 and 7 % (with no capital) in the "grajdansko drujestvo", which is probably done for simplicity reasons considering that the decision-making in the consortium framework is done with anonymous vote.

A general recommendation is to clarify the relations between the three agreements: Consortium Agreement, Partnership Agreement and Statute of the Association, in order to provide legal certainty to all external third parties such as industrial clients and partners, potential investors. In any case, there must be clear pre-agreed rules as to who will be the contracting party (the Association or the partner organisation[s] or together jointly) vis-à-vis third parties, as well as who

will provide the funding and resources for the specific type of activity, and last but not least which legal entity or entities should benefit from the revenues, possible IPRs etc. At present it is stated that the Centre will be the beneficiary, however it is not clear if the Centre will also provide the funding and resources for an activity/project and whether from its own budget or through an ad-hoc contribution from one or more of the partner/member organisation to the association.

Organisational Framework

The appropriate Organisational Framework is, in formal terms dependent on the formal Legal Framework of the Centre as discussed above, but whatever the final legal framework the Organisational Framework must be sufficiently lean and independent that it can operate effectively, efficiently, and sufficiently transparently that it can be held accountable to the stakeholders.

The experts feel that the multidisciplinary nature of the activities of this Centre will require a variety of skill sets that can best be provided by all of the partners contributing some of their staff to a dedicated management team. This team will be multi- and inter-disciplinary and should be incentivised to deliver on specific objectives and goals of the CoE and not just on the objectives of the individual stakeholders.

We strongly recommend that the overall management of the CoE be handled by a core team of staff who are 100% dedicated to its mission. This is the only way to ensure the success of the CoE and to avoid conflicts of interest with the founders. The founders can then supply specific expertise in the form of experts seconded to specific projects but a dedicated team should professionally handle the management of the CoE.

The management team should establish a strategic plan as indicated in some of the best practice examples in the final section of this report. In the project proposal, repeated references were made to plans that "will be developed". Now is the time to produce these action plans with concrete proposals for actions and specific, measurable objectives.

There is no single best organisational framework and the final decision needs to be one that is endorsed by the whole partnership if it is to work. Please refer to the Organisational Framework (Chapter 3 of the report) for further discussion of various options and their pros and cons, and continue reading below.

Governance and decision-making; management of the tangible and intangible assets of the Centre

The Project Heritage BG is led by Sofia University as a leading partner following the Partnership agreement signed by the 12 partner organisations. The project is being implemented in a rather decentralised manner, meaning that (besides a "common office" or "administrative units" as mentioned in project documentation) legal, financial and administrative resources as well as the equipment and infrastructure are distributed among partners. It seems that the Centre's scientific personnel who come from different partner organisations remain employed by their parent organisations. Procurement for equipment and infrastructure is distributed and done by each partner separately.

The CoE is managed by a board of directors (Management Board). The Board of the Association consists of five persons and seems to have standard powers incl. it can conclude contracts with third parties without the need for agreement of all members (as opposed to the initial Consortium Agreement). Please refer to the comparison table. The tactical and operational decision-making

should be done by the manager of the not-for-profit organisation/association. The manager should be largely independent in its management, operation, collaborations with industry and international R&D&I while reporting on outputs annually to the individual partners. It should be reassessed whether the present structure with five members of the Board having equal rights is optimal and effective especially for the period when the procurement/works are completed and actual R&D&I operational activities begin to intensify. Thus, the Board Members might be then called "Component Leaders" for instance, leading certain types of more specific joint activities within the CoE.[172]

If the single leader/manager receives more powers and accountabilities compared to the other members of the Board he/she will also have to be further (e.g. quarterly) "supervised" by this same Management Board and should not be able to sign contracts or execute payments above certain amount without the consent of the Management Board or respectively the General Assembly. We should not forget that at present there is also a Control Committee.

The founding partner organisations should clearly continue to be involved and retain the decision-making with regard to strategic decisions on the future development of the CoE (e.g. the Ovcha Kupel bath reconstruction and development concept).

Research Infrastructure

Two central elements for the operation of the Centre are the Data Centre, its technical/physical networks and the necessary services, which in total amount to approx. 5 million BGN with another 2 million BGN dedicated for an Integration Portal.

The project documentation states that no structural unit of the infrastructure is an end in itself but is designed as part of a distributed network of complementary specialised laboratories / observatories. Thus, laboratories can be used in a stand-alone mode of operation, but when needed, in an integrated package. The responsible CoE administrative units are to control the use of distributed infrastructure, duly keep documentation and provide it to the project management team.

It was expressed that on occasions it was difficult to persuade researchers to share their equipment for the purposes of the Centre's activities. One solution for this could be to work on project-basis and specific need-based. It may suffice if the Centre has the "availability" to use the equipment should there be an occasion.

According to the MA's Financial Plans and Prognosis from Q4 2019, the Centre's verified expenditure reached only 0.3 million BGN, which represents only 1% of total allocated grant. Most delays in implementation are caused by construction work in buildings that are under heritage protection.

Specific recommendation for the Heritage BG:

- Re-evaluate the feasibility of the time-plan for construction work in buildings that are under heritage protection. If there is a substantial risk of missing deadlines for payments from the OP, consider disinvesting or changing the investment plan from building to equipment (subject to approval by MA), always targeting the 75%:25% ratio for investments in infrastructure and equipment and other costs.

[172] See Chapter 3 on Organisational Framework of this report.

- Even if the construction is slow, the procurement of equipment should be accelerated, and installation of equipment done in alternative premises, which would allow the research and commercialisation activities to begin.
- It is imperative that skilled expertise is brought in to overcome specific problems and accelerate the activities, particularly as far as the building work is concerned. As some expertise exists in other CoEs and CoCs, it would be sensible to discuss collaboration with those who have a proven track record of overcoming these problems and delivering construction projects on time.

STATE AID RULES AND PRINCIPLES

On page 28 of Project Justification, possibly due to inaccurate translation or misunderstanding of the concept, the Centre refers to "non-profit" activity instead of non-economic, whereas these are different concepts (similar confusion is observed in other Centres). Whether the research organisation seeks to make profits or not is irrelevant in terms of its classification as an undertaking and the obligations stemming from it. Conditions apply. Even if the legal entity established is a non-profit association, the CoE can still exercise economic activities (whether through the legal entity or directly contracted by the partners).

Furthermore, there seems to be a very narrow stipulation/definition for the activity group "business activities of limited scope" explaining that "*business activities will be limited and will be connected to the marketing of a product/service and/or supply of the achieved results*". We must clarify here that *economic activities* include as a rule research on behalf of undertakings (research services and contract research) and well as the renting of equipment. These activities count towards the 20% capacity limitation. We assume that the Centre means by "supply of achieved results" knowledge transfer. Concerning knowledge transfer activities, if the revenues from these knowledge transfer (incl. TT) activities are re-invested into the main non-economic activities of the Centre, then the activity will not count towards the 20% capacity threshold. See Chapter 4 of the report for more information.

In the following, we list some principles laid down in provisions of the Notice on the notion of State aid with relevance to the activities of Heritage BG CoE.

Info box: to take into account when structuring the projects, activities and actions of the Centre related to cultural or heritage conservation.
Extracts from the Commission Notice on the notion of State aid as referred to in Article 107(1) of the Treaty on the Functioning of the European Union (2016/C 262/01).
34. Taking into account their particular nature, certain activities related to culture, heritage and nature conservation may be organised in a non-commercial way and thus be non-economic in nature. Public funding thereof may therefore not constitute State aid. The Commission considers that public funding of a cultural or heritage conservation activity accessible to the general public free of charge fulfils a purely social and cultural purpose which is non-economic in nature. In the same vein, the fact that visitors of a cultural institution or participants in a cultural or heritage conservation activity, including nature conservation, open to the general public are required to pay a monetary contribution that only covers a fraction of the true costs does not alter the non- economic nature of that activity, as it cannot be considered genuine remuneration for the service provided. *35. In contrast, cultural or heritage conservation activities (including nature conservation) predominantly financed by visitor or user fees or by*

other commercial means (for example, commercial exhibitions, cinemas, commercial music performances and festivals and arts schools predominantly financed from tuition fees) should be qualified as economic in nature. Similarly, heritage conservation or cultural activities benefitting exclusively certain undertakings rather than the general public (for example, the restoration of a historical building used by a private company) should normally be qualified as economic in nature.

36. Moreover, many cultural or heritage conservation activities are objectively non-substitutable (for example, keeping public archives holding unique documents) and thus exclude the existence of a genuine market. In the Commission's view, such activities would also qualify as non-economic in nature.

37. In cases where an entity carries out cultural or heritage conservation activities, some of which are non-economic activities as set out in paragraphs 34 and 36 and some of which are economic activities, public funding it receives will fall under the State aid rules only insofar as it covers the costs linked to the economic activities.

Furthermore, the following decision can be useful for this particular Centre, if it establishes a facility that is to receive visitors: **Decision not to raise objections in case SA.42545 Revitalisation of the Hamburg Congress Center (CCH).** The Commission noted in this decision that the aid for the project in question will contribute in "*particular to development of local and regional cultural activities mainly addressed to local/regional visitors which will not negatively affect competition between the centres in other Member States*".[173] So, even where such cultural or heritage conservation activities could partly be considered as economic in nature, if they only have a local or regional significance to the effect that there it will not negatively affect competition between the market players in other Member States, there are no state aid objections.

In addition, the following working document may be useful for the Centre Heritage BG: **Infrastructure Analytical Grid for Culture, Heritage and Nature Conservation**.[174]

TECHNOLOGY TRANSFER AND COMMERCIALISATION

Centres' TT strategy outline and expectations

The Centre has the IP rulebook that was an obligatory part of the project application. It has also adopted TT strategy that is targeting consulting and training, material sales and valorisation projects (POC projects) as the main channels for commercialisation. There is no dedicated TTO personnel. Also, there is no information on dedicated personnel with competence and experience needed for proactive commercialisation through formal channels of knowledge and technology transfer. The Centre plans to support setting up spin-offs.

Between 400k and 500k BGN have been foreseen for commercialisation, including a "structure" for knowledge transfer, operations and for the protection of IP, while this budget is also said to include wide dissemination. Sofia University is vested with the establishment of this structure for knowledge transfer. It is however not clear how this structure will cooperate with the existing TTO of Sofia University.

Since establishment, the Centre has not managed to engage in any projects with industrial partners. In the future, the CoE foresees that 10-15% of their income will come from the private sector.

[173] https://ec.europa.eu/competition/state_aid/cases/259545/259545_1894651_204_2.pdf , see para 3.3.5 on page 15.
[174] https://ec.europa.eu/competition/state_aid/modernisation/grid_culture_en.pdf

The activities to better shape the conditions for TT are (re)shaping the research capabilities and orientation towards the market demand, improving intermediation support, and shaping framework and business conditions.

According to the financial plans, the first income from funding sources other than national and EU budget will be for the amount of 1.000.000 EUR, planned for the 7th year after the establishment of the Centre. This income remains the same in the next 3 years (until the end of year 10). The plan is to attract private investment in terms of contracts with external customers for the amount of BGN 200.000 annually and BGN 800.000 annually from other unspecified resources.

The Centre has a large number of associated partners, among them publishing companies and nine tourism associations, which participate in the project to facilitate knowledge and technology transfer.

Identified Challenges and Needs

- The TT strategy and plans for commercialisation are not aligned in terms of spinouts and joint ventures.
- Contacts with industry were made, predominantly with associated partners, but so far have only shown that what CoE is offering is not interesting enough to be monetised. According to the survey, scanning the market demand is not considered by CoE to be an important way of facilitating transfer.
- There is an apparent lack of knowledge, skills and experience about the necessary internal ecosystem, which would enable and promote TT, from formal channels and procedures to sources of translational funding.
- There is an apparent lack of knowledge, skills and experience about the necessary contemporary business development methodologies, contemporary incremental spin-off development, and attracting and closing Early Stage Investments.
- The financial plan is not well elaborated for the majority of income thus does not seem realistic.
- The CoE wants to be closer to industry but does not plan to start capturing economic development and industry demand nor is it planning activities to better shape conditions needed for Tech transfer like improving (internal) entrepreneurial culture and mindset, or improving institutional legal framework and incentives.

Recommendations

(a) TT Arrangement for the Centres (Strategy, Policy and Process)

- Align TT strategy with updated plans for commercialisation especially in terms of spin-offs as well as joint initiatives with different partners, including from the business sector. Spin-offs should be a by-product of the CoE's research with commercial potential as opposed to a specific stand-alone target in itself. The strategies and plans should clearly target the main CoE output products and services, which are copyrighted, database rights protected etc. as these are usually licensed to many parties and are probably more relevant to this Centre than patents.
- Do not just copy TT Strategy, Policy and Process, but instead study best practices and develop own custom arrangements based on the local context, considering inhibitors and motivators of local researchers and with support of international experts.

- Engage dedicated staff for TTO and commercialisation.
- Build capacity on how to manage necessary internal ecosystems that would enable and promote TT, from formal channels and procedures to sources of translational funding.
- Engage in systematic "networking" activities such as exhibitions to approximate potential partners, demonstrate capacities, collect revenues and promote the Centre's brand. Introduce technology scouts or brokers that can bridge the gaps between academia and industry. Besides existing domestic associated partners, strategically include associated partners from abroad.
- Technology Transfer is not a theoretical science but a hands-on activity. Realistic plans need to be developed with clear goals and objectives and fully trained staff to implement them. Without a dose of realism, the TT strategy will remain a pipe-dream.

(b) Collaboration with industry

- There is a unique potential of this Centre as consortia members are also faculties and institutions in humanities and cultural sectors that can offer creative, consulting services, trainings and education services, cultural database-based products and services with great value added.
- It is recommended to develop own sector specific commercialisation (and incubation) support programme oriented towards humanities and cultural sectors where specificities of development and commercialisation of the above-mentioned products and services should be addressed. This programme should involve capacity building on subjects such as crowdfunding, crowdsourcing, gamification, raising funds from charity organisations and access to national and international public funding.
- Collaboration, especially with associated partners that participate in the project to transfer knowledge developed by Centres, should be based on industry needs. Instead of offering knowledge and technologies, scan for demand, and based on the demand develop your offerings.
- Collaboration should be built on trust. The most reliable way to build and develop trust is through traction, i.e. by successfully delivering a number of services to the industry. "Low hanging fruits" with existing industry contacts (regardless of potentially being small in value) will build traction and the Centre's brand.
- It is important to focus on industry sectors that absorb innovation.
- Build capacity on Academia-industry interaction, contemporary business development methodologies, and contemporary incremental spin-off development and on attracting and closing Early Stage Investments (pitching, valuation, negotiations, etc.).
- To create a funnel of spin-off ideas, focus on campaigns that promote an entrepreneurial mind-set. Identify early adopters, secure individual financial and soft support for their entrepreneurial projects, and promote the champions.
- To support spin-off creation of the projects based on engineering and life sciences, seek for synergies with existing institutions and support programmes (see below).

Synergies and Complementary Initiatives

- To avoid duplication and to use already available support for spin-off creation especially in engineering and life sciences, the soft support available from the Sofia Tech Park's incubator and newly established Groworking[175] programme for researchers could be used.
- Local Municipalities in Bulgaria often receive funding to preserve objects of regional historical and cultural significance. They need to be aware of the R&D possibilities, available infrastructure and services that the CoE can offer. Explore closer synergies with these local/regional programmes. This is clearly also valid for objects of national significance as the country ranks high in terms of cultural heritage and has long history of human presence and activity.
- Sofia Tech Park also announced a financing scheme for very early stage high technology startups, offering 75.000 EUR of funding, and also free access to laboratories and innovators community.
- Financial support for Proof of Concept or development of prototypes is also available from the Innovation fund.
- Regionally recognised private venture funds and accelerators stationed in Sofia such as Eleven and Lunch hub offer smart money for spin-offs in ICT sector.
- Test possibility for collaboration with regional innovation Centres, and especially the companies within them.

KPIs

Straightforward key performance indicators demonstrating the effectiveness of activities for commercialisation, the final financial results, but also social impact should be implemented:

- Indicators of market conversion leads, hot leads, income, number of FTE fully financed through external funding
- Indicators of effectiveness of marketing channels: income vs cost of marketing channel
- Social impact: number of services/programmes with social impact implemented, number of beneficiaries (institutional partners), number of end users
- Cost benefit indicators of IP: cost of protection vs income from IPR
- Start-up funnel: Number of ideas, number of pre-seed stage teams, number of start-ups, investments raised, value of exits

It is worth noting that IP related KPIs such as number of patents or patent applications is not always the best indicator when the Centre does not want to disclose its exclusive knowledge. Therefore, IP-related KPIs should not be used as the sole determinant of excellence of the Centres. For this Centre, social impact should also be a very relevant indicator of performance.

[175] https://groworking.space/

Centre Sustainability

Requirements and Expectations

The Centre plans to have over 10 million BGN revenues (understood to exclude block-funding) in the years from the 7th to the 10th of the project with main sources R&D projects, private investment, joint initiatives with municipalities on local levels, and a smaller part from limited economic activity consisting in renting of infrastructure and sales.

CoE expects that there will be available national resources within the next operational programme, but also to be able to apply for EU funding for research projects. As there is no availability of private sector sponsorship, angel investors and venture capital for translational funding, the Centre expects to be able to apply for national, EU and other international grants instead. They should also focus on getting money from charitable organisations, also international; explore global funding programmes in the fields of cultural heritage, humanities and social sciences. The Centre has already identified crowdfunding, crowdsourcing and gamification as possible sources of revenues.

Recommendations

The expert panel distinguishes between short-term and long-term sustainability. For short-term sustainability, the experts consider it of paramount importance that the CoE focuses on identifying short and middle-term needs with local and regional industry, local and national public sector, cultural sites and entities, fine-tunes its R&D agenda to those needs, and exerts targeted business development efforts aimed at local and regional industry to secure contract research assignments. However, it is very unlikely that the CoE will soon (if ever) reach self-sustainability, therefore it should seek national, European and international public (research) funding. Such independent or collaborative research projects may be used to initiate subsequent or simultaneous contract research. As to the public funding of research infrastructures, please note that all conditions and requirements under EU State aid law have to be fulfilled not only in the initial investment and creation of a research infrastructure, but also in its continued exploitation.[176]

A separate legal entity should facilitate long-term sustainability. Such an entity, with availability to use all infrastructure and equipment of the CoE, would be viable for any kind of public financing to support its sustainability (provided it is registered in public interest, see the previous chapters for more details).

Regarding commercial income, the general recommendation is to use contemporary approaches to business modelling as a way to develop an offering of the new entity, which is based on the needs of the society and markets. In this manner, the discovery of clear target segments and their needs is the first step, followed by the development of a clear value proposition in the form of appropriate innovative knowledge, technology, service or product. The resources are only engaged when there is a very high certainty that the end result can be commercialised.

It is also necessary to explore all types of funding, public, commercial and also private donations. Given the nature of the heritage CoEs activities, it lends itself more than most to attracting donor funding from foundations and wealthy private individuals but today this funding does not find the recipient by accident, the recipient needs expertise in soliciting donations and charitable fundraising. These avenues should be explored both nationally and internationally.

The possibility for Public-Private Partnerships (PPPs) has been mentioned in the project documentation, which we find interesting for this specific Centre. Such possibilities for cooperation

[176] See Chapter 4 on State Aid of the general part of this report.

with businesses and investors should be further explored as they could provide a steady flow of money to the Centre. Despite the complexity of structuring and negotiating PPPs, they offer some benefits in that the Centre would not need to deal directly with the end-users, operate an object, nor welcome visitors as this would be taken care of by the private partner/operator/investor. The Centre would provide technology, know-how, creativity while another public partner (a municipality for instance) could be the main actor and driver if it owns the site/land/objects of interest and is convinced of the project.[177] You could first initiate a broad discussion with stakeholders and a promotion programme to collect ideas from businesses and citizens from across the country for possible PPP projects after the Centre becomes operational and knows better what it can offer.

ROADMAP ON LONG-TERM SUPPORT

- Evaluations of similar programmes in the South East Europe showed that progress in the performance of research and innovation ecosystems is only visible in the long term. The main reason for that is the huge gap between academia and industry, but also between academic partners. Centres have the potential to act as boundary spanners, provided that there is enough time to develop trust among key players. Therefore, the next national OP 2021-2027 should extend the support for the Centres including the following new features:

  - Capacity building in terms of soft skills for
    (a) contemporary bottom-up business development
    (b) Academia-industry interaction
    (c) Targeted Global networking
    (d) Strategic management and development of IP
    (e) Non-linear TT process
    (f) Contemporary spin-off development and attraction of early stage investments
  - Foresee financing for limited number of DEMO projects selected upon interest demonstrated by industry
  - International independent monitoring and evaluation
  - To enable a more active role and clear benefits for industry, allow the possibility to include industry as equal partners in Centres of Competence and even in Centres of Excellence.
  - Integration with Regional Innovation Centres

ANNEX: INSIGHT INTO SOME GOOD PRACTICES AND INTERNATIONAL INITIATIVES

Case 1: INCIPIT Spain

The Institute of Heritage Sciences (Incipit) is a group of over 50 people focusing on the study of cultural heritage as a scientific problem. Incipit constitutes the evolution of the former The Heritage Laboratory (LaPa), after being consolidated as a research Centre with its own identity.

INCIPIT is a classic model of a research Centre belonging to the Spanish Research Council.[178]

[177] See the JRC publication: Lund, E., Addarii, F., Schmitz, H., Kokorotsikos, P. and Bush, R., Public-Private Partnerships for Science and Technology Parks. Utilising PPPs and related models for the development and operation of STPs and Innovation Districts, Kaymaktchiyski, S., Fazio, A. and Shamuilia, S. ed., EUR 30439 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-25169-9, doi:10.2760/3057, JRC122409. https://ec.europa.eu/jrc/en/publication/public-private-partnerships-science-and-technology-parks

[178] http://www.incipit.csic.es/en/Default.aspx

INCIPIT is organised by research discipline, with groups specialising in Anthropology, Archaeology, Geospatial Technologies, Semantic Technologies but significantly has a separate unit dedicated to Valorisation. Its mission is to study the valorisation processes generated around cultural heritage, the valorisation of Incipit's research processes and results, aiming to increase its social relevance according to its scientific strategy, and the promotion of the participation of Incipit in different ways in valorisation processes generated around cultural heritage.

They have developed their own model of knowledge dissemination that is described at this link.[179]

Case 2: NIKU Norway

The Norwegian Institute for Cultural Heritage Research (NIKU) is an independent institute for applied R&D and for services within the wider field of Cultural Heritage in Norway and beyond. It is a modern Centre that works with businesses as well.[180]

Their strategy has a very clear vision and mission, and sets goals and associates indicators in a clear way.[181]

NIKO is a very proactive organisation. Though they are partly funded by the national government, they also attract revenues from competitive projects and from commercial services. They have archaeologists who undertake archaeological excavations, investigations and registrations. Their architects, engineers, ethnologists and art historians conduct research, examine, and provide services related to preservation of historic buildings. NIKO's conservators examine, restore, conduct research and provide professional advice on conservation of art and historic buildings. NIKU is also adopting a broad range of new technology for the surveying, recording, and monitoring of cultural heritage sites. A group of researchers and advisors have expertise on cultural heritage in spatial planning, management and community development. They conduct research and deliver impact assessments on cultural heritage sites.

UNESCO Recognition of Best Practice in World Heritage Management[182]

An interesting example of an innovative capacity building initiative is the **Recognition of Best Practice in World Heritage Management**, an initiative, requested by the World Heritage Committee and carried out within the framework of the 40th anniversary of the World Heritage Convention. The Historic Town of Vigan in the Philippines was chosen as a best practice achieved with relatively limited resources but there are numerous other examples of best practices, which may have aspects of value to be taken into consideration in Bulgaria.

Management practices recognized as being successful and sustainable include everything from involving local people in site management, to creating innovative policies and regulating tourism. There are sites that include students from local schools in the management of the site (Slovenia) or train local inhabitants as tour guides (Peru). The Heritage Centre of Excellence should evaluate these practices to find solutions that work.

This initiative provides incentives for States Parties and site managers to reflect on their management practices and explore improvement possibilities.

The full list follows:

[179] http://www.incipit.csic.es/en/OtrasWebs.aspx
[180] https://www.niku.no/en/about-niku/
[181] https://www.niku.no/en/strategi-for-norsk-institutt-for-kulturminneforskning-niku-2018-2023/
[182] https://whc.unesco.org/en/recognition-of-best-practices/

Consult best practice examples

- **Acropolis, Athens**
- Angkor
- Archaeological Ensemble of Mérida
- Boyana Church
- Coffee Cultural Landscape of Colombia
- Cueva de las Manos, Río Pinturas
- Fossil Hominid Sites of Sterkfontein, Swartkrans, Kromdraai, and Environs
- Gros Morne National Park
- **Historic and Architectural Complex of the Kazan Kremlin**
- Historic Areas of Istanbul
- Historic Centre of Oaxaca and Archaeological Site of Monte Albán
- **Historic Monuments of Ancient Kyoto (Kyoto, Uji and Otsu Cities)**
- Historic Town of Vigan
- Jiuzhaigou Valley Scenic and Historic Interest Area
- Land of Frankincense
- Le Morne Cultural Landscape
- Mogao Caves
- Old Havana and its Fortifications
- SGang Gwaay
- Sacred City of Caral-Supe
- San Marino Historic Centre and Mount Titano
- Shiretoko
- Škocjan Caves
- Sundarbans National Park
- Teide National Park
- Wet Tropics of Queensland

The experts single out **Acropolis Athens** for their research work, **Historic and Architectural Complex of the Kazan Kremlin** for their integrated heritage preservation, media coverage as a tourist product, special legal protection measures, accreditation of tour guides, special tourist infrastructures and divers tools for interpretation of the site, and **Historic Monuments of Ancient Kyoto** (Kyoto, Uji and Otsu Cities) for their interesting approach to urban conservation against broad issues in the modern city. Other best practices have useful insights in terms of managerial approaches and sustainable finance.

The management team should also consult the World Heritage Manual

"**Managing Cultural World Heritage**"[183]

Another useful resource is "**Cultural Heritage Tourism" Best Practices**[184]

Advisory Council on Historic Preservation
Appalachian Regional Commission
National Endowment for the Arts
National Endowment for the Humanities
Institute of Museum and Library Services

[183] https://whc.unesco.org/en/managing-cultural-world-heritage/
[184] https://culturalheritagetourism.org/cultural-heritage-tourism-best-practices/

President's Committee on the Arts and the Humanities
U.S. Departments (various)

Of particular note is the Institute of Museum and Library Services that has a clear strategic plan.[185]

Finally, in terms of advice on revenue generating activities, relating to the exploitation of cultural heritage and its links to tourism, useful information can be drawn from the TOURISM DEVELOPMENT RESOURCES of TDS & Associates. For example:

Checklist of Key Success Factors: Museums & Non-Profit Cultural Attractions by Bruce Dickson, Tourism Development Solutions (TDS). The Checklist includes such factors as: Visitor Content Appeal, Understanding Visitors, Organisational Practices.

[185] https://www.imls.gov/publications/transforming-communities-imls-strategic-plan-2018-2022.

9.2 Centre of Excellence "Universities for ScieNce, Informatics and Technologies in eSociety" (UNITe)

Summary of Centre of Excellence

Identification number: BG05M2OP001-1.001-0004

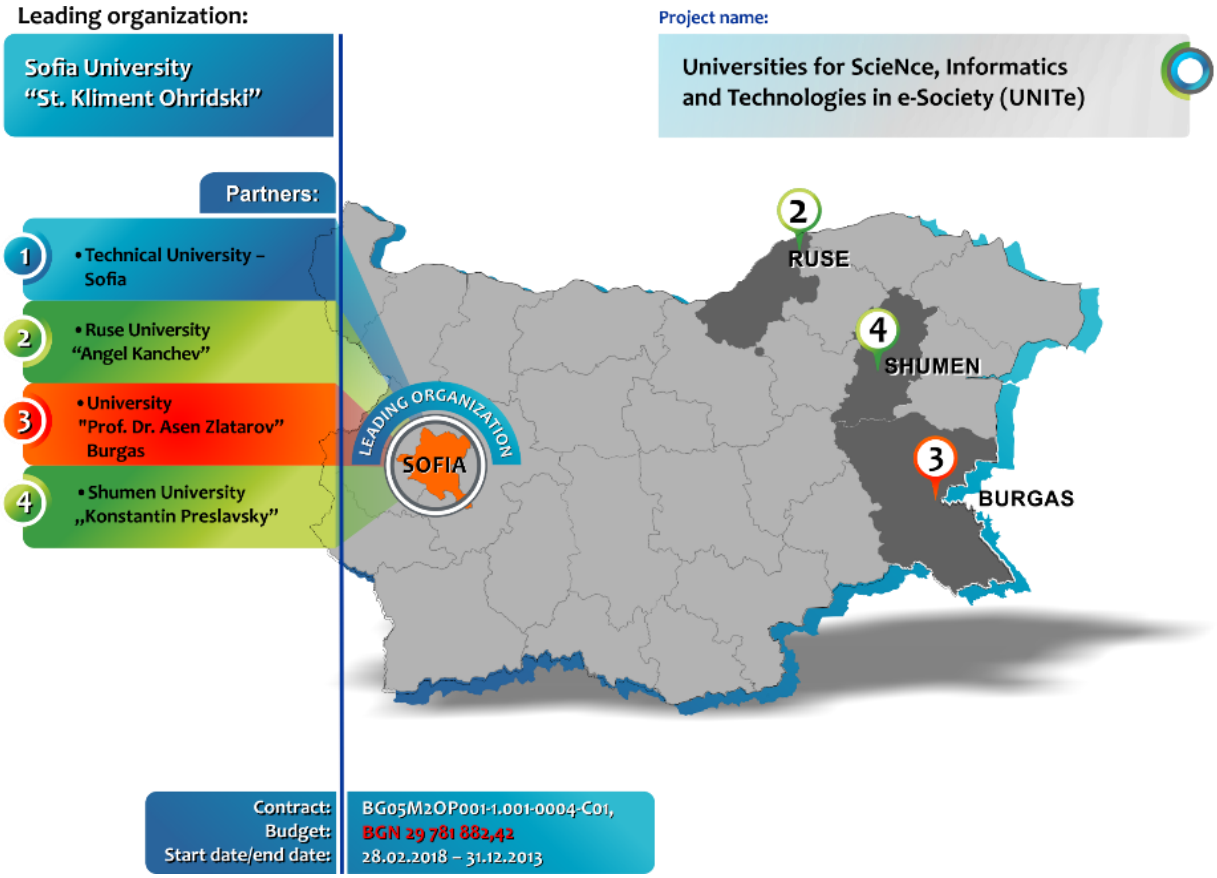
Centre name: Centre of Excellence "Universities for ScieNce, Informatics and Technologies in eSociety" (UNITe)

Budget of the project: BGN29.7M allocated; verified expenditure BGM1.1M with further BGN11.5M spending planned (as of Q4 2019)

Lead organisation: Sofia University "St. Kliment Ohridski"

Start date: from 28.02.2018, End date: 31.12.2023

The main objective of the project: To raise the overall level of research and to enhance the market orientation of the research activities of the leading ICT research departments at the five partner universities, and to use the new infrastructure to attract highly qualified researchers in this priority area of ISSS to raise the profile of UNITe partners internationally.



Specific project goals:

1. To develop a Distributed Research Infrastructure (DRI) CoE UNITe, as a competitive and internationally recognised R&D complex, that satisfies the modern requirements and is required for the world class ISSS research within the priority area of Informatics and ICT.
2. To improve the collaboration of researchers and academics in geographically distributed regions in Bulgaria (Burgas, Ruse, Sofia and Shumen) with each other and partners all over the world via the UNITe.
3. To significantly improve the scientific support of business in the regions of the country by providing access to high-quality distributed scientific infrastructure of the UNITe and specialised consulting for businesses, especially for small and medium enterprises.
4. To facilitate and improve communication and information flow between dispersed organisations using computer aided communication systems as a way to introduce a new model of organising shared work that will prevail in the decade 2020-2030.

The UNITe aims to provide the following services: Big Data infrastructure as a service for business and research community, Big Data software development services, innovative mathematical methods and models for the use by digital society, Big Data analytics and visualisation systems, digitalisation and prototyping, smart systems for sustainable cities, and manufacturing 4.0.

Current status of Centre

Analysis of questionnaire

The uniform questionnaire, sent to all centres included in this study to collect centre-specific data, was answered by the administrative director of the UNITe. The centre-specific characteristics arising from this questionnaire are:

- The CoE is managed by Sofia University acting as a leading partner in the consortium of five partner universities: Sofia University, Technical University of Sofia, Konstantin Pereslavsky University of Shumen, Angel Kanchev University of Ruse, and Prof. Dr Asen Zlatarov University Burgas. The management board is representative of all partners.

- The management believes that the CoE should be governed independently and manage its finances, operations, collaborations with industry and international R&D&I projects through an independent legal entity that will report annually to the individual partners.

- To achieve this, UNITe considers the need and the options to establish an independent legal entity and notes that this will require an adoption of specialised legislation for establishment of CoE and CoC in order for this legal entity to be recognised as a public organisation.

- Distributed equipment and research infrastructure assigned to the CoE are owned by the individual partners and should remain in their ownership in the future.

- The CoE should have access to administrative and research staff contracted from the individual partners on the project basis.

- There is an insufficient number of skilled financial and legal experts to carry out business planning, compliance, control and contracting functions, and monitoring the use of the research infrastructure.

- The relationships between founding partners and future Centre entity regarding IPR and sharing industry contacts and leads have not been defined yet and there are no unified IPR protection policy.

- There is no TTO dedicated to UNITe, as according to the project proposal all partners have their TTOs whose services might be utilised as required. No information was provided on the availability of dedicated personnel with competence and experience needed for proactive commercialisation through established channels of knowledge and technology transfer.

- There is no availability of private sector sponsorship, angel investors and venture capital for translational funding. Government, EU and other international grants will be used instead. There are no existing sales of services and no active contacts with industry have been reported.

- According to the administrative director, the most significant barrier to successful technology transfer is lack of competence among the UNITe researchers in academia to industry knowledge transfer and a low level of entrepreneurial mind-set.

Identified needs and challenges

The challenges that were identified by Centres representatives are:

- Legal Framework, Organisational and Management Framework, Decision-Making
  - Non-existing legislation for establishment of new research organisations such as CoE.
  - Research framework is not aligned with the European Research Area (ERA) priorities: difficulties in integration and attracting talent.
  - Need for changes in organisational culture and willingness of partners to implement the change.
  - Lack of management capacity and readiness for collaboration at partner organisations.
  - HR management difficulties and team building challenges.

- Access to the Research Infrastructures, State Aid, monitoring
  - Lack of skills for management of research infrastructure and provision of access.
  - Not sufficient knowledge and understanding of state aid rules (incl. monitoring).

- Technology Transfer and Commercialisation
  - Lack of researchers' skills in IPR protection and knowledge/ technology transfer.
  - Low level of entrepreneurial mind set among researchers.

The needs and challenges that were identified by expert panel:

- Poor performance in implementation caused in part by each partner separately carrying out procurement procedures suggests a lack of experience in collaboration among the individual universities, which resulted in delays in decision making and compromised effective project management during the early stages. Although most delays in implementation were/ are caused by construction works, the poor performance thus far and the lack of coherent development strategy and direction indicates internal as well as external challenges to the CoE. This might be an adverse effect of adopting a decentralised management model of the decentralised infrastructure owned by individual partners, which is likely to impede the future operational activity of the CoE also due to complicated internal procedures of individual partners and potentiality of conflicting interests arising.

- Before the enactment of the implementing Decree of Council of Ministers in March 2020, we observed a poor understanding of the current legal framework that allows universities to carry out commercial activities and create/ own spin-off companies as well as limited institutional support from the individual partners who were, in the absence of an implementing legal act, reluctant to adapt their respective missions to include commercialisation. Similarly, a poor understanding of the corporate law causes delays, including in establishing a legal structure aligned with the current legislative framework.

- UNITe's future greatly depends on universities' top management commitment and decision to co-fund the continuous operations of the Centre project whether or not there will be an additional legal entity. The management is expected to proactively look for solutions particularly creating a unified IPR protection strategy, equipment and personnel use policies based on the contractual agreements between the individual partners. Currently, the project appears to have stalled as many important questions remain unanswered as "The Centre is not established yet". It is important to note that when a new organisation of a national importance is established, it is the vision and the research strategy that determine the need for legal entity.

- If the Centre establishes the need to employ researchers directly by the new legal entity, a more integrated model/option will be necessary, which can be also more complex (see two models in the general part of report). If the current partnership structure is preserved the IP created by project staff (researchers) belongs to the respective partner universities, which are the actual employers. The question of whether, in the existence of a new entity, part of the revenues from TT activities would be dedicated to supporting the costs of this new structure follows. Below, we looked deeper in the documents of the Centre and it appears that the Centre will seek to preserve part of the ownership rights to IPR and that the revenues derived from these IPRs will be used for the Centre development and not distributed among the partners. This should be supported by a clear, well defined agreement between partners, surviving the current management and covering the lifespan of the CoE.

- In the absence of a recognised legal structure, the flexible hiring of highly skilled personnel, whether full time or contractually, will be considerably more challenging. The Centre might be able to hire an expert or scientist under a consultancy agreement (i.e. civil contract as opposed to employment contract) through one of the partners. For most activities, this arrangement is expected to be sufficient. Note that if the partners choose to operate as a loose consortium, this type of engagement contract would provide freelance-type contracts for hired experts or scientists, which may not be seen as long-term solution. If the hired expert or scientist retains an employment contract with a third party, the CoE would only be able to offer part-time engagement. It should be noted that the discrepancy in the engagements with scientists by the CoC as a legal entity or by the partner organisations should not create a discriminative environment in the pay levels whereby scientists in the PRO partners receive much lower compensation than those in the CoC. This could have a demoralising effect in the scientific community.

- In the absence of a unified IPR strategy, the collaboration between the individual partners will be inefficient.

- In the absence of unified equipment and personnel use policies, the collaboration between the individual partners will be challenged.

- Lack of dedicated TTO and commercialisation personnel with skills and experience in formal channels of technology transfer and procedures, securing translational funding and spin-off formation will make the commercialisation of UNITe services very challenging.
- Lack of KPIs for monitoring performance in terms of commercialisation and technology transfer and its effectiveness in terms of income will make financial performance reporting difficult.

LONG-TERM VISION

UNITe's financing plan is made for 10 years and the financial modelling was done until 2043, however the long-term vision has not been made clear within the documents developed to date. The management of the CoE declares the need for creation of a separate entity, but this has not yet been agreed/elaborated by all partners. To participate in the CoE, some of the partner universities believe they need to establish and take a shared ownership of a new entity that will be providing services and commercialise the research results. However, the majority of partner universities still have not adopted commercialisation fully as a part of their mission, which should be expected soon since the national rules on economic activity of universities and spin-off creation were already enacted in March 2020. We note that for the provision of services a new legal entity is not necessary from a *legal* point of view (i.e. it is not legally required) but may be useful from *organisation* perspective. Bear in mind that the possibility given to universities to create spin-off companies has limitations including as to the purpose and activities of those corporate entities.

The features of UNITe's long-term vision that can be deduced from the financial modelling include commercialisation activities (both licensing and spin-off creation). Still, as a CoE, UNITe is strongly focused on fundamental research, applied research, and experimental development, the economic activities of the centre will remain of ancillary nature and limited in scope (in line with 20% of the infrastructure's overall annual capacity limitation). This CoE should be seen as a project that does not generate sufficient revenue to offset operational expenses with a potential to increase its non-government revenues over time.

The management plan to rely on public research funding schemes (EC grants, national research funding frameworks, etc.) as the main source of financing for both operational and sustainability costs. This strategy carries high risks over the project lifespan, which are mitigated to some extent by CoE being a distributed R&D&I facility with own buildings and equipment, having management skilled at securing public funding and a policy of reinvesting all surpluses in the CoE activity.

It is expected that the public funding will be raised initially with the aim of strengthening the technological development and innovation. Thus, the projects funded by the CoE will necessarily reflect a market need stronger than university-based research, while the focus of the UNITe of excellence might significantly increase the potential social impact of these developments. This will allow UNITe to establish its reputation as an institution, which carries out effective knowledge transfer from academia to industry at the same time generating wider economic value. If UNITe is successful in strategic use of the public research funds to demonstrate leadership in their field, it will be possible to leverage the reputation by reducing the reliance on EU and national schemes. It will be possible to increase the financial contribution of contract research and consultancy but also of "effective collaboration" with industry, improving the perspective of financial return on the (national) capital deployed in the project.

However, despite the possibility of success of UNITe's direction towards becoming a nationally important research centre, without clear contractual basis on which the individual partners will

provide the services and share the responsibilities and outcomes, the long-term sustainability of the CoE is not achievable, with or without a legal entity. Alarmingly, the replies in the survey demonstrate that even in the short- to mid-term the continued existence of the Centre is questionable as little strategic planning has been done to date. To address this early hurdle, the CoE should develop a joint vision of the CoE (a vision statement) describing in detail the field(s) of application and the scope of excellence as well as their expected national/regional/international positioning. Creating detailed mid-term and long-term strategies, while addressing the short-term challenges proactively will also help.

Legal Framework of the Centre

Current legal framework

The CoE is currently constituted by the partnership agreement between five partner organisations according to terms and conditions of the public call defined by the MA. The rules for access to the equipment and IPR protection have been developed and adopted in accordance with the terms and conditions of the public call. During the meetings in November 2019, the Centre representatives expressed that it cannot be fully separated from the university/ies because its activities are closely linked to the activities of the university. Thus, on the one hand, the R&D activities and work packages of the CoE arguably cannot be managed independently from the university partners. On the other hand, the work packages and planned activities described in project documentation appear to be very much interlinked and dependent upon one another. These factors should be taken into account when deciding upon the future legal and organisational structure.[186]

Recommendations

In any case, there must be clear arrangements on participation in costs, maintenance, management, distribution of rights and obligations.

One possibility for organisational structure could be to establish a (joint) university institute.[187] Since Sofia University and Technical University of Sofia, each major beneficiaries, appear to require the pooling of their various resources in order to participate in the UNITE-project, these two partners should further explore the possibilities and advantages of establishing jointly a "university institute" under Articles 25 and 266 of the Law on Higher Education.

That being said, the expert panel recognises that establishing a parallel and additional legal entity could bring several benefits for the future operation of the Centre. This could be done under the NGO law (not-for-profit association, in Bulgarian - sdrujenie) and in the public interest as management envisages. A separate legal entity may serve to streamline funding and institutional support and should be formed once the CoE has a more developed activity and clear relations with industry. Establishing a single stand-alone legal entity would facilitate the development of the UNITe's brand and attract industrial and research clients due to more straightforward administrative processes and increased coordination and efficiency. In addition, such setup will enable internationally competitive salaries to attract experienced and skilful international experts needed to ensure UNITe's performance and increase its sustainability.

The management of the Centre expressed a concern that establishing an independent legal entity will require an adoption of specialised national legislation in order for this legal entity to be recognised as a public organisation and to be eligible for funding. The National Roadmap for

[186] Meaning whether the Centre should opt for a less integrated option/model or a more integrated one. See Chapter 2 (Legal Framework) and Chapter 3 (Organisation Framework) of this report.
[187] The establishment of university institutes is discussed in Chapter 2 (Legal Framework).

Research Infrastructures 2017-2023 recognises "Scientific Complexes" as eligible for funding – these are described as networks of similar thematically infrastructures that can be concentrated. This means that the Centre should already be recognised as such by government policy and any future programmes (e.g. of the National Science Fund) will have to reflect that.

To be able to achieve common goals, the management of all individual partners should adopt commercialisation as a part of their mission and support it by institutional policy, which will enable the establishment of effective joint participation in the CoE.

In Chapters 2 and 3 of the report, we propose a *more integrated option/model* for some Centres, which entails a separate legal entity with more competences conferred. If the partners in UNITe see this model as more appropriate to their situation (especially due to the highly interlinked and interdependent work-packages), then the new entity can gain rights to utilise the availability (manage the use) of the infrastructure and equipment purchased within the Centre project. The new entity may then apply also on its own behalf for EU framework financing and may become a member of European research networks. If a *less integrated* option is chosen, then the entity will have lighter and mostly coordination function with less staff.[188]

According to the CoE partnership agreement, the rights of ownership of the property belongs to Sofia University, and will be used by the owner and by partner universities according to the agreed rules. These rules have not yet been developed in sufficient detail, however, it is stated that the UNITe's Centre for processing and storage of data will be used by the whole scientific community in Bulgaria in public interest. Given the importance of this infrastructure, it is essential to ensure that the right of access to movable and immovable property is distributed between the partner organisations and (free) access is granted to the other parties only for the purposes of the project.

It is not recommended that the ownership of the equipment and real estates acquired within the programme is transferred to the CoE; the ownership should remain with the individual partners[189]. The depreciation costs are substantial and would most likely result in negative balance sheets with consequential loss of the access to EU framework financing. The rules for access to the equipment and personnel, and IPR protection should be unified and apply to all participating partners equally. Though the partners have agreed to ensure the sustainability of the partnership for the lifespan of the project, it is unclear what happens to the property and the equipment following the project completion (besides that the partners remain owners). Since the partners did not opt for joint ownership but kept a clear separation of ownership rights, the strong form of the vague right to access should be agreed upon until the completion of the project. Any continuation of the rights beyond the lifespan of the project should be subject to a separate agreement, as well as the right of the owner to repurpose the building after the project has finished and the additional 5 years sustainable operation has been ensured and completed.

As the CoE is focused on providing a variety of products and services within Big Data management and storage which requires the alignment with both EU and national data protection, sharing and security laws, it should have access to an experienced legal counsel to ensure compliance with data protection regulatory rules for all products and services offered to the market. A robust legal framework should be developed for the protection and sharing of data collected and stored in the CoE. UNITe mentions developing a plan for managing the data obtained though research, ensuring

[188] See again general body of report (Chapters 2 & 3) for description of the two models, as well as the possibility for a university institute.

[189] The transfer of ownership of equipment and research infrastructures is not *required* for the operation of the CoE. It is perfectly feasible that the individual partners lease the equipment to the CoE by means of an agreement.

that data is stored and used appropriately for a limited period of time and it is available for referral and reuse. UNITe also states that it encourages open data access wherever possible. It is important that the legal framework encompassing all data-related issues is fully compliant with GDPR framework as well as with the national data protection and privacy laws whenever the data collected is of personal nature, and explicit consent is obtained in every case where personal data might be used under open data schemes. This is particularly important when the data is requested for research use by a private (commercial) entity.

Organisational Framework

Ownership structure, Work packages, IPR

Sofia University is specialised in software and in natural sciences as well as running the Open Big Data services, the TU-Sofia is specialised in hardware and electronics and the other partners in mathematics, virtualisation etc. The Central Hub for the Centre will be located at Sofia University in its new building while the partners will maintain their institutional programmes accepting that the capacity and resources devoted to the Centre will be coordinated and managed by the Central Hub. A common scientific programme is to connect the nodes outside the Central Hub.

The planned activities are organised in nine work packages (WPs), ranging from big data software as a service to smart cities to big data in natural sciences with one of the partner organisations leading a WP (Sofia Uni and TU-Sofia each leading three WPs). The WPs are interrelated to an extent that activities of one WP ensure and/or directly feed into other WPs starting from Big Data Infrastructure as a Service (on base level) and finishing at Big Data Application (as a final result). Each WP is connected to at least several other WPs. This speaks for itself: the success of the CoE project is largely dependent on the close and regular liaison among the leaders of the nine WPs supplemented by overall coordination, direction and supervision of the R&D&I activities by top management at the CoE level operationally, and at the level of university/partner representatives strategically.

The Partnership Agreement states that the ownership rights of the results and benefits of the Centre Project, including IPR, shall be used by the partners on the basis of a share between 1/9 and 3/9. The Rules on Allocation of IP among Partners in the Centre state that during the 10 years initial period of the Centre "the potential benefits and revenue from the implementation of a development remain for general use by UNITE" and then there will be renegotiation OR the revenues and benefits will be eventually distributed among the partners according to the abovementioned shares. If a partner has had an outstanding contribution for the realization of certain revenues, a different ratio for the division of profit can be agreed by the partners. Considering the current arrangement, we see that the 1/9 and 3/9 arrangement broadly reflect the Work Packages. Most of the other Centres in Bulgaria do not put a fixed share but look at each case and activity individually signing a Protocol of Contribution. This will allow more flexibility in assessing the research results contributions on a case by case basis.

The Rules also state that the UNITE Centre should keep between 10-50% ownership in the research results created (the share is to be decided by the Board). However, in joint projects with external organisations this rule can be flexible so that UNITE Centre may also grant the full rights to the external partner (e.g. industry). To us it is not clear if (and how – in the absence of a dedicated legal entity) UNITE should keep ownership or the right to receive revenues from commercialised IP. As an example, the independent institutes of BAS usually provide between 10-20% of the revenues to the common Innovation Fund/Unit (Joint Innovation Centre) of the umbrella Academy and this could be

a meaningful approach also for UNITE when it established a separate legal entity. It is advised to further explore the relations between the BAS institutes and the Joint Innovation Centre.

Governance and decision-making; management of the tangible and intangible assets of the Centre

The Project UNITe is managed by Sofia University as a leading partner. The project is being implemented in the decentralised manner, meaning that legal, financial and administrative resources as well as the equipment and infrastructure are distributed among partners. The scientific personnel coming from different partner organisations remain employed by their parent organisations. Procurement is distributed and carried out by each partner separately.

One issue expressed by the Centre is that rectors should sign all documents creating an additional heavy layer of administration. It may be true that large procurements require administration but once this is completed, more decision-making power should be streamlined to the Centres' management to perform their operational activities directed towards R&D and industry liaison in a flexible, effective and accountable way, while leaving the most strategic decisions heavily impacting the development of the CoE to the rectors.

The CoE is managed by a Management Board consisting of seven members: two representatives of SU, two representative of TU, and one representative of each of the other partners in the consortium. The members of the board elect a Chairman for a 3-year term. The main task of the board is to provide the strategic direction. The board is supported by a Scientific Board (which includes leaders of the work packages as well as representatives of the associated partners) and Advisory Boards (composed of inter alia leading international researchers). To give a clear overview of the current organisational structure the following levels of management and execution exist:

1. Management Board (described above)

2. Board of Directors, chaired by the Executive Director, serving as the main executive body with directors for infrastructure, science, equipment, administration and knowledge transfer. The Scientific Director is subordinate to the Executive Director and coordinates the activities of the Work Packages. The Knowledge Transfer Director's described position includes activities for wide dissemination while technology transfer and start-ups are under the Director for Business Development who is also responsible for public procurement and construction. We recommend that, following the completion of the procurements, a dedicated Industrial Liaison Director should be engaged for the broader tasks of negotiations and to oversee and promote specific technology transfer activities.

3. Chief expert team: acting as a sort of middle management PMU with experts on administration, finance, architecture etc. We believe that this team might need to be restructured to reflect the operational needs of the Centre (and not the construction phase needs).

4. Executive expert team including expert contractors and technical staff such as on public procurement. These technical staff might also need to address operational needs and would be engaged only based on specific R&D project needs.

These four levels may be useful for the construction/renovation but after the completion of the procurements (and closer to the end of the six years) need to be reduced and/or simplified and streamlined to reflect **operational R&D activities** and not project implementation. The centralised management model, identified thus far as a key success factor in performance of the Centres,

might improve the CoE's performance by streamlining the decision-making processes and assist the development of coherent development strategy aligned with interests of all partners.

The general manager of the CoE should be a single full-time leader with broad mandate needed to achieve its ambitious goals. He/ she should be accountable and responsible for UNITe operations and performance and should be subject to an independent audit. The Centre should also hire a dedicated full time TT/commercial director, responsible for the business development, establishing networks and sales of services.

In multiple other Centres, we recommended the creation of thematic "Component Leaders" in the main fields of operation of the Centre, who can broadly be seen as consolidated WP leaders or leaders responsible for several related work packages (see also Chapter 3 of report).

The legal entity for the Centre has not yet been agreed by all independent partners and the CoE is not yet operational in part due to the fact that infrastructure and equipment have not been installed yet.

Last but not least, the CoE should consider accepting more specific (more integrated) rules for the building Campus Lozenetz as has been done for instance by the National Centre for Mechatronics and CleanTech for the Campus Studentski grad.

Research Infrastructure, State Aid rules and Monitoring

As in other Centres, free access is given by the partner owner of the equipment to the other partners in the Centre, including to the main new building of 4000 sq.m. in Campus Lozenetz and for the purposes of implementing the Centre project. It is planned that by providing access to the infrastructure to industry additional revenues can be collected.

The Project Justification (p.48) states that the Centre will perform 100% "not-for-profit" activities and this approach is maintained across project documentation. During the physical meetings with the experts in November 2019, there seemed to be confusion whether the Centre can "generate profit" or not and this might have been the reason for stating that it will operate not-for-profit. We must remind here that non-profit is not equivalent to non-economic activity.

A question was asked whether a change of the law is necessary to which we answer that the existent Grant Contract between the partners and the MA Agency allows the Centre to conduct economic activities using up to 20% of its capacity while at the same time requiring the separate accounting and a monitoring system. This report will help you understand the main rules under EU State Aid law (see also main Chapter on State Aid).

The Centre expressed also during the meeting that universities were not at the time allowed to create spin-offs. In the meantime (March 2020), the decree by the Council of Ministers implemented the law allowing universities to create spin-offs and setting conditions for financial contributions in the capital of the spin-offs.

Another question asked was whether the Centre or the individual partners should be the one creating spin-offs. To this, we can find the answer in the new rules from March 2020, which stipulate that universities **can create** companies/spin-offs for the realisation of their research results **and they can also participate** in the capital (of spin-offs created *by one of the other partner universities*).

In the project documentation, a number of potential joint projects are listed with industry relating to the design and/or development of particular systems and solutions where there would be a division

of tasks and human resources. If these joint activities indeed fulfil the minimum requirements for "effective collaboration", they are non-economic. This seems to be the described original plan and intention of the Centre.

However, if the universities/the Centre perform research on behalf of undertakings (contract research and research services) or renting of equipment, these activities are of economic nature. We remind that the Centre expressed that giving access to the infrastructure to enterprises will bring revenues. Furthermore, it is not clear whether the Digital Innovation Hub will perform research services to SMEs or only projects in the context of "effective collaboration". It is mentioned that the Hub will offer models, methodologies to SMEs among others. We are not aware of the specificities of these services/activities/projects and it will be necessary to make sure that **each transaction/contract/joint activity with industrial partner will have to be carefully drafted and classified so that it is clear what kind of activity the joint project represents (non-economic or economic).** We remind also that if economic activities are performed, these should be limited to 20% of the annual capacity. Finally, we note that in both non-economic and in economic activities, there are conditions to be fulfilled to avoid passing on state aid to the industrial partner/client. We refer you to the main part of the report (Chapter 4).

The UNITe should build capacity in implementing the state aid rules, i.e. planning, controlling, contracting and monitoring of the use of the research infrastructure.

Technology Transfer and Commercialisation

Centre's TT strategy outline and expectations

Apart from the IP rulebook, that was an obligatory part of the project application, the Centre at the moment has not developed long-term IP policy and/ or strategy. According to the survey, this is due to the fact that the separate legal entity has not been established yet.

The budget of the Centre project for IP protection and technology transfer is approx. 150.000 BGN and about 40.000 for development of policies and rules for IP and commercialisation. Sofia University's TTO is said to be responsible for commercialisation according to Project Proposal. Although during the personal meetings in November 2019 it was expressed than an own TTO has been considered it seems that Sofia University will play (the) major role together with the TTOs of the partners.

It is recommended that UNITe does not exclusively prioritise independent scientific research but also pursue commercial and business goals simultaneously and within the 20% capacity limitation. This approach might significantly contribute to improving the sustainability of the CoE. There has to be a balance in the revenues (also considering EU framework financing and access to national funds for research).

According to the financial plans, the first income of BGN 571K has been planned for 2020, reaching BGN 4.3M in 2023. In ten years from the beginning of the project, the income from sources outside the national and EU budgets are projected to reach BGN 19.1M. The main source of this income is envisaged as private 'investment' in joint R&D (59% of revenues or BGN 11.2M). These joint R&D projects are described as "effective collaboration". The income from licencing, consultancy services, fees for training and mobility programmes, sales of products, books and R&D results is projected at 43% or BGN 6.5M. The income from dividends or exits from spin-off companies created within UNITe is projected at 8% or BGN 1.5M. The Centre intends to take minimum share of 5% in spin-off companies.

Industry collaborations are seen by the Centre and described divided in two groups:

- ICT companies and joint projects with them based on the nine work packages (several of these companies are already involved as associated partners and clusters of companies) and
- non-ICT companies which are believed to be engaged for validation and pilot testing of new knowledge with living labs at their premises (joint projects).

A number of concrete ideas for joint projects and activities are listed in the project documentation that can possibly be performed in collaboration with industry.

A planned Digital Innovation Hub will be designed as a main channel for knowledge exchange with industry as a platform facilitating activities with external stakeholders and offering among others advice and services to SMEs, supporting start-ups with innovative prototypes as well as giving access to the Centre's open database. The Hub will help implement "specific research collaboration models" and a living lab as well as validation activities. During the meeting in November 2019, it was however not clear whether the funding for this Hub is foreseen to be exclusively as part of the Centre project or whether the parallel programme of DG CONNECT of the European Commission can provide additional funding. The recommendation would be to use the available funding short- to midterm and apply for DIH programme in the period following the first six years of operation.

Identified Challenges and Needs

- Grounds for the income planned in the financial sheets are unclear and unrealistic (i.e. unsupported by evidence), misaligned with current market needs and existing competence and traction of the TTOs of partner organisations:
    - The response in the survey indicates very low ability to attract investments, however according to the financial plan a great part (59%) of the income is expected from private investors. At the same time, no indication is provided of the attractiveness of the current or future R&D projects for direct equity investment or the feasibility of generating sufficient numbers of spin-off or start-up companies to commercialise the research results, which will be able to raise equity investment in seed rounds to meet the projected investment-based income.
    - An important limitation lies in the lack of experience of partner universities in start-up or spin-off creation. The early stage technology companies require careful growth and market strategy, team building, customer discovery, value proposition and delivery, commercial strategy, business case development, and financial modelling accompanied by financial support and management consulting to create a successful company. The plan for the spin-offs/ start-ups to accumulate the planned profit and reach the planned market capitalisation and exit in the short- to mid-term is not realistic even given the potentially commercially viable technologies already available within the universities.
    - TTOs at partner organisations have limited to very limited experience of IP management, limited industry contacts and no traction in commercialisation activity, however the income from licensing is expected to reach BGN 3.6M over the next 10 years. This goal is in principle achievable in the time period indicated but will require a dedicated TTO, a commercial director experienced in licensing deal structuring, strong industry links, and a sound understanding of current market demands as well as the

future technology landscapes. Significant effort should be dedicated to the personnel training as well as talent acquisition that is not reflected in the projected costs.

  - The financial discount rate used in the projections (4%) does not reflect the risk associated with early stage and research projects being spun out, where the risk typically varies from 90% to 30% depending on technology readiness level.

- In financial sheets (Financial Plan doc.) no income is planned from external use of infrastructure/equipment.
- There is an apparent lack of knowledge, skills and experience about the necessary internal ecosystem, which would enable and promote TT, formal channels of TT, procedures, and sources of translational funding.
- There is a lack of knowledge, skills and experience of the contemporary business development methodologies, incremental spin-off development and attracting early stage development funds from the market sources (crowdfunding, business angels, early stage venture, etc.)
- There is an insufficient number of skilled financial and legal experts for the business planning, compliance, control and contracting functions, and monitoring of the use of the research infrastructure.
- The relationships between the partners and the CoE regarding IPR, resource sharing, profit/ dividend distribution, and sharing industry contacts and leads have not been defined yet (except the above described arrangement on the IP use and sharing roughly divided according to WPs).

  There is a lack of entrepreneurial mind-set among both researchers and management.

Recommendations

(a) TT Arrangement for the Centres (Strategy, Policy and Process)

- Create necessary internal ecosystem that would enable and promote TT, establish formal channels, procedures and identify likely sources of translational funding. Invest in training TT personnel and talent acquisition.
- Create the unified IPR protection strategy that is recognised by UNITe and all founding partners.
- Build capacity in creating and managing the IP portfolio, particularly licensing agreements, copyrights and database rights.
- Build capacity on meeting the sector compliance requirements, with a focus on the requirements for products and services used outside of the research environment.
- Develop own custom arrangements based on the local context, considering inhibitors and motivators of local researchers and support of international experts instead of copying the best practices from successful foreign entities 'lock, stock, and barrel'.
- Create a funnel of spin-off ideas, focus on campaigns that promote an entrepreneurial mind-set. Identify the winning teams, secure individual financial and management consulting support for their entrepreneurial projects and promote the champions.

- Establish a database of industry contacts to use for strategic marketing search, identifying potential early adopters and seeking pilot partners. Ring-fence a part of the financial allowance to co-finance pilot projects with industry.
- Develop own systematic and supported "networking" practices to identify potential partners.

  Use the services of technology scouts or brokers, that can bridge the gap between academia and industry, or train own staff in these activities.

(b) Collaboration with industry

- Collaboration should be developed based on the industry needs, identified though primary market research for every technology accepted for commercialisation, and trust. The most reliable way to develop trust is trough traction i.e. by delivering services to industry via collaborative research or unpaid pilot projects. Leveraging existing industry contacts will build the traction and the brand.
- It is important to focus on industry sectors that absorb inventions, and approach companies that are known for growth strategy based on innovation.
- Due to lack of experience of existing TTOs at some of the partner institutions, hiring international agents and technology brokers will ensure wide technology exposure to industry, the valuable industry feedback, and build brand recognition.
- Considering State Aid rules and the expertise of the partners, the primary focus should be on engaging in collaborative research, followed by delivering contract research and consultancy.
- Build capacity in academia-industry interaction, contemporary business development methodologies and incremental spin-off development.
- Build capacity in fundraising focusing on attracting venture capital investment into early stage companies including investment proposition development, pitching, IP and start-up company valuation, term sheet negotiations, etc.
- Explore the opportunity to create additional revenue streams from leasing the equipment and highly qualified personnel to third parties for research, offer temporary secure data storage, data migration or data collection services, collaborate with the government on creating industry guidelines and best practices, and regulatory support.

Synergies and Complementary Initiatives

It is highly recommended not to develop own incubators or similar support but to find synergies with existing institutions and support programmes:

- The soft support is available from the Sofia Tech Park's incubator & newly established Grow Working programme for researchers.
- Sofia Tech Park offers a financing scheme for very early stage high technology startups (€75K) and free access to laboratories and innovators community.
- Financial support for Proof of Concept or development of prototypes is available from the Innovation fund, but is limited only to potential newly created spin-off companies.
- Regionally recognised private venture funds and accelerators stationed in Sofia such as Eleven and Lunch hub offer smart money for spin-offs in ICT sector.

- Explore the opportunity for collaboration with regional innovation centres (if those are eventually created), and especially the companies within them.

There are partial synergies with several other Centres: Digitalisation and digital transformation led by UNWE and QUASAR led by BAS. Synergies are also apparent with the Digital Innovation Hubs, which are in principle part of another EU programme and which have play a role in the knowledge transfer of the Centre to non-ICT industry. There may also be synergies with the other High Performance Computing infrastructures across Bulgaria.

KPIs

Straightforward key performance indicators demonstrating the effectiveness of activities for commercialisation but also the final financial results should be implemented:

- Cost benefit indicators of IP: cost of protection vs. income from IPR exploitation
- Indicators of market conversion: leads, hot leads, contracts, income from contract research or consulting
- Indicator of licensing: number of licensing agreements reached, income from royalties
- Indicators of effectiveness of marketing channels: income vs cost of marketing channel
- Indicators of effectiveness of scouting activity: income vs cost of customer acquisition
- Start-up funnel: number of ideas, number of pre-seed stage teams, number of start-ups, total investments raised, total value of exits, total value of equity share
- Social impact: number of services/programmes with social impact implemented, number of beneficiaries (institutional partners), number of end users

It is worth noting that IP related KPIs such as number of patents or patent applications is not always the best indicator when the centre does not want to disclose it exclusive knowledge, which is frequently the case working with defence industry or holds significant soft or unprotected IP as is the case with software development. Therefore, IP-related KPIs should not be used as the sole determinant of excellence of the Centres; and is not particularly relevant for this CoE. Commercialisation does not always require the generation or use of IP. Furthermore, scientific and technical excellence can also be derived from the number of articles published in scientific magazines, the citations index and the impact factor of the peer reviewed journal, number of spin-offs created, number of licensed software or databases and R&D activities. Joint R&D projects with industrial partners are already established as a part of the mandatory KPIs for the centres, however, this is a compound metric and these projects would be better classified in terms of their nature (as collaborative or contract research or research services) with their financial characteristics recorded (e.g. size of contracts). In case of this CoE, social impact should also be a very relevant indicator of performance.

The Digitalisation Centre by UNWE is focused slightly more on applied research activities aiming to provide big data analytical services, ERP and process digitalisation/optimization. The UNITE Centre of Excellence should not forget that it is not created to serve industry but to perform excellent independent R&D and, where relevant, engage in projects with industry.

CENTRE SUSTAINABILITY

Requirements and Expectations

UNITe expects to use resources within the next operational programme, but also to be able to apply for EU funding for research projects. As there is no current availability of private sector sponsorship, angel investors and venture capital for translational funding, CoE expects to use national, EU and other international grants instead. The National Roadmap for RI may also provide operational funding.

Recommendations

The expert panel distinguishes between short-term and long-term sustainability. For short-term sustainability, the experts consider it of paramount importance that the UNITe identifies short- and middle-term needs of local and regional industry, aligns its R&D agenda and business development efforts to these needs, and secures contract research assignments. However, it is very unlikely that the UNITe will be able to reach self-sustainability in the short term therefore it should continue seeking national, EU and international public funding. Such independent or collaborative research projects may be used to initiate subsequent or simultaneous contract research and/or longer duration effective collaboration.

A dedicated university institute and/or a separate legal entity (association) should be established to facilitate the long-term sustainable management, coordination and joint effort of the partners. If a more integrated option is chosen, an entity with full access to all infrastructure and equipment of UNITe could be viable for additional sources of public financing.

The general recommendation is to use contemporary approaches to business modelling as the way to develop several well-researched product and service offerings based not on the general market need and global technology trends but on the **specific requirements of the local and national market players.** These needs should be focused on the pain points within the data collection, data management, data analytics, etc. faced by the local companies and foreign companies operating locally. All product and service offer developed should be supported by value propositions, business plans and financial modelling considering the costs of the technology, product or a service to market and the expected commercial or economic benefit derived from the technology implementation. The UNITe resources should only be engaged when there is a very high certainty that the research results can be commercialised.

Target segment/needs identification is the first step, which will be eventually followed by the development of innovative solutions with wider industry appeal and potential for international commercialisation.

The established TT evaluation procedures will help to identify these; and the engagement with the international technology scouts and brokers will ensure the exposure of such technologies to the international markets. These are likely to be rare cases. The majority of the developments should aim to answer the need of the local society to assist digitalisation and Big Data harnessing in industry sectors open to innovation.

ROADMAP ON LONG-TERM SUPPORT

Evaluations of similar programmes in the South East Europe showed that progress in the performance of research and innovation ecosystems is only visible in the long term. The main reason for that is the huge gap between academia and industry, but also between academic partners. Centres have the potential to act as boundary spanners, only provided that there is

enough time to develop trust among key players. Therefore, the next national Operation Programme should extend the support for the centres including the following new features:

- capacity building in terms of soft skills for
    (a) contemporary bottom-up business development
    (b) Academia – industry interaction
    (c) Targeted Global networking
    (d) Strategic management and development of IP
    (e) Non-linear TT process
    (f) Contemporary spin-off development and attraction of early stage investments
- Foresee financing for limited number of DEMO projects selected upon interest demonstrated by industry
- International independent monitoring and evaluation

9.3 Centre of Excellence "Informatics, Information and Communication Technologies"

Summary of Centre

Identification number: BG05M2OP001-1.001-0003-C01

Budget of the project: 29 355 861,12 BGN

Leading: Institute of Information and Communication Technologies – BAS

Start/end date: 03.08.2018 – 31.12.2013

Specific goals: Developing an advanced electronic infrastructure – high performance computer systems, data storage resources and services – as well as granting access for Bulgarian researchers. Integrating the different layers of an e-infrastructure with common/ standardised services as well as services specific to the different scientific communities, in order to create a virtual research environment. Stimulating the development of a big scientific capacity in Bulgaria and promoting interdisciplinary approaches. Providing features that allow data management for scientific communities. Providing adequate training and support programmes to the users in Bulgaria.


Leading organization:
Institute of Information and Communication Technologies - BAS
Project name:
Center of Excellence in Informatics and Information and Communication Technologies
Partners:
1 • Institute of Mathematics and Informatics – BAS
2 • Institute of Mechanics – BAS
3 • National Institute of Geophysics, Geodesy and Geography – BAS
4 • Medical University – Sofia
5 • Plovdiv University - "Paisii Hilendarski"
6 • University of Library Studies and Information Technologies
LEADING ORGANIZATION
SOFIA
5
PLOVDIV
Contract: BG05M2OP001-1.001-0003-C01
Budget: BGN 29 355 861,12
Start date/end date: 03.08.2018 – 31.12.2013

CURRENT STATUS OF CENTRE

The project of this CoE formally started on 3 August 2018. The Centre has 7 partners in the consortium (4 institutes of the Bulgarian Academy of Science and 3 universities), but about 93% of the funding allocated to the Lead partner the Institute of Information and Communication Technologies – BAS (with full responsibility for procurements and contracts). This represents, in comparison to other Centres, a highly centralised model.

The site where most investments are made is located inside the leading partner premises, which appears to be in reasonable refurbishment state, with ongoing upgrades in the buildings, which will host the High Performance Computing (HPC) part. The other partners receive smaller investments and are involved through a collaborative approach managed by a General Assembly and a Management Board. Competences made available from the partners span from software (mathematics) aspects, materials analytical computing requirements, to medical and environmental data requirements.

Until February 2020, only 7.23% of the total budget was spent. It is partially related to the project implementation stages. The Centre has two stages of development – Data Centre and HPC systems – with ongoing development of the 3D microstructure lab in both phases. The first stage is believed to be completed in 2020, while the second stage will be completed in the next 3 years. The planning in two phases takes into account the fairly rapid obsolescence of the hardware which will require updates and upgrades with three to five years cycles.

The Centre received considerable political attention with visits of the Commissioner, deputy Prime Minister etc., who recognised it as a strategic infrastructure. The Centre is trying to build its position and visibility for example through their own website[190], which is fully operational since April 2019. It also has considerable media presence through interviews, conference presentations, and mainly national news coverage. More than 30 scientific results papers are recorded on the project website.

From the **analysis of the completed questionnaire**, the following observations were noted:

- Clear choice towards keeping the present structure (agreement-based), with no plan to adopt a legal entity, however still declares the concept of governance "under development".
- The basic financial budget for research is EUR 226 000. Only one technician is planned to support the activities; ratio research and technical staff to administrative staff: 26/14, but not sufficient "good quality" legal and financial expert support.
- Science and Technology (S&T) activities organised along 11 projects for which Partners provide operation costs "in part". At present 23 collaborative projects are undergoing (no contract research).
- Marginal costs expected to be charged to users ("Estimation of the support effort: the actual mean rate multiplied by the number of people multiplied by the period" – no accounting of overhead) and about 10% expected realistic income from private sector.
- No budget or personnel allocated for TTO, but the present staff includes people with competence to develop required services
- Expected sources of funding: government and EU grants. Barrier for (more) significant liaison to industry: low salaries allowed for technical support staff.

[190] http://ict.acad.bg/

- Listed KPIs still mainly related to the setting up and establishment of the infrastructure.
- No policy yet for licensing IP to existing companies or the setting up of spin-off companies.

Identified risks, needs and challenges

- Risk due to rapid obsolescence of equipment, and possible lack of further investment after 2023.
- Low capability to attract needed technical support also in view of end of maintenance contracts.
- Insufficient availability of operational funding (and staff) to achieve full potential use of facilities.
- Possible risk of incomplete cost analysis due to a lack of analytical overhead accounting, and possible under-costing of services triggering state aid/unfair competition in (albeit limited) commercial services.
- Lack of a clear statement on how important a policy is for alignment / synergies with EU programmes and existing Research Infrastructures in the field, e.g. coordination with HPC and European Open Science Cloud (EOSC) programmes in Europe.
- Lack of a structured international advisory Committee and quality control for research access.
- Access management may need to be better defined, based on effective practice.
- Software development may need more independent capabilities and trained personnel.

Other Issues and strengths

- Strong support by the main hosting institution, which has also most of the project resources and responsibility.
- Management of the partnership structure as presently trust-base tested and developed.
- No need to go to separate legal entity (but may require clear structuring within the BAS).
- Timeline of procuring and setting up the Centre's equipment (takes into account the fast pace in ICT).

LONG-TERM VISION

According to the project application, the vision is to set up the Centre for the purpose of advanced computing and data processing. It will bring together the efforts of leading Bulgarian researchers in the field of high performance and distributed computing and will provide access to computing resources at the highest level. It will provide the means for data storage and processing using modern protocols, software, and middleware. Establishing a modern datacentre with the ability to store and process petabytes of data and a computing power of several petaflops, will cover the needs of innovative research and applications at a national level. Deploying a hybrid supercomputing complex with a capacity of over 1 petaflop will ensure the continuation of the research initiated during Phase 1. Using next-generation computational technology will lend research relevance and sustainability of the Centre's work in the medium term, and provide an attractive environment for young scientists.

Additionally, the vision refers also to maintaining connectivity to major European electronic computing infrastructures – the European Grid Infrastructure (EGI)[191] and the Partnership for Advanced Computing in Europe (PRACE)[192] – and ensures the adequate participation of Bulgarian research teams in the international consortia that use these infrastructures. The open access, regular training and the necessity to resolve arising issues and problems will enable Bulgarian researchers to develop their applications and achieve research results that would otherwise lack the necessary hardware resources and expertise. Similarly, the Centre is expected to provide opportunities to develop innovations that are of strategic importance for the development of the IT sector in Bulgaria towards services with high added value.

This vision is sound and follows a number of examples in Europe. The existing knowledge base and previous experience are a strong starting point. The way in which this vision is embedded into the planned organisational frame is still conservative and based on previous experience. The effective challenges will be met when the full infrastructure is set-up and will need to find the right balance between in-house research and service activities.

Legal Framework

Currently, the Centre is established as a Consortium of four institutes of the BAS and three universities, with some associated partners. The decision to form as a consortium without a legal entity seems well justified, not only because the leading partner institute has had similar experiences in the past years coordinating a consortium of partners, but also because the majority of investment will be made at the leading partner institute (90+%) so that it becomes an integrated and indispensable part of the IICT.

In this specific case, and for the project implementation timeframe, the creation of an independent legal entity does not seem necessary, given the claimed experience that the lead partner institute has accumulated, the high concentration of funding, the clear leadership role and the organisational integration of the Centre into the lead partner, and the wide possibility for the BAS Institutes to have industry-related activities. This project, and the acquired instruments, are already strongly concentrated in an existing institute showing specific specialisation and capabilities. Leaving the property of the other (somehow complementary but not critical) instruments to the other partners is not limiting the outlook for long-term integrated activities.

Recommendations

While the proposed choice may be effective in the short to medium term, the growth of an effective HPC Centre, with the need of a three-to-five years cycle in the renewal and upgrade of the mainframe equipment, will require a strong leadership and support by the State/Ministry of Science and/or BAS central budget, to ensure that the Centre keeps its competitiveness. The focus on equipment should be connected to a continuous development of the software and "humanware" capabilities, to ensure full use of the HPC capabilities, as well as the capability to attract and serve external users. If the Centre remains completely within the BAS it should still get sufficient recognition, funding and some degree of operational autonomy dedicated to achieving its objectives.

In the medium to long-term, there is an increased need to:

[191] EGI – Advanced Computing Services for Research, https://www.egi.eu/
[192] https://prace-ri.eu/

- create even more critical mass for HPC, data management, different IICT based services and other related activities,
- strengthen interdisciplinarity,
- strengthen and concentrate skills and human capacity in relevant areas,
- consider the possibility of integration and synergies with other projects from the IICT sphere of activity (e.g. UNITe, Digitalisation DEBD, Heritage.BG etc.) as well as with the upcoming supercomputer to be located at Sofia Tech Park's premises.

This kind of infrastructural, functional and organisational integration, might be operationalised through the consolidation of key activities, which should be built internally in the lead partner institute (in synergy with the broader structure of BAS).[193]

Considering that this is a CoE and is an indispensable part of the lead partner IICT, we consider the current choice to maintain the present structure as sound, i.e. to retain the present legal structure and to focus on building capacities instead (see below in the forthcoming sections).

Organisational Framework

The Centre presents a very centralised management model. The leading partner holds a very significant share of financial resources, equipment, and infrastructure installed at its premises. In addition, the core project team members are direct employees of the leading partner. There is also strong BAS institutional support. It is clear that the major (almost exclusive) beneficiary and driving force of the proposed Centre is the leading institution (institute of BAS). Other partners are marginal in terms of project spending and project future results.

The partners' obligations towards the Centre are the following:

- Each partner leads at least one Research Project (out of 11).
- Each partner has a financial contribution to cover part of the running costs, including, electricity cost for the equipment that is provided for their use; cost of some local renovation/adaptation of the labs where this equipment is hosted, etc.
- The partners provide some administrative support concerning their participation in the Centre activities.

According to the project proposal, the Centre has the management structure currently based on the Management Board (MB) and the General Assembly of Partners (GA). The **Management Board (MB)** is responsible for:

- Current project management, including:
  - Organisation and overall coordination for project activities implementation;
  - Coordination of the scientific and technical project programmes, and dissemination and exploitation of the project results;

[193] This does not however mean, that some particular activities or tasks cannot in principle, be "outsourced" to a wholly-owned legal entity – e.g. for matters related to marketing, building relations with business, technology transfer and commercialisation etc.

- Monitoring of scientific infrastructure development and usage, financial management and budget distribution;
- Applying the policy for access to the CoE' equipment.

• Strategic decisions taking on project implementation, research activity and innovation strategy control.

The Director of the IICT – BAS (the leading partner) has an exclusive right to determine the MB staff that includes: the Director of the CoE, Deputy Director of the CoE, Person in charge for financial management of CoE, Person in charge for scientific infrastructure of CoE; Person in charge for innovations. The MB is assisted by the Management Team.

The General Assembly of Partners (GA) consists of one representative of each partner and associated partner in the project. The GA assesses research activity and innovation strategy implementation and represents partners' opinion for existent CoE policies.

The current director of the CoE has been leading similar consortia projects and structures in the past involving other institutes and universities (e.g. CoE in Supercomputing Applications (SuperCA ++)). It is stated in the project documentation that the proposed management structure of the CoE is based on the IICT's experience in implementation of similar projects. During the meetings, the CoE expressed that it needs recommendations for a "better business model", which in our opinion includes not only the organisational aspects but also the relations with industry and the transfer of technology.

Recommendations

Taking into account the level of centralisation of the project management and implementation, as well as its importance for the IICT – BAS, the Centre should consider, when entering the longer-term operation phase, to integrate the management of the project with the management of the Institute.

This would clarify who is responsible for the CoE's development (IICT institute at BAS). Rationales for such an idea come naturally considering that the lead partner already covers a very wide range of responsibilities. This would simplify the future structure and allow taking care of two basic aspects.

One is related to the effective leadership of the research activity, including monitoring, strategy development and individual researcher's career development, which would be run by the Scientific Committee (SC) of the Institute including representatives of the current project partners.

The second aspect, currently lacking, is the stakeholder engagement. It could be achieved through setting up of an International Advisory Board or similar structure, where highly reputable representatives of international and national research and industry representatives will be present. This structure should strengthen connections with major scientific and business players in the area, support the choice of strategic scientific and innovation directions (priorities), but also support the recognition and visibility of the Centre.

When the above recommendations will be implemented, it should be ensured that some structures of the initial project are not kept and duplicated under one umbrella of the IICT – BAS. Such duplication would not support efficient use of resources and hamper transparency (as some aspects/activities could be managed, supervised or advised by parallel structures).

- Note: The participation of the other partners could and should still be guaranteed. According to the experts, to continue to maintain a partnership agreement would be the most natural

and effective solution. In 2023, the partnership agreements should be revised/updated as necessary (or there could be for instance one framework agreement for the Centre and more-specific R&D operational agreements for each research project).

Allocation of IPRs

Below, we briefly list the rules and current arrangement for the allocation of IPRs among partners.

- *The partners are equal in terms of IPRs arising as a result from implementation of the project.*
- *The IPRs arising as a result from implementation of the planned Research Projects under Activity II "Conducting independent R&D within the framework of CoE" belong to partners who implement them.*
- *The IPRs arising as a result of joint work of more than one partner implementing the tasks under Activity II "Conducting independent R&D within the framework of CoE" are distributed equally between the partners, unless previously agreed otherwise specifically distribution rights.*

This arrangement is somewhat similar to other Centres (most Centres share the IPR based on the contribution of each partner to its creation), and also this aspect should be taken into account when the CoE will enter into the longer term operation, and eventually be embedded into the ICT-BAS. In this sense, the current "equality" statement may not be appropriate.[194]

RESEARCH INFRASTRUCTURE

During the meetings we were first asked to clarify the definition of "research infrastructure".

<table>
<tr><th colspan="2"><u>What is a Research Infrastructure in the EU? Definitions</u></th></tr>
<tr><td>As in Commission Staff Working Document: Sustainable Research Infrastructures: A Call for Action[195]

✓ Facilities, resources or services of a unique nature that have been identified by European research communities to conduct top-level activities in all fields of science.
✓ This definition includes the associated human resources, covers major equipment or sets of instruments, in addition to knowledge-containing resources such as collections, archives and data banks.
✓ RI may be located in a single site (for example, large telescopes, Synchrotrons, High Performance Computing) or can</td><td>As in Framework for State Aid in R&D&I[196]:

✓ Facilities, resources and related services that are used by the scientific community to conduct research in their respective fields and covers scientific equipment or set of instruments, knowledge-based resources such as collections, archives or structured scientific information, enabling information and communication technology-based infrastructures such as grid, computing, software and communication, or any other entity of a unique nature essential to conduct research. Such infrastructures may be 'single-sited' or 'distributed' (an</td></tr>
</table>

[194] See also the standard Horizon arrangement (explained in Chapter 2 - Legal Framework - of this report).
[195] https://ec.europa.eu/info/sites/info/files/research_and_innovation/research_by_area/documents/swd-infrastructures_323-2017.pdf.
[196] Communication from the Commission: Framework for State aid for research and development and innovation, (2014/C 198/01).

be distributed across even large number of sites working jointly (for example, biobanks, archives, marine stations).	organised network of resources)

The specific aspect that distinguishes an Infrastructure from a Facility or Equipment, embedded into an Institute or a University, is the specific mission to be open for external users. This means that the management of the infrastructure must assure the technical and scientific support to attract and give a scientific service to users who may not be technically trained to use the infrastructure. This, in turn, requires that the management is capable to attract proposals by external users, evaluate these proposals in a fair and equitable way (e.g. by independent peer review) and give assistance to allow the users to achieve the best use of the infrastructure. Analysing now the proposal of setting up the CoE, six specific objectives have been listed mostly related to set up and use of the new research infrastructure. These include, among others, developing an advanced electronic infrastructure – computer systems, data storage resources and services – as well as granting access for Bulgarian researchers; the integration of the different layers of an e-infrastructure with common/standardized services as well as services specific to the different scientific communities, in order to create a virtual research environment; stimulating the development of a big scientific capacity in Bulgaria and promoting interdisciplinary approaches; data management for scientific communities; training etc.

These objectives are safely within the definitions and outlook of research infrastructures as defined above. However, when coming to the implementation, at present, the focus is very much on the construction phase. In the experience of most research infrastructures, the transition from construction to operation is a critical phase and needs to be planned well in advance.

The project KPIs are mostly connected to the implementation phase. These are clearly concentrated on technical (internal) and scientific activities of the project, and none of them measures market activity or external impact. This reflects the overall vision of the project to increase the scientific capability of the Bulgarian scientific environment. However, the market activity/external impact should be integrated by a presentation and KPIs related to the way the CoE will operate and attract external researchers, also by providing the needed information and supporting the selection and training of future users.

Coming to a more technical description of the progress, at present, a new HPC Systems was installed in 2019, based on 40 servers Fujitsu Primergy RX 2540 M4. The further development of the research infrastructure includes:

- a Data Centre capable of storing and processing more than 3 PB of data;
- maintenance organisation for capacity expansion helping to ensure a more sustainable development;
- a Supercomputer Complex based on the latest generation of technologies, with an emphasis on energy efficiency, peak performance over 1 PFLOPS and 24x7 operating mode, enabling solution of wide range problems with high scientific and social impact;
- a Laboratory for 3D Digitization and Microstructural Analysis, which includes industrial computed tomography, 3D laser scanning and dynamic processes digitization equipment.

The huge amount of data being produced will be stored and analysed using the new capabilities of the Data Centre and the Supercomputer Complex.

Coming back to the issue of the future operation, around 50% of the funding for basic operations is planned to come from BAS, while the other 50% from the National Roadmap for Research Infrastructures (Ministry of Science). This mix of funding, if it will be sufficient to cover the basic operation, should ensure the access by researchers coming from the public (academic) environment (national and also international) and the capability of the Centre to attract and select users on the basis of a quality-based selection (international peer review), thus ensuring the "capture" of the best users available.

The management will, however, need to define how to attract, alongside the academic researchers, also industrial and other non-academic users (e.g. State services needing to manage Big Data), and how to calculate and charge for these services in such a way to cover effectively the costs and allow reasonable margins. This will need to make a detailed analysis of the existing "market" (and shall be reflected in a specific set of KPIs).

The plan to have three "test calls" during the project is a good move. If well designed, it will teach a lot on what needs to be done when entering full operations.

The technical parts, which will be acquired during the construction period, and the pre-existing capabilities and experience are an adequate base to reach the vision of the Centre. But the detailed planning should be developed and submitted to a critical review of a set of international experts, to be able to invest the available resources in the best way when the Centre will reach the full operation level.

From a formal point of view, the Access policies to the RI are designed to ensure the implementation of Open Science principles for academic users. The activities of the Centre described in project documentation are claimed to be in a full alignment with the State Aid monitoring requirements.

Recommendations

The CoE builds on an existing knowledge base in informatics and computer science (incl. an existing supercomputer, 6 years old), with a specific part on materials computer based 3D tomography. It is strongly embedded in the lead partner, the IICT. Orientation to industry requirements, potential or already existing based on past programmes, seems satisfactory. However, it will require planning for the entry into operation of the new capacities and continuous improvement in the long-term, aiming to achieve a solid success in the 'start-up' phase.

The proposers plan to have three "test calls" during the project duration, also to test the attraction of possible industry users: these calls should be carefully planned based on what is really available and taking into account the future capabilities, to be effectively useful for the potential users.

Experts agree that every 3-5 years the equipment would need to be upgraded. This issue is addressed by the two-stage structure of the project, but high maintenance and renewal costs have to be secured also into the future, beyond the project timeframe. In the longer term, when the CoE will need to build a larger market and a stronger partnership with relevant contributors, including the capability to renovate the equipment, the Centre may require specific arrangements in the ownership of some critical parts. For example, it could be useful to attract and host (within lean contractual agreements) additional "computational nodes") owned by external users, for instance Pharmaceutical or Energy Companies (also at European level) or attract additional investment and operational support within the healthcare system for the analysis of Big Data (e.g. in the case of pandemics like COVID) etc.

Monitoring mechanisms, e.g. based on the effective use of KPIs, should be coupled with a feedback mechanism on the management of the Centre. Similarly, as in all research infrastructures that seek to become competitive at national and international level, the management should be able to rely on and make good use of the independent and critical advice of an International Advisory Committee. The monitoring mechanism based on key performance and impact indicators, should be further developed in discussion with the external advisors, and used by the management as a tool to drive and assess the effectiveness in exploiting the resources available.

STATE AID RULES AND PRINCIPLES

A necessary tool is the separate accounting system of the Centre/its partners, which should allow monitoring of resources and capacity usage in a manner that distinguishes economic from non-economic activities. A system like this is mandatory if the CoE conducts economic activity (and also under the Grant Contract) and should help decrease the risk of non-compliance with state aid rules.

The CoE asked during the meetings how to calculate the costs of its services. As regards the formulation of the fees/prices for services, including access to the infrastructure to industrial parties we refer this to the general part of the report (Chapter 4 on State Aid) where we explain in more detail the core principles and conditions. This field (ICT) is sufficiently developed in Europe to **be able to verify what the "market prices" are for services** developed and define the effective strategies in this aspect.

During the meeting in November 2020, the Centre expressed that there is high interest from industry clients to use the infrastructure of the CoE/IICT. These requests could also turn to private providers to receive these services (e.g. Amazon). The competitive advantage of the CoE/IICT is believed to be not in the services which are of similar or the same nature but in the provision of value-adding support (scientific services, capacities and skills) resulting in the offer of a "sale of service" and not the sale of mere access. As these seem to be activities of economic nature, all rules for the capacity usage (under 20% and ancillary activities) and the price formulation (charging market prices or the equivalent) are applicable – see Chapter 4 of this report.

In relation to that, the proposers have not given details on pre-existing economic activities (research on behalf of undertakings) but only listed several "collaborative research projects". The CoE and IICT, when entering the operation phase, should design their accounting rules and procedures in a way allowing them to be able to clearly classify each contract with industry and the related income and expenditures as either within the area of an economic or a non-economic activity. Only if the transaction/arrangement fulfils the conditions for "effective collaboration" in the meaning of EU State Aid rules should the activity in question be classified as non-economic.

Furthermore, the CoE/IICT asked to have the opinion of the experts:

> "*about the positioning of the available funding schemes, e.g. through the Bulgarian Innovation Fund in the context of EU State Aid Law in R&D&I and the related two core modalities for joint projects with industrial partners*".

We have checked the latest call (10th call) of the National Innovation Fund and its latest Rules for Governance of 2019 and it appears that the aid intensities resemble the allowed intensities under Article 25 of the Commission Regulation No 651/2014 (the GBER). In these projects, the public research organisation should cover at least 10% of the eligible costs and will have the right to publish their own research results. It has been clarified by the CoE representatives that a specific issue that has arisen is that the research organisation is often seen as a "large enterprise" by the

National Innovation Fund and OPIC programmes and expected to co-fund 1/3 of the projects' value. The experts believe that this should not be the case and that a clarification should be achieved.

For other projects in which the CoE/IICT engages with industry (which are not financed by the National Innovation Fund), please refer to the general part of this report. Chapter 4 mostly explains how to apply the principles of the Framework for State Aid in R&D&I for research on behalf of undertakings (economic activity) and for effective collaboration (non-economic activity).

Technology Transfer and Commercialisation

For exploitation and commercialisation of the research results, the CoE will use the experience of the Office for Technology Transfer existing in IICT and apply the relevant regulations of the partners. Another source of support will be the Joint Innovation Centre of BAS (since IICT is naturally part of the umbrella of BAS). The JIC is a coordinating unit within BAS with the mission to facilitate the formation and implementation of innovation policy of BAS and its institutes.

As to the human resource development for industry liaison, the CoE plans to engage the researchers, that are coming back from countries with stronger relations between industry and that those in Bulgaria, in activities related with industrial developments and innovations.

As is rightly pointed out in the project proposal, there is still a clear difference between the high scientific research level of some Bulgarian public research groups and the low absorptive capacity of most Bulgarian companies. According to the proposal, the absorptive capacity for scientific results of Bulgarian SMEs can be enhanced through additional training and consultancy by people who possess important knowledge and skills rather than by simple transfer of research results. The Centre is going to develop means of using the know-how of foreign companies and apply it to the Bulgarian SME sector or to help SMEs connect with global innovation chains via R&D projects.

The project proposal presents comprehensive and, to an extent, sound concepts and activity plan for marketing, dissemination, technology transfer and commercialisation activity. However, information collected during experts' missions and through the survey does not confirm adequate level of implementation of the stated activities in the proposal. For example, it is clear from the survey, that no project budget is allocated to TTO activity and there is no personnel dedicated to TT activity of the Centre (besides the person hired "responsible for innovation" member of the Management Board). One major barrier for that activity is the lack of competitiveness and balance in salaries, i.e. the existence of low salaries for the research/development staff and high salaries for the qualified technical staff in industry. Strengthening the TT capacity of the lead partner will also strengthen the TT capacity of the CoE project since it is an integral part of it.

The Centre shows pre-existing industry collaborations with 17 industrial contracts in 2018, mainly with SMEs, but most outcomes seem to be within the research area (publications, joint participation in projects building of partner networks, educational programmes etc.)

It is clear, that the products of the Centre are highly variable. It is difficult to organise a standardised service, with a standard marketing and commercialisation approach. In most cases, the major customers will be research Institutions, who may bring along industrial users needing specialised developments. There may be some services that can be developed on a more standardised basis, but with a lower research content and only based on the computational power. The balance between the "standard" and "advanced" use of the supercomputing power will be an important factor in the quality growth of the Centre.

According to the interviews, the Centre will not provide external users with direct access to the use of infrastructure. The core philosophy for commercialisation of this Centre is providing knowledge-intensive services. There is a common understanding, that the Centre's added value is combination of skills and capacity. As already pointed out, the CoE then offers this as a "sale of service" and not a sale of access.

Although we did not identify across the project documentation any specific funding dedicated to commercialisation, the CoE representatives stated during the meetings in February 2020 that there is some funding for IPR and commercialisation policy development as well as for small "pilot projects" with industry. This builds upon the expressed wish by the CoE earlier in September 2019 that it would be useful to have funding for such pilot projects where businesses can verify the added value and potential of the equipment.

Recommendations

In the short term (already before the full entry into operation), the CoE needs to prepare itself for the implementation of more comprehensive knowledge and technology transfer/IP commercialisation activities than those stated in the proposal. All industry-focused processes should be designed and streamlined, and relevant personnel should be employed. Different option could be explored but in general core TT responsibilities should be assigned to internal personnel (building internal capacities at IICT) while more specific/highly specialised and/or technical tasks can (at least in the beginning) be delivered by externally contracted consultants/organisations,such as complex market research assessment or identification of particular IP strategy. In the medium to long-term horizon, strategic decisions should be taken on business-related processes and related resource allocation.

Generally, ICT inventions do not benefit from patent protection, with an exception of several countries, including the US whose legislation still allows for protecting programme code. Protecting in the US is however expensive and should be an option only if the Centre is convinced that an interested party in the US will license the copyrighted code/product. Often the strategy around protection of the programme code and the relevant know-how will navigate around 'defending' the IP, meaning trying the best to prevent the source code being seen or leaked. There are other strategies to protect the interest of the creators, including drafting strong confidentiality agreements and charging small fees for development/test license. Another strategy would be to license to reputable companies, who have the track record in honoring licensing agreements (often the big corporations do not follow the rules themselves, unfortunately, as they have abundance of liquidity to fight court cases therefore, 'big' partners are not always the best solution).

There is literature on the topic of commercialisation of ICT inventions and also materials can be found at the ASTP Proton and other similar organisations websites for further advice.

Training and awareness raising activities can be implemented with participation of SMEs and large industrial organisations to create a positive environment around the Centre and develop a network of current and potential users. There is a strong need to attract companies for research and innovation cooperation through engagement in different activities, also using the contacts already established. Launching of pilot projects in cooperation with SMEs, also based on the infrastructure already existing in BAS, can be a good first step in the process.

CENTRE SUSTAINABILITY

Although it is not entirely clear from the financial statements and analysis of the project proposal, the future activity of the project post-2023 is expected to be based on a mix of public financial resources (national or international) and projects with private/industry engagements.

Historically, we understand that the lead partner institute IICT manages to ensure sustainability of its present activities through EU and national funding sources. After the project is completed (post-2023) and based on the partners' experience, the CoE expects two main streams of income: one from EU projects and one from industry. In relation to the EU projects, the expectation is that the new infrastructure will allow winning European projects for at least 10 million BGN during the financed period (1st -6th year) and at least 15 million BGN for the whole period of the project (six plus five years). This approach was confirmed in the project presentation for experts in February 2020.

As for the industry, reference is made to "joint research projects with companies, know how transfer or contracted scientific and applied research" representing sources for a minimum of 200 000 BGN per year and 800 000 BGN from other contracts. However, it is not clear what this "other" contract category actually includes.

The CoE believes that the advanced nature of the hardware would generate interest also from big companies, particularly branches of leading international companies in carrying out joint applied research, which would utilise the unique characteristics of the infrastructure.

From another perspective, we should also note that the non-direct non-financial returns, that is, returns of societal and environmental value, can be high..

The infrastructure planned for this project, will be fully integrated within the European e-infrastructures, as supported by the current positions of the participating partner organisations. New infrastructure, which will be funded through the Centre, is expected to have a synergistic effect on two types of investments in basic as well as applied research:

- first, on the national projects financed by the National Science Fund along with projects for applied research, funded by the Innovation Fund; as well as other similar initiatives at local level.
- and second, on the projects for scientific research, financed by European programmes like Horizon 2020/Europe and similar ones.

Recommendations

Although project estimates and forecast for income, and in particular that from economic activities, are very optimistic, it is recommended to prepare (in a risk management approach) a more pessimistic (and maybe more realistic) business plan to outline exactly what measures will be taken and by whom in case some income does not materialize and/or how to act in order to ensure that these various revenue streams materialize. The excellence of the research capability is in no doubt and the enhanced research infrastructure will make it possible to propose attractive research projects to the industrial and business community, but it is not enough to have an interesting offer, but this has to meet a demand which may be non-expressed. It is worth, in any case, to remember that a business plan is a living document, and once its preparation process is done, its update and revision should start almost immediately. Such a document should reflect the most updated information on available public and private opportunities, market conditions, competitive position

etc. Most of these parameters, as well as national and international environment are under permanent evolution, so the development of the business plan is a continuous process.

To implement longer-term sustainability of the Centre as a collaborative effort hosted and led by the IICT Institute, it is suggested to:

- ✓ Define formally how the Institute of Information and Communication Technologies of BAS will act as the leading Institution in the Centre to be able to ensure joint contract-based activities and continuity of the collaboration with the other BAS and university partners: for example verify if it possible for the BAS to set-up an internal "inter-institutes" arrangement/framework agreement, allowing a formal longer-term integrated capability to address also external requests with effective responses.
- ✓ Define a future technical roadmap within an EU wide approach.
- ✓ Implement a specific international advice mechanism and use it also to hunt for new opportunities in the research "market" (see recommendation to set up International Advisory Board)
- ✓ Define and implement a legal/contractual frame allowing to train, attract and retain the needed technical support personnel
- ✓ Define an "Industrial liaison and information" strategy allowing more structured collaborations and interactions with users and industry.
- ✓ Build strategic partnership with central or regional administrations to offer services, which might be recognised as "public services" paid by governments on the mid- to long-term contractual basis (e.g. weather forecast, handling of public big data and strategic big data analysis (e.g. for health sector, identification and monitoring of diseases), energy production and consumption modelling (energy grid modelling), etc. In the experts' experience, a number of European HPC infrastructures rely largely on such public services.

ROADMAP FOR LONG-TERM SUPPORT

The specific aspect of a High-Power Computing Centre is to have "life cycles" strongly connected to the technological cycles of the mainframe equipment, with a 3-5 years cycle. This requires, from its Governance and its funders, the capability to plan according to these cycles, and to its management to allow the Centre to be connected to other Centres (in Bulgaria and in Europe) into a collaboration/coordination mode that allows to be in a network where at least some of the Centres are at the forefront of technology even at the end of a cycle of this Centre, allowing to keep attractiveness by sharing the staff resources and the users. This brings to the recommendation to seek as soon as possible an alliance with other Centres in Europe of the same level and develop an international network allowing the continuity needed. One example which could be taken as a model is PRACE, which allows several countries to plan the new-cycles investments in such a way to obtain a continuing competitiveness.

The Centre, and in particular its leading partner IICT - BAS should look for its opportunity in being a driver in the growth of the Bulgarian research system, starting with the BAS itself). The IICT within the framework of the CoE project and beyond that (e.g. in closer cooperation with other projects) could develop and implement a new, modern model for research and innovation activity within public research organisations. Building on its excellence, unique infrastructure and competitive position, the Centre could play a role of leader (driver) of changes in the Bulgarian system.

In more short term, pragmatic, actions to be taken, the following ideas should be explored as a topics for further, more targeted support:

- ✓ setting up effective management structures and mechanisms, in particular for business-related processes (business relations, business development, technology transfer and commercialisation).
- ✓ development of a realistic business plan for the next 3 to 5 years, with forecast up to 10 years, with an efficient process of development and renewal of the plan according to an evolving framework.
- ✓ development of internal regulations for IPR, policy for commercialisation and access to infrastructure (including more details on the accounting principles and procedures and related price setting), with at least a reference to the implementation of the core principles and requirements of EU State Aid law in the field of R&D&I.
- ✓ deep analysis of the present and future relations between the Centre and the hosting institute (leading partner IICT) and BAS in general, with focus on the optimisation of management and use of resources, taking into account that over 93% of the funding and the corresponding infrastructure of the CoE project becomes an integral and indispensable part of the IICT-BAS. The core principle should be optimisation of management of the CoE within the IICT and overall the BAS organisational structure.
- ✓ Risk analysis and how to mitigate potential risks.

9.4 Centre of Excellence "National Centre for Mechatronics and Clean Technology"

Summary of National Centre for Mechatronics and Clean Technology

Identification number: BG05M2OP001-1.001-0008

Centre name: National Centre for Mechatronics and Clean Technology (NCM&CT)

Budget of the project: BGN 69 878 391 (approx. €35 m)

Beneficiary: Institute of General and Inorganic Chemistry – Bulgarian Academy of Science (IGIC)

Start date: 28 February 2018 **End date:** 30 December 2023

Main project goal: to mobilise the research potential, thus to achieve a qualitatively new level of knowledge in several mutually overlapping economic segments: mechanics, robotics, energy efficiency, sustainable use of raw materials and resources, reduction of greenhouse gas emissions.

Specific goals:

- To designate three scientific research campuses, equipped with modern scientific facilities
- To implement modern, long-term scientific plans in the area of "mechatronics and clean technologies" based on the competence of the partner organisations and on the needs of the Bulgarian industry.
- To maintain highly qualified scientific team
- To establish conditions and improved capacities for effective technological transfer

The National Centre for Mechatronics and Clean Technology is initiated and later established by 17 partners, located in four different Bulgarian cities: 11 BAS institutes - Sofia, Sofia University, Technical University - Sofia, Technical University - Varna, Technical University - Gabrovo, University of Chemical Technology and Metallurgy - Sofia and the Central Laboratory of Applied Physics to

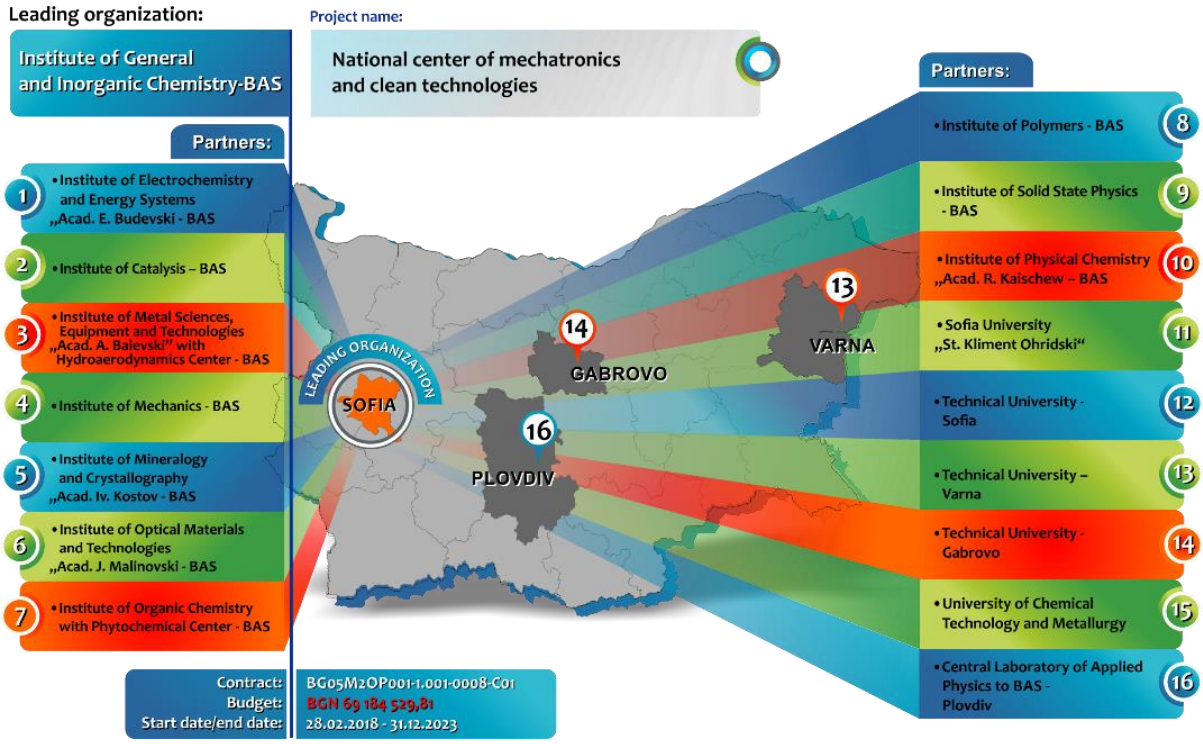
BAS - Plovdiv. For the purpose of closer relations with business, Mechatronics Cluster, Borima EAD and R&D Association have been attracted as associate partners based on a publicly announced competition. In order to provide a higher scientific level of the Centre, units of world-famous universities (Tel Aviv, Berlin and Delft) and the Institute of Robotics and Intelligent Systems at the Federal Technical University, Zurich, have been attracted as associate partners, in the same way.

The IGIC – BAS is appointed as a leading organisation.

All partners have agreed to focus their efforts on technical infrastructure revitalisation and modernization as well as utilising this infrastructure mostly for non-economic purposes. To reach such target, the Centre plans for several main activities:

- Creation and modernization of specialised research infrastructure on three campuses - BAS (Geo Milev District), SU (Lozenets District) and TU-Sofia (Students town District). 49 new laboratories will be created in the three campuses, equipped to conduct advanced research. Upgrading of certain parts of appropriate building infrastructure in Plovdiv, Varna, Gabrovo and 8th kilometre – Sofia is also planned.
- Conduct of R&D and dissemination activities in the listed areas, divided into four work packages (WPs, thematically relevant and synchronized with ISSS's priorities):
    - WP 1: Computer modelling and development of technologies and new materials for engineering and reengineering;
    - WP 2: Electronic, optical, sensor and bio-mechatronic systems and technologies;
    - WP 3: Mechatronic systems and technologies;
    - WP 4: Clean energy and green technologies.

This Centre has the largest numbers of partners among all CoC and CoEs, which provides some opportunities, based on broad expertise, academic resources, infrastructure, equipment, practices, contacts on national and international level with the scientific and business communities on one hand, but on the other hand it leads to complicated basis for future management, sustainability and development of the Centre.


Leading organization:
Institute of General and Inorganic Chemistry-BAS
Project name:
National center of mechatronics and clean technologies
Partners:
1 • Institute of Electrochemistry and Energy Systems „Acad. E. Budevski - BAS
2 • Institute of Catalysis – BAS
3 • Institute of Metal Sciences, Equipment and Technologies „Acad. A. Balevski" with Hydroaerodynamics Center - BAS
4 • Institute of Mechanics - BAS
5 • Institute of Mineralogy and Crystallography „Acad. Iv. Kostov - BAS
6 • Institute of Optical Materials and Technologies „Acad. J. Malinovski - BAS
7 • Institute of Organic Chemistry with Phytochemical Center - BAS
LEADING ORGANIZATION
SOFIA
14 GABROVO
16 PLOVDIV
13 VARNA
Partners:
8 • Institute of Polymers - BAS
9 • Institute of Solid State Physics - BAS
10 • Institute of Physical Chemistry „Acad. R. Kaischew – BAS
11 • Sofia University „St. Kliment Ohridski"
12 • Technical University - Sofia
13 • Technical University – Varna
14 • Technical University - Gabrovo
15 • University of Chemical Technology and Metallurgy
16 • Central Laboratory of Applied Physics to BAS - Plovdiv
Contract: BG05M2OP001-1.001-0008-C01
Budget: BGN 69 184 529,81
Start date/end date: 28.02.2018 - 31.12.2023

CURRENT STATUS OF THE CENTRE OF EXCELLENCE (COE), PROJECT IMPLEMENTATION

Project partners managed to accomplish the following so far (March 2020):

- The Centre is at early investment stage;
- Started market demand analysis: conducted two meetings with business representatives (as of November 2019);
- So far there is no dedicated TTO for the Centre but relying on the TTO of the BAS institutes (chemistry), the one of Sofia University and the R&D Centre of the Technical University;
- In March 2020 the (re-) construction of the new Campus Student town was launched.

Analysis of questionnaire

Three respondents provided answers to the questionnaire designed to identify the challenges, needs, plans and preferences of project partners: TU – Varna: Institute of Polymers; and the Institute of Physical Chemistry (BAS).

A number of important **challenges (Cs) from the overall review** on implementation and functioning have arisen:

1. The partnership includes different types of organisations, acting under different legal framework, internal, and external environment. There should be management and project implementation rules tailored to the specifics of the organisations on one hand and matched with the project funding requirements on the other.
2. A great number of partners require an organisational structure recognising and rewarding the efforts, intellectual property rights, and voice of each partner or at least the three core institutions (BAS, TU-Sofia and Sofia Uni).
3. The future organisational structure should not limit opportunities for public funding (state budget, EU grants and programmes) and work with the international scientific community. It should also promote effective collaboration with industry.
4. Regarding the future legal form, there seems to be opposing views, with some contemplating the creation of an association while others express that no additional legal entity should be created.
5. There are also opposing views regarding substantive decision-making on whether and how research programmes and projects should be put into a common management, or if the partners should decide upon their own actions themselves (in the latter case meaning partners prefer a decentralised management model).
6. All three respondents indicated that the Centre should be independent in its management and execution of operations, but should agree on its strategy and budget with the individual partners and report on outputs either annually or quarterly.
7. All three respondents agree that the Centre should have research staff in addition to administrative staff but in a non-permanent fashion and only project-based.
8. Partners' human resources consist of experienced and well-prepared scientists, but there is certain lack in management, organisational, IP, legal, financial and sustainable development expertise.

9. Limits in remuneration of all involved in publicly/state funded R&D Centres create obstacles in attracting and recruiting professional managers, project leaders, legal advisors, young scientists, etc.

10. Partners still do not have a revenue sharing mechanism and royalty payments in place. Some believe it would be developed with the start of such activities.

11. Access to the research infrastructure and the utilisation of the equipment, the application of state aid rules - including the 20% limitations - creates confusion also mirrored in uncertainties in performing technology transfer.

12. Some "technical" implementation issues and challenges exist; including ones associated with the Bulgarian Public Procurement Act, ownership of buildings and communication procedures with legal and local authorities, start of construction procedures, need of some changes in the equipment planned for purchase under the project, etc.

Based on the questionnaire analysis, it was inferred that partners have different levels of capacity, management experience, joint activities readiness, and understanding about core research practices and opportunities. They also have different vision for Centre strategies and focus, TT, and management structure. All responding partners insist that the infrastructure should be owned by the individual members/partners. There are no common rules, KPIs[197], monitoring systems, and policies. It seems that the individual partners considered the application of their own practices and experience, which is not necessarily a negative feature, but which does not ensure the future sustainability and development of the Centre as a project of common efforts. This is why a complementary legal structure (not substituting the partners) with common rules, policies, strategies, and vision could be recommended. This will help the development of a common organisational culture, and will unify goals, tools, and practices. It is also crucial to identify effective ways of promotion, interaction with the private sector, and with international scientific communities and networks. The organisation should be capable of managing IP and balance the usage of equipment and facilities with regard to economic and non-economic activities in an acceptable manner. Last but not least, the partners need to define incentives, revenue sharing mechanisms, and the split of royalty payments.

Long-term vision

The CoE wants to become an internationally-recognised scientific institution for its top-level research team and modern facilities. Partners want it to be a competitive, high-quality research contractor, meeting world standards and practices. It is foreseen as an organisation participating actively in international and trans-national research partnerships, networks, and programmes guaranteeing: significant international visibility and scientific coherence; integration in the National Roadmap for Scientific Infrastructure, and European infrastructures. The Centre wants to be an industry partner and challenges solver by conducting diversity of market-oriented scientific research and efficient development activities, aiming at increasing the competitiveness of Bulgarian economy.

[197] Strongly advised in Peer Review of the Bulgarian Research and Innovation system (EC, 2015)

LEGAL FRAMEWORK OF THE CENTRE

Legal structure

The NCM&CT CoE is constituted by the Partnership Agreement between 17 partner organisations according to terms and conditions of the public call defined by the Managing Authority (MA).

Legal Background

During the personal meeting in November 2019 it was expressed by representatives of some partners that:

1. Having the infrastructure concentrated in three buildings will make it easier to distinguish between the activities of the partners and of the Centre and this presents a reason for the establishment of a legal entity.
2. There are uncertainties as to whether (and if yes – how) to structure the income/financing/expenditure "at one place" during the exploitation of the infrastructure.
3. The Centre must be connected to the founding partners and have the possibility to use current existing equipment.
4. The arrangements need to allow and facilitate the execution of more complex, cross-sectoral projects such as a prototype for a device with physical and chemical characterises requiring coordination among partners.

A brief overview is given first of the status of BAS and universities. The Institutes of the Bulgarian Academy of Sciences (BAS) have complete freedom to form and participate in commercial companies and other organisations with an object of activity related to the conduct and application of their research activities. Occupation of positions in the management of the companies under discussion is not permissible by persons holding managerial positions in the Institutes, except in cases where they appear as representatives of the Institutes or the respective independent unit. Thus, it becomes clear that the only possible complementary structure is a non-profit association. Unlike the Institutes of the BAS, the state higher education institutions (HEI) are not directly related to each other, the relationship between them being expressed mainly in their common source of funding and, accordingly, in their administrative management. They are not entirely independent, with the law stipulating that HEIs enjoy academic autonomy. The right to associate with other entities, as well as to set up commercial companies for the purpose of the economic realisation of the results of research and intellectual property objects with their own resources, shall be exercised under terms and conditions determined by the Council of Ministers. In March 2020, the Council of Ministers Decree entered into force allowing universities to form companies but only for the realisation of their research results (e.g. meaning that universities and BAS institutes can now jointly form commercial companies (incl. spin-offs) if needed and where appropriate). However, this is relevant mostly for the technology transfer section below and not for the legal form of the Centre itself/per se.

In Q2 2020 we organised an additional teleconference with representatives of the CoE from TU-Sofia, who were unable to attend the meeting in November 2019, and with a view to understand more on the specific rules enacted for Campus Student-Town as well as elaborate the concept of **"federalization" of the CoE's activities**. We understand that a possible legal entity formation, in particular after a six years long project timeline is being considered, so that the role of the central coordinating unit/board (or an equivalent of it) would be concentrated on, inter alia, the high-level organisation, overall governance, marketing and promotion. BAS experience could be used where the institutes operate independently and are legal entities with own budget and decision-making,

while the umbrella/central organisation concludes mostly "framework contracts" setting the broad intention/conditions/frame for individual institutes to engage in particular activities. With regard to the **situation of the future separate legal entity** (possibly to be formed as an association - sdrujenie), we observe that:

- ❖ It should be able to facilitate (not substitute) a federalised structural and operational model for the CoE.
- ❖ It should be able to facilitate the joint participation/application and representation in/for various funding opportunities.
- ❖ Full eligibility for funding in all national and EU/international programmes should be ensured, with diverse possibilities for participation of the new legal entity. This means that, for instance, in the context of the future Horizon Europe programme, coordination and support actions may be implemented by one or more legal entities [...]".[198]
- ❖ The legal entity for this particular Centre should not be involved in (daily) management of the infrastructure and interfere in the operations of the founding partners beyond its granted scope of competence (this is also valid for the three Campuses which may have their own rules).
- ❖ Concrete activities should mostly be executed on Campus level. Specific rules have already been enacted to streamline and integrate the activities of the partners participating in one of these sites (Campus Studentski grad)
- ❖ Giving exclusive rights to another completely new and independent legal entity on its own may not allow the creation of the necessary critical mass (including human resources). The natural connection with founding partners could also be lost/weakened in this way. The reasoning is that the idea of this CoE project is for the 17 partners universities and BAS institutes to build upon/upgrade/widen their capacities and opportunities and not to split and disintegrate the (already limited) resources.
    - ➢ Thus, a completely independent legal and organizational entity vested with broad competences including the exclusive use of the infrastructure of the CoE would create further administration and incur costs in the process of its operations, which the founding partners may not be ready, able or willing to cover. This includes, rents, maintenance etc. This means that making their infrastructure/equipment to 100% exclusively devoted to a new legal entity is not reasonable for at least some of the main partner research organisations and in all cases part of the resources and capacity should remain available for the partners-owners of the infrastructure (with the caveat that the partners should still pursue the objectives of the Centre of Excellence). That being said, a separate legal entity is indeed recommended for this Centre but of the less integrated model (see also Chapters 2 and 3 of the report)
- ❖ The role of the future central organisational and management body/legal entity/permanent structure should focus mostly on complementary and value-adding activities such as improved overall and targeted coordination, advertisement and promotion, direction and facilitation of partnerships. This is particularly important and valid after the formal project financing period comes to an end in 2023.

[198] See Horizon Europe (Proposal, 2018), Article 18.

The above described situation appears to be more specific for this particular CoE since it has 17 partner organisations of which two large universities and several institutes from the framework of BAS. This means that if the CoE has its activities focused in three campuses, as in the present case, there will naturally be a **degree of higher campus-level integration as opposed to Centre-level integration**. This ultimately reflects in the competences granted to the new legal entity – likely to be of a less integrated model entrusted with clearly defined, concrete, supporting functions and not with broad exclusive powers.[199]

In relation to the structuring of joint projects and activities between the partners, we understood that the practice has been until now that one of the partners signs as leading or alternatively a multi-party contact is signed. This is seen, as expressed by some CoE representatives, as preserving the flexibility without adding an additional legal actor or contracting parties – a fact that should be taken into account when deciding on the role of the future legal entity.

Organisational Framework

The consortium, aiming for the development of NCM&CT Centre, has set an organisational structure to serve the project implementation phase.

Responsibilities of the partners and the roles assigned to the leaders and coordinators are described in broad terms, without specifics or standardisation on how, when, to what level of detail they have to deliver their work, reporting, access to the infrastructure, financial management, etc.

The current organisational structure may serve the Centre during the project implementation phase, but future sustainability requires simplicity for

- better and faster decision-making. Unification of processes;
- guarantee of the quality of the services provided and products being developed;
- professionalism in operational management,
- adequate distribution of the outcomes (patents, revenue, recognition, etc.) among partners;
- permanent and effective efforts for market positioning and collaboration with other CoEs and scientific organisations on international level;
- developing and applying relevant KPIs and monitoring systems, among others.

Therefore, the establishment of an entity that will be responsible for and/or supportive to particular aspects of the future development and operation of the Centre is proposed.

The potential benefit of forming a joint legal entity in the form of a not-for-profit association would help:

1) to facilitate, through a permanent structure, the organisation of joint R&D&I activities where relevant, providing formal coordination and interaction channels also in the period post-2023 between the 17 partners, and without substituting their core activities;

2) to also facilitate the joint application for numerous public funds, programmes and grants. For more detail - see the two models/options described in the general part of report.

The three main campuses/complexes operate on the principle of “complementarity and synergy”. This is believed to integrate most of existing infrastructure within the newly established Centre.

[199] See Chapter 3 - Organisational Framework – for a description of the elements of this less integrated model/option.

***Table 12**. Overview of the three main campus buildings, as planned*

Campus/Complex	**Specialisation/Focus**	**Ownership and usage (many of the apparatuses are co-owned by partners from different institutions)**
Technical University of Sofia, Student Town	Mechatronics	Lead taken by Technical University. Specific Rules accepted for the operation of the Campus. Building will be used to install scientific equipment purchased by the partners TU-Sofia, UCTM, TU-Gabrovo and TU-Varna.
Sofia University (Lozenetz)	Clean Technologies	Ownership of Sofia University. Research program set by Sofia University but usage also open to and foreseen for BAS institutes and less so to Technical University
Academy of Sciences	Both Mechatronics and Clean Tech	Ownership and main usage of Academy institutes, but also serving the universities.

As evident from the document Rights on the Equipment, for a significant part of the **equipment and apparatuses/devices up to five-six partners are joint owners** with a respective different percentage allocation for their individual share. We understand that for the jointly owned equipment the consent of the other partner-owners might be required when engaging with third parties. From the Rules on Access to the Centre's infrastructure, it is evident that the partners of the Centre do not pay fees to each other when the investigations are within the research program of the Centre. When providing access to its infrastructure to external parties (referred to as users from business, academia and government) the Centre has set a principle to receive at least non-exclusive right of free use of the created research results for Centre's own research and commercial purposes.

From an administrative perspective - and mostly for the procurements and overall physical development of these three campuses - three coordinators are to take the lead from each of the three biggest partner organisation respectively.

As mentioned, the **R&D structure is organised in four broad work packages (WPs),** each of which is thematically oriented. Important from an organisational perspective is that each of the work packages includes research topics with the participation of more than one scientific group from institutes and faculties participating in the Centre, indicating a degree of interconnectedness and necessity for a strong coordination. The "heterogeneous" structure (defined as such in the project documentation) building on the "links between work packages and organisational and administrative units" of the Centre, is stated to correspond to the vast area of the planned research. Furthermore, in the Project Justification the Centre recognised that it will "implement an interdisciplinary approach to the different assignments by the industry and will guarantee high dependability of problem solution through attraction of specialists from complementary fields".

Specific Rules on campus level: Student Town Campus, led by TU-Sofia

To overcome the challenges coming from the great number of independent partners and high complexity and volume of project activities, specific **Rules for Campus Studentski grad** have been developed to guide the activities and collaboration for implementation of this part of the Centre project (as one of the three main Campuses and the only one involving multiple partners together). The idea is to consolidate the R&D structures and the scientific resources.

We understand that the Scientific Expert Councils are organised on the levels of the three respective campuses (not one council for the whole CoE). Thus, the three main research groups represent the three main campuses (e.g. one is Mechatronics for the Campus Student Town).

Campus Student Town is administered by specific Team for Organisation and Management (a small admin body with 5 staff members specifically engaged with the development of this campus). This team supports a Director and a Coordinator who form part of the Scientific Expert Council. The Council includes also representatives of the individual laboratory sections (approx. 20) within the Campus and is responsible for the overall work program and the usage of the property of the Campus. The heads of all lab sections coordinate the execution of all activities and report on results, equipment usage and costs made. In addition to the Deputy Chairmen of the Council one more expert will be engaged to work for the coordination of the labs' sections.

The three other partners participating in the Campus Student Town also have their mini-governance teams responsible for their respective lab sections.

We recommend that the list of economic activities in the Rules for Campus Student town be revised (see our recommendations in the state aid section below).

Ownership structure

Ownership is stated in the partnership agreement and it is currently with the independent partners, thus the Centre has no legal rights of ownership apart from the free access granted by partners to each other's infrastructures.

A research[200] in six countries shows that in most cases CoEs seem to be free to choose the form and ownership of organisation, while ensuring transparent decision-making structures, diversity, and effective formal communication. It is recommended to have an advisory and governing board and some sort of formal connection between CoE leadership and host (partners who own a specific RI, to be used by the Centre).

There is usually (but not always) a recommendation for unitary organisation, i.e. 'under one umbrella'. It could be in the form of an Association of CoEs and CoCs, aiming at capacity improvement, working for quality improvement of services and products, promotion, support for internationalisation, administrative and legal advice, and support for initiatives improving the Centres' environment.

These institutional conditions could differ in most respects from typical project funding, and there is no doubt they will have a positive impact on institutional capacity building.

Governance and decision-making management of the tangible and intangible assets of the Centres

The project is being implemented in a mixed (hybrid) model, i.e., legal, financial and administrative resources, procurement, equipment and infrastructure, are largely distributed among three main

[200] Held by Tomas Hellström in 2018 (Centres of Excellence and Capacity Building: from Strategy to Impact)

partners. The scientific personnel coming from different partner organisations are still employed by their parent organisations.

Currently, the Managing Body of the CoE is the **Management Board**, which consists of seven members. Partners elect the management board members (three by BAS, two by Sofia University, two by Technical University). There is a representative of a Cluster association for mechatronics within the board. It is claimed that the board enjoys a high degree of independence. The decisions of the Board are binding for all Partners and the Leading Organisation.

The Board takes decisions with a majority of two-thirds (2/3). This practically means that none of the three core partners (TU/Sofia Uni/BAS) can take unilateral decisions not agreed by at least one of the other major partners. However, it also means that if two of the major organisations agree on an issue and one does not - the decision can still become binding to that partner despite the lack of consensus. This is a question closely connected to the actual competences of the Management Board, meaning that if the Board of the CoE has rather limited high-level strategic competences the decisions should instead be taken by a consensus. On the contrary, if the Board of the CoE gets involved in more operational matters, then the existing arrangement could make sense for reasons of flexibility in decision-making. We note that since most of the operational activities are distributed in the three main campuses which feature their own separate Teams and their own Scientific Councils, the CoE will have to decide which decisions are sufficiently strategic to require the consensus of all partners on the level of CoE Board and which can be devoted to the campus-level. This will ultimately influence the future arrangement, in particular in post-2023 period, when the CoE would form an a legal entity - association (if not formed by then). The Statute of this association will lay down the competences of the management of this new legal entity and the exact decision-making mechanisms.

In principle, we should note that from the project documentation there appears to be a **General Scientific Council** consisting of two thematic divisions: "mechatronics" and "clean technologies". This is an expert body with advisory functions, subordinated to the Board, and is authorised to advise the Board on the adoption of decisions on the research programme, the dissemination of project results.

As to the governance of the intangible assets, the sharing of IP and research results is envisaged to depend on the percentage contribution to the particular activity leading to creation of these results, similar to the arrangement in most of the Centres. The CoE sees this as reasonable.

Management of the CoE

The budget dedicated for the management of the project implementation is a about BGN 5,564 m (EUR 2,845 m). Responsible to organise, implement and if needed subcontract this is the Institute of General and Inorganic Chemistry – Bulgarian Academy of Science as the leading partner.

A **Project Management Unit (PMU)** implements the operational management and consists of project manager (1), assistant project manager (1), coordinators and accountants – (17, one from each partner), lawyer (1), architect (1), a financial expert (1) and an expert with experience in project management (1). The PMU deals with administrative, procurement, finance, legal and technical reporting. The only more operational (R&D) activity performed by the PMU appears to be the monitoring of economic activities.

This current structure is organised to serve the project implementation (i.e. procurements and control) but needs to be re-designed after constructions/delivery of equipment has been completed, together with re-engineering of the processes related to partners' collaboration and future research activities, liaison with industry and results dissemination. The NCM&CT CoE has to develop a

strategic plan and an annual operational plan aligned with KPIs tied to the organisation's vision. The Management measures each of the various aspects of the operations on a monthly basis, it drives change, and it puts more energy into the areas that need support to meet their targets.

Good International Practices

Other countries, such as New Zealand, support since the early 2000's Centres of Research Excellence based on joining complementary capabilities of different institutions. They have faced the same kind of issues that CoEs and CoCs are facing now in Bulgaria concerning governance, organisation, and so on. For NCM&CT CoE a Centre to look at is the "The MacDiarmid Institute for Advanced Materials and Nanotechnology" (NZ) - https://www.macdiarmid.ac.nz/, a partnership between five Universities and two Crown Research Institutes based in five different locations: Auckland, Palmerston North, Wellington, Christchurch and Dunedin. The Centre is funded by the Ministry of Tertiary Education in the context of a CoRES a program to support Centres of Research Excellence. The strategic plan is available for download on the website.

The section, "Our People", describes the governing and managerial model. The table below summarises the main characteristics:

<table>
<tr><th colspan="3">MCDIARMID INSTITUTE GOVERNING AND MANAGERIAL STRUCTURES</th></tr>
<tr><th colspan="3">OVERVIEW OF THE GOVERNING STRUCTURE</th></tr>
<tr><td>INTERNATIONAL SCIENCE ADVISORY BOARD

It comprises some of the world's leading scientists in the fields of research represented by the Institute. The ISAB meets every two years.
It is formed by 10 foreign leading researchers and the Co-Directors.</td><td>GOVERNANCE REPRESENTATIVE BOARD

Board whose members are drawn largely from the partner organisations.
Currently it has 13 members</td><td>INDUSTRY ADVISORY GROUP

It provides advice on structures that will improve CoE's interactions with New Zealand industry.
In particular, the IAG advises on mechanisms for the translation of research to industry;
It is formed by 7 local firms</td></tr>
<tr><td colspan="3">SCIENCE EXECUTIVE BOARD

Provides a vital sounding board and source of guidance for the Director and Deputy Directors in their day-by-day leadership roles.
This executive comprises the Co-Directors, the Deputy Directors, Science Leaders, elected Principal Investigator (PI) and Associate Investigator (AI) representatives, a Māori Research representative and a representative of MESA. The Institute's Centre Manager, Strategic Engagement Manager and Commercialisation Manager are also members of the Science Executive.</td></tr>
<tr><td colspan="3">OVERVIEW OF MANAGEMENT STRUCTURE</td></tr>
</table>

Co-Directors	Deputy Directors	Support Office
Two Co-Directors from two of the university partners Responsible for the oversight and strategic direction across all areas of the Institute.	Two Deputy Directors from two of the university partners One for encouraging and fostering commercialization and gaining expertise in commercial analysis of their research. One for stakeholder engagement through partnerships with key practitioners in outreach and science communication, including with communities, government, educators and students.	Centre Manager, Strategic Engagement Manager, Commercialization Manager.

In the general part of the report (Chapter 7), the CORES system of Centres in New Zealand is presented. MacDiarmid is one of these centres.[201] The Association of CoREs acts as an umbrella body to further promote and connect research and educational excellence.[202]

RESEARCH INFRASTRUCTURE

Any research-oriented institution needs an adequate, modern, and safe research infrastructure. Access to equipment should have all external organisations without any discriminatory principles. Equipment will be used by different entities including the associated partners, research organisations, enterprises, etc.

To ensure proper utilisation and sustainability the Centre has to follow several basic rules:

1. A Research Infrastructure (RI) Access Charter has to be developed and formalised. NCM&CT CoE may use a model of collaboration (e.g. through co-authored papers/projects/products with other organisations/scientists), cost-recovery, user fee, full-cost or for-profit, depending on the user of the infrastructure and decision of the Centre.
2. The adopted access rules have to ensure transparency, predictability, and traceability of RI's usage. It is recommended that the access rules be complemented by software system tracing type of users, time, scientific and data diaries, databases, etc.
3. Implement a data policy that supports European Open Science Data, but also enhances the return on investment by reuse of the data.
4. Online information and promotion of NCM&CT CoE's RI, that is user friendly, user attracting, findable, always current and complete, clear and detailed enough when it comes to capacity, scope, responsible organisation(s) and persons, access policies, services and automation of application for usage of the NCM&CT CoE's RI.

[201] There it is stated that "Centres of Research Excellence (CoREs) are defined as inter-institutional research networks, with researchers working together on commonly agreed work programmes."
[202] Website is: http://www.acore.ac.nz/

5. The NCM&CT CoE partners must agree, under an MoU, and commit how they will use/provide/make available the RI for the purposes of the Centre of Excellence. (This is especially valid after 2023. The persons and structures who/which can be held accountable for their operations and results should be clearly designated and have certain guaranteed time horizon to achieve these goals.

6. All RI has to meet the needed ISO standards and to be accredited to prove operational and scientific quality. Annual internal performance assessment should be implemented, based on preliminary developed KPIs.

7. The Centre has to maintain publicly available testimonials/evaluations by users and stakeholders, and/or overviews of the scientific output generated using the facilities.

8. Maintain electronic diaries to follow the state aid requirements that economic activities do not exceed 20% of the annual capacity and remain ancillary in nature.

9. For industry, users and research services to undertakings there are specific rules under EU State Aid law, which need to be observed including with regard to the formation of the fees/costs that the industry partner has to pay and in relation to the distribution of right to the research results/IPRs. Please refer to Chapter 4 of the report.

From the perspective of TU-Sofia's representatives the Centre's infrastructure should be able to equally serve own projects (for instance of one of the partners) as well as joint projects and activities. In reality, most activities are specific for each of the three Campuses, which, again, means that it will not be appropriate/feasible to govern all CoE project activities from one central entity.

STATE AID RULES

The established CoE will meet the definition of "research infrastructure" of the Framework for State aid for research, development and innovation, and thus the project will contribute to achieving the objectives of the Operational Programme. The partners understand they have to balance the utilisation of Centre's capacity and consider the 20% capacity "limitation" for economic activities, but need some specifics and recommendations on how to be compliant and financially sustainable at the same time. This Centre's constraints are similar to the challenges recognised by the other CoEs and CoCs. Therefore, for the questions that we did not manage to answer in this section below please refer to the generic part of the report (Chapter 4 on State Aid rules).

During the meeting in November 2019, the Centre expressed two main questions regarding State Aid, to which we provide the following brief answers:

- ✓ Can the Centre generate more than 20% of its revenues from industry? Economic activities include research on behalf of undertakings (contract research and research services) and renting out of equipment. The Centre/its partners can generate more than 20% of its/their revenues from these activities provided the capacity used for economic activities (in order to generate these revenues) remains equal to or below 20% of the overall annual capacity of the research infrastructure (note: this goes together with the requirement that the economic activities also remain ancillary in nature – see Chapter 4 of this report).

- ✓ Second, how to determine the relevant entity? The capacity your organisation allocates to economic activities must be equal to or less that 20% of your organisation's overall annual capacity **at the level of your organisation's relevant entity that actually carries out the economic activity in question**. Usually research organisations have several departments,

sections, so it should be at the level of the relevant department or section. An even more comprehensive definition provides stipulates that: "every individual entity (such as a laboratory or department) that, with the organisational structure, capital, material and workforce that it effectively has at its disposal, could alone perform the activity concerned.[203]

Furthermore, we noted several specific issues from project documentation that we would like to address and clarify for this Centre.

- On page 34 in the Project Justification public education organised within the national education system is listed as "profit activity". We advise you to check carefully points 28-32 of the Commission Notice on the notion of State aid as referred to in Article 107(1) of the Treaty on the Functioning of the European Union C/2016/2946.[204]

- In the Financial Analysis document, commercialisation and licensing of IPR (patents) is listed as an economic activity counted under the category of the 20% capacity usage limitation. We must clarify here that knowledge transfer activities (in particular *the activities leading to it, incl. licensing and spin-off creation, but not the actual licensing or sale of IP)*[205] are considered non-economic if all income from those activities is reinvested in the primary non-economic activities of the research organisations or infrastructures concerned. If reinvestment were the norm, then the particular activity would not count towards the 20% capacity limitation.

- The "attraction of private funds" may not necessarily count as economic activity. If the financing for a joint project comes from a private partner (undertaking) in the context of effective collaboration (provided the conditions for effective collaboration have been fulfilled), then this is considered a non-economic activity even if the full costs of the joint project are covered by the industrial partner.

- From the questionnaire answers, it seems that not all partners have implemented a separate accounting system for economic and non-economic activities and not all have a monitoring system in place to monitor the capacity. All research organisations or research infrastructures which perform economic activities must implement separate accounting and where necessary – a monitoring system. This is an obligation under the Grant Contract as well as under EU State Aid law.

The specific **Rules for the Campus Student town**, in Article 7 include a list of supposedly economic activities. We must clarify here that of the listed activities, the following are, as a rule, of non-economic nature and do not count towards the 20% capacity limitation:

- Publication and wide dissemination of scientific literature

- Creation of programmes in the field of education and science

- Teaching, lectures and education activities. As a rule, education and teaching form part of the primary (non-economic) activities of a research organisation (see just above the reference to the Notice on the notion of State Aid)

[203] State aid rules for RDI: Key issues / Questions identified by practitioners in Member States, 2018, https://ec.europa.eu/regional_policy/sources/conferences/state-aid/rdi_2018/presentation_rdi_avgoustidou.pdf, page 14.
[204] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52016XC0719%2805%29.
[205] In the sense that research organisation should avoid passing on indirect state aid to third parties (see Chapter 4 of the main report).

- Independent research and development for more knowledge and better understanding
- Knowledge transfer activities e.g. the activities of a TTO (but not the actual licensing or sale of IP or knowledge[206]) as well as other form of management of knowledge but only on the condition that all income from those activities is reinvested in the primary activities (as explained above already).

Monitoring Mechanisms

The 20% limitation for economic activities of the annual capacity of research infrastructures capacity requires ongoing and strict monitoring, in order to prove, when necessary, that the ceiling is not exceeded. It is obvious in such a big consortium this will be a challenging task. Even the limited number of questionnaire answers provided on the topic show partners have different understanding and capabilities to measure and keep track of the actual operational use of equipment and to keep accounting separately. There should be a **software solution**/access and reporting automation implemented to ensure regulated access and reporting on the utilisation of the capacity of machines and equipment, to track the time and results and to assign responsible users.

TECHNOLOGY TRANSFER AND COMMERCIALISATION

The Project Proposal outlines the Technology Transfer strategy, based on the following characteristics:

- "User-oriented approach", where five broad groups of identified potential users, including scientific community, industry, government, and society. During the project, this will be updated/expanded.
- Current partners of the research institutions involved in the CoE are leading players of the automation -transport- sector, energy, biomechatronics based in Bulgaria (Sensata, Visteon, Hyundai, Department of Neurosurgery, UMHATEM "NIPirogov ", and others).
- Links and good awareness of the Bulgarian System of Innovation in the fields of interest for the CoE: SofiaTech Park, Mechatronic and Automation Cluster, etc. Establishing links with the future Centres of Competences is also in their plans.
- Good balance between "Push – Pull marketing actions", having in mind the user needs; the marketing approach involves what they call "active supply" and "active demand" actions.
- Furthermore, two types of action to intensify relations with industry are foreseen: passive (through wide accessibility of information) and active (direct communication with interested third parties).
- Technology transfer channels: investigations on contracts with industry and patenting discoveries and inventions and subsequent offering to interested parties.
- TT activities conducted by all partners.
- Implementation involves database of results portfolio, competitive surveillance, organisation of workshops and seminars, involvement in innovation ecosystem activities, joint projects promotion and media appearances.

[206] The actual licensing should be arranged in a way to avoid passing on indirect state aid to third parties (see requirements in Chapter 4 of the main report).

- In addition, the information and publicity work-package involves other activities such as web page, brochures, etc., which can be used as promotion mechanisms.
- The Partnership Contract regulates IPR and exploitation of results.
- A clear goal of synchronising with the needs of industry influenced the laboratories' design.

In terms of technology transfer, the project has a good definition: it puts the focus on the commercialisation of results, it is part of a demand approach, it contemplates transfer mechanisms, and it has established rules among the members of the partnership.

We looked into the document Allocation of Funds from which it becomes clear that the budget allocated for "Dissemination and transfer of research results and for protection of IP" per partner is as follows:

- Sofia University gets approx. BGN 300.000
- Technical University of Sofia get approx. BGN 700.000
- Individual BAS Institutes and the remaining universities get between BGN 30.000 and 90.000
- One partner does not receive funding for this: University of Chemical Technology and Metallurgy

The **main structures for technology transfer for the Centre's activities are:** 1) the TTO responsible for all chemical institutes at the Academy of Sciences, 2) TTO of Technical University of Sofia and 3) the TTO of Sofia University. The idea is to modernize the existing TTO structures and adapt them to the activities of the Centre, whereas the Centre recognizes **the need to ensure smooth coordination among the three TTO structures**. The R&D Centre of the TU-Sofia has a long-lasting experience with industry collaboration, 13 staff members and independent budget. It was expressed by the Centre that dedicated Technology Transfer staff would be hired and engaged in each of the three new buildings. As of February 2020 the Centre hasn't found the exact solution model yet for structuring its industry liaison and TT activities not only to effectively coordinate among the partners but at the same time still avoid creating additional unnecessary bureaucracy and maintaining the close direct contacts between researchers and industry.

Sharing of research results

In respect of the sharing of research results in joint projects, below we summarise the existing arrangements to understand the main principles as planned. Similar to the other Centres, the result from the activities carried out in the project is property of the partner who has generated it. The project documentation states the following:

> *"Since CoE comprises the efforts of the different research teams, it is expected that such results will be generated, which are mainly the subject of co-ownership. The exploitation of the joint research work results will be based on distribution of shares of co-proprietors, which will be regulated by the Managing Body, taking into account proposal of the respective leaders of the laboratories". [...]*
>
> *For giving license on the results to third parties it is required that a written consent between the parties is signed, defining their respective rights and obligations, included, but not restricted to it, the distribution of the expenses for obtaining or giving license and the revenues. Another possibility for exploitation and management of the intellectual property rights is on the basis of separate agreements for mutual co-ownership. These agreements will be used to reflect the respective specific situation of co-ownership.*

There is also a separate document on the Allocation of IPRs.

***Table 13**. Scenarios of actors, activities and IPR allocation arrangements*

Activity	**Ownership allocation and rights for the research results & the benefits thereof (according to document "Allocation of IPRs")**
Activity of one of the project partners within its work in the CoE	Only for the respective partner
Activity of two or more project partners within their work in the CoE	Ownership rights on the results are joint between these [participating] organisations and the joint ownership is distributed in Appendix №3 to Partnership Contract. The percentage is defined in a Protocol for Contribution of each organisation signed by the relevant partners
Activity of one, two or more project partners within their work in CoE and third parties (business and/or other parties outside the CoE, incl. natural persons whether (or not) employees of the partner)	Ownership rights on the results are joint between these partners and the third parties and the joint ownership is distributed in percentage defined in a Protocol for Contribution of the partners and the third party (template attached). IP protection expenses and any income from its commercialization and/or implementation are distributed between the partners and/or between the partners and third parties, in percentage specified in the same Protocol.

Recommendations

General

- To address the current challenges in the NCM&CT CoE operations, partners should move towards a better balance of instruments (policy mix) that will foster academic entrepreneurship, support both supply and demand led innovation and also encourage collaborations between research and the private sector.

- The Centre shall consider internationalisation as beneficial, in terms of exposing to alternative models of operation that can help them diversify their funding sources and behave in a more market oriented and entrepreneurial manner.

- NCM&CT CoE should be required and supported to map their innovation potential (expertise, facilities, services, and research outputs) and promote these to the private sector through modern on-line searchable databases, among other methods. There should be a clear single point of contact for communications regarding contract research. We envision this as a two-step process: Phase I shall be a self- developed and promoted database; Phase II would be to be incorporated in a national RI portal.

- It is strongly recommended that the CoE takes steps to develop its human capital, and in particular specialist competencies to complement associated investment in research infrastructures (instruments: industry driven projects; the National Road Map of RI etc.)

- IPR methodology is discussed in Appendix №3 to art. 10(2) of the Partnership Contract from 03.02.2017 but it lacks clarity and does not comply with best practice. The Centre should look to update its IPR framework with professionals.

TT governance, organisation and management

As a general principle, we recommend a simple, lean management approved by all partners and focus on Policy and procedures to ensure transparency and efficiency. Since the largest three partners (BAS, TU-Sofia and Sofia Uni) already have their own TT offices and R&D Centres the TT structure for the CoE would have strong coordinator role, be operational and responsible directly to

the Centre management. This structure could be part of the new legal entity created. Below we elaborate further on recommendations and possibilities.

- Governance: creation of an industrial or innovation advisory committee

  An industrial advisory committee will give advice to define and monitor the Centre's knowledge transfer strategy and seek the most effective mechanisms to interact with the industry. Its composition could consider different representatives of the value chain "from the laboratory to the market" (technological centres, firms, IPR experts, investors…). Some of the mentioned partners such as Sensata Technologies, Visteon, and Hyundai can be good candidates.

  This type body is beginning to become commonplace in the governance of research Centres of excellence, complementing the scientific advice provided by the external Scientific Advisory Board. See, for example, the functions and composition of the Industry Advisory Group of the McDiarmid Institute mentioned as good practice[207].

- Creation of a TT unit depending on the Centre Manager

  Most of Centres of Research Excellence, even if they are not autonomous from the universities, have their own KTT unit. See the case of the mentioned McDiarmid Institute that has a Deputy Director of Commercialisation and Industry Engagement based at one of the Universities that are part of the partnership and a commercialisation manager that works across all partner campuses[208].

  One option to consider is to scale up the TT management model as the Centre develops. Initially to have a small transfer unit, even sharing project management and marketing functions, and as the Centre grows, have specific units with their own structures. See the cases of CIQUS -founded in 2010. It belongs to the University of Santiago de Compostela that has a KTT and international affairs unit[209] and ICIQ - a world class research Centre now that was founded in 2000 and that has a KTT unit staffing six people and a research project unit with three people, in charge of international and collaborative research[210].

  Whatever the model, what has to be clear for both internal users (researchers) and external (companies, clusters) is where to “knock” to look for results, collaboration opportunities, services. This will strengthen TT capabilities.

  In this sense, it is recommended to identify the internal strengths at the partnership members in terms of TT know-how and good practices in benefit of the whole CoE.

- Definition of valorisation procedures

  Development of valorisation and transfer procedures aligned with the CoE transfer model and covering all "laboratory to customer" processes. For example, given that a results database is contemplated, it is recommended to develop a procedure for pre-screening the commercial potential of results that will allow a ranking of technologies according to their commercial potential and to establish a roadmap to the market.

[207] https://www.macdiarmid.ac.nz/our-people/industry-advisory-group/
[208] https://www.macdiarmid.ac.nz/our-people/management-strategic-and-professional-staff/
[209] https://www.usc.es/ciqus/en/about-ciqus/structure-and-organisation
[210] http://www.iciq.org/about-us/organisational-chart/

Although it belongs to a different research field, the Technology and Business Development Office of the Centre for Genomic Regulation is a good practice of technology transfer management; information about their procedures can be found at its website[211]

- Professional career development for TT managers and researchers

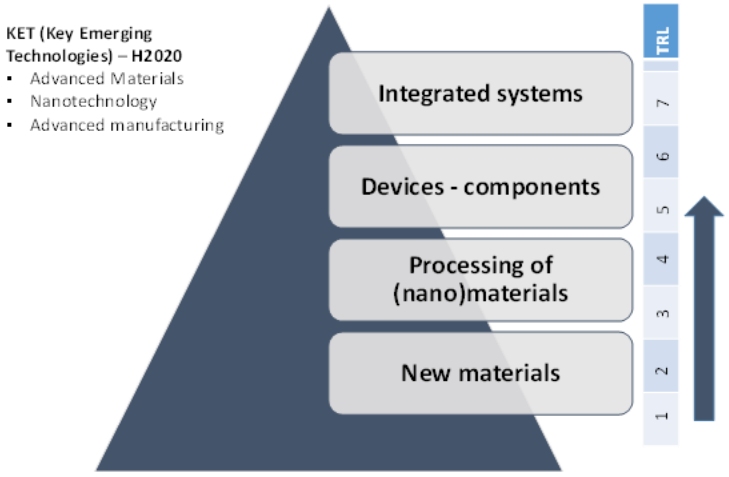
  The proposal provides for training for technical staff does not refer to the people who will implement the transfer actions. In order to develop knowledge transfer capabilities for the CoE, it is recommended that the technology transfer skills of the team be analysed and a career development plan be drawn up that includes a training programme that covers both marketing and transfer management. In this sense, the option of accessing training certified by the Alliance of Technology Transfer Professionals could be considered.

  Furthermore, enhance researchers skills in technology transfer develop training programmes and awareness activities in TT topics (cooperative and contract research, protection of results, spin-of creation). Especially in the case of young researchers, together with class-training, mentoring programmes involving experienced researchers and firms can be a good mechanism to develop the TT culture at the research community.

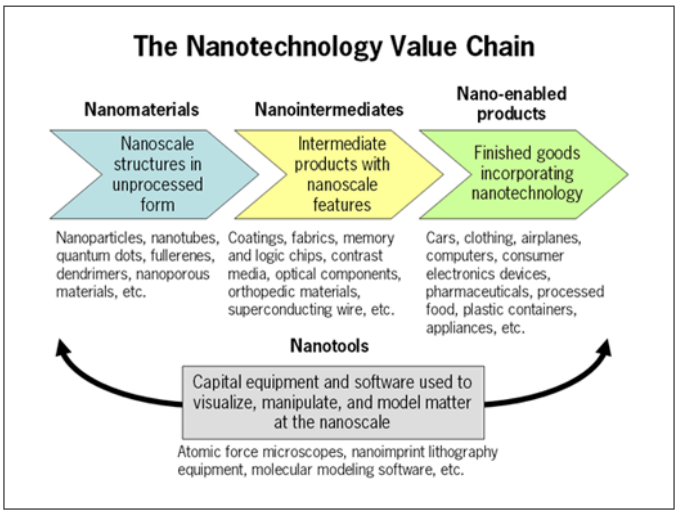
<u>Implementation of the work package related to transfer</u>

- Analysis of the research results portfolio and identification of the target market

  The project envisages the development of a database with the achievements of CoE with readiness for technology transfer; also, it mentions the identification of five user groups, or potential adopters of the new technologies to be developed. Once this database is elaborated, it is recommended to analyse the results to identify the market players who will uptake the research results first - the next link in the value chain from 'lab to the market'- and to define the most appropriate mechanisms to approach them.



[211] https://tbdo.crg.eu/



- Market research

  Characterisation of market segments, who are the potential customers (companies, technology centres) and what is their profile (multinationals, spin-offs, etc.) and geographical areas. The approach can be done with different methodologies: using firm databases to identify these firms (Kompass, Business Insights); analysing through the H2020 dashboard[212] firms participating in the programmes of interest of the CoE, through the clusters in which the CoE has linkages. In this sense, being part of the local initiatives to support innovation such as hubs and clusters is a way of being in permanent contact with the market. By doing this, the CoE has in mind a broad set of diffusion activities (open days, seminars, etc.). This market research to identify the key audience will be of interest to increase success in terms of technology transfer (closing contracts, identifying new partners for research projects).

- Definition of transfer mechanisms and support instruments

  By combining the results of the above analyses, the most appropriate transfer mechanisms can be selected and tailored actions can be defined to get to target clients. Joint exploitation projects and licensing are contemplated in the project proposal but there are also other mechanisms to exploit research outputs, such as the creation of spin-off companies (particularly where there is a platform technology to create) and even the provision of specialised consultancy to the private or the public sector.

  In this sense, the ICIQ mentioned above is also a good practice of tailoring the technology transfer mechanisms according to its scientific and research base. See: http://www.iciq.org/industry/

  Considering that the CoE considers - *"Especially important for realization of the purposes of the proposed project are the activities aiming at acceleration of the transfer of the scientific developments to the business parties included in the program for transfer of technologies and innovations"*[213] - it is recommended the design, and the allocation of budget, of CoE's

[212] https://webgate.ec.europa.eu/dashboard/sense/app/93297a69-09fd-4ef5-889f-b83c4e21d33e/sheet/a879124b-bfc3-493f-93a9-34f0e7fba124/state/analysis

[213] See section Results of the Proposal, page 45.

own mechanisms to support those steps of the road from the lab to the market that are not covered by the public system. For example, Proof-of-Concept programmes that support the process of technological and commercial valorisation of results, providing financial resources but also technical assistance. In this sense, the Centre could consider the definition of a **small internal PoC fund** to accelerate transfer processes.

The following provide examples of proof-of-concept programmes run by universities and research organisations:

- Okinawa Institute of Science and Technology[214]
- University of Melbourne PoC Fund[215]
- Powerbridge[216]

- Development of a plan for transfer and prioritisation of actions

  Finally, based on the above information (results, targets, mechanisms), it is recommended to establish a prioritization of actions to be carried out according to the objectives that are set as priorities in terms of transfer (achieving economic return, access to new markets, etc.)

CENTRE SUSTAINABILITY

In the Project Justification, it is stated that from the 7th year the Centre will be financially stable without additional co-financing by the beneficiaries, while the income from commercialisation is expected to materialize & increase from the 11th year. The Centre plans to start getting income from [public/competitive] project from the 7th year of operation and from economic activities from the 3rd year, eventually reaching a ratio of 1.4 million from economic activity and 1.2 million from projects, able to just cover its operating costs. It is interesting to note that, as opposed other Centres, here the three main partners prepared individual financial plans and forecasts for their activities in the framework of the Centre.

[214] https://groups.oist.jp/tdic/proof-concept
[215] https://research.unimelb.edu.au/partner/technology-licensing/for-researchers/funding/proof-of-concept-fund
[216] https://www.bnl.gov/techtransfer/docs/powerbridge_presentation-2.pdf

Sustainability of NCM&CT CoE means ensuring long-term functioning and success while positively contributing towards the economy, society and the environment. When talking about sustainability there are several aspects to be considered:

Financial - the basic, founding aspect. It refers to organisation of the research activities in a sustainable way and building a safe and positive "corporate like" environment for the employees/researchers/administrative staff.

How to achieve financial comfort? Securing funding for research is challenging due to limited national resources and high competition within the EU PROs. Funding can be derived from several sources:

- Operational budget: a relatively secure way of ensuring continual funding. However, this funding can be relatively small. This requires careful assessments of the research programmes/projects the Centre is able to implement. The Centre's management has to be somewhat selective in the studies they conduct, avoiding those with high operating costs.
- Industry-sponsored research projects: generally, have a higher compensation, but may also have higher operating costs to consider and it is important to ensure that the costs of running the program/research project are lower than the revenue generated from accruing cases. There are rules for the formation of the price paid and the allocation of IPRs and related conditions in EU state aid rules which need to be observed to avoid passing on aid to the industrial partner (see Chapter 4 of the general part of this report).
- Grant funding: Grants may be obtained to cover the costs of performing relatively small studies or to fund major long-term research groups or infrastructure. An example of grants and R&D supporting EU programmes/organisations are: Horizon 2020 (and future Horizon Europe), LIFE, EUREKA; European Research Council; European Cooperation in Science and Technology etc.
- Donated funds: Some organisations provide resources/funds as an unrestricted grant for research/educational purposes, others may donate to start a specific program. Private donors may donate money to research.
- "In-kind" funding: another institution provides non-monetary support for research activities, such as equipment, space or human resources.
- Others (such as National Roadmap for Research Infrastructure 2017/2023 adopted by the Council of Ministers in 2017. The roadmap serves the implementation of the National Science strategy and allows for funding of key and priority R&D infrastructure in the country).

However, it is not enough to know where to "find money" and how to prioritize research projects. The financial management of research activities is complex, because funds come from multiple sources and have to be disbursed to the multiple partners of the Centre, based on their contribution in a specific research activity/project. Sound financial management and accounting is required to ensure that: research activities are budgeted correctly; financial resources are sufficient to fund both the short- and long-term costs of the CoE and they are spent appropriately; there are measures in place to ensure accountability; skilled financial and accounting specialists are recruited to ensure the financial activities and management. Research activities have to be subject to auditing – internal or from the body providing the funding. Transparency is also important to build trust among Centre's partners. Accurate and standardized reports have to be provided to all the partners annually. They have to be mandatory for each partner using common infrastructure and

resources (see the New Zealand practice/case described elsewhere of this report). A possible solution for resolving the challenge is establishment of two units – one engaged with attracting research activities (incl. collaborative research projects and research on behalf of undertakings) and managing them and second for TT– commercially exploiting the IPRs generated. Therefore, the responsibilities will be distributed and results could be measured.

Societal - focuses on relationships between Centre and customers/suppliers and other research institutions.

Recommendation for social sustainability

Social sustainability means the Centre is able to position itself well on the market and builds trust among its customers/suppliers. To achieve this, NCM&CT CoE has to: cooperate with well positioned, competitive international Centres of its type. This includes such actors as the European Centre for Mechatronics located (Aachen, Germany); Mechatronics Alliance, Linz Centre of Mechatronics (Austria), Flanders Make (Belgium), FIMECC (Finland), E-TIME Institute (France), Centre of Excellence in Mechatronics Systems (Warsaw University of Technology, Poland), MIT-Siemens Centre of Excellence, etc. The CoE should participate in strategic alliances to attract front-line international research talents for its activities. Continually develop capacity to train future generations of researchers and involve young scientists in research activities. The CoE should also strengthen the relationships with business, public organisations, municipal and government authorities (through organising industry specific and Centre promoting events. Market research and proactive contact development with businesses potentially interested in Centre's services and products is important. Organising of open days in Centre's facilities for businesses and journalists; organising hackathons and competitions for young researchers, implement customer relations management practices to ensure adequate communication with customers and provision of quality services; etc.; attracting researchers from Bulgarian diaspora abroad; accreditation of its laboratories to guarantee certain quality level, control and legitimacy of results; etc.

Organisational - implementing best practices and systems that improve management and work methods and delivery of services/products.

It is recommended all processes for: access and utilisation of the Centres infrastructure; control; reporting; KPIs, internal communication, marketing and business development; strategic, operational and project planning; cooperation and attraction of external experts, distribution of results; recognition for participation in research projects and activities, etc. to be engineered, standardized and agreed and the have to become obligatory for all partners.

Institutional - the right management structure has to be chosen to serve the transparent and profitable operation of the Centre.

NCM&CT CoE aims at becoming an internationally recognized and sustainable research infrastructural entity. To achieve it and be sustainable the partners have to think not only about its equipment but also about:

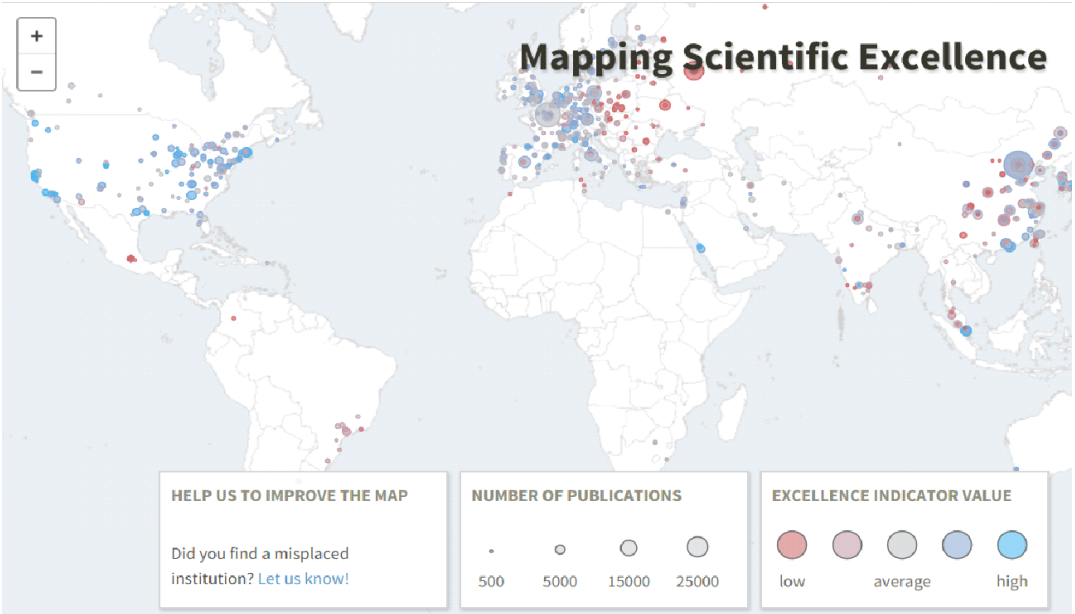
- Provision of international research and local analysis and advice (critical mass in terms of scientific excellence in promising research areas of national importance);
- Identification of relevant research agendas to make the Centre unique or well recognised and trusted partner and advisor;
- Encouragement of critical thinking (international benchmarking to evaluate the research work at NCM&CT);

- Development of capacity to train its scientists and future generations of researchers (support of researcher-to-researcher collaboration, through organised programme strategies; mentorship programmes, internships for young scientists, etc.);
- Stimulation of national innovation systems (focused efforts on improvement of national research networks and co-operation and initiation of cross-sector partnerships - including partnerships between researchers, the public sector and private sector, such as collaboration with strategic agencies and end users; research utilisation and commercialisation through patents and licensing or spin-off firms).

The key to sustained success is to start out small, set realistic goals, gain wider support, and prove its worth with early wins. Gradual deployment, progressing through the deployment stages[217] of 1) design 2) building 3) prototyping and 4) operating is a proven approach to building a successful Centre of Excellence.

ROADMAP ON LONG-TERM SUPPORT – IDEAS

The National Centre for Mechatronics and Clean Technology aims at becoming a competitive scientific structure at European level after the 5th year.[218] To accomplish this vision, it has to be considered that scientific research takes place in a highly competitive environment: increasing competition for resources, recognition and results. See as an example, the world map of institutions with scientific production in Material Science[219]



Leading scientific institutions are based on the following pillars:

- Mission: to produce science to advance knowledge but around relevant socio-economic problems;

[217] Executive Field Guide: Launching a Centre of Excellence by https://abraic.com/
[218] Project Proposal, page 38.
[219] Source Mapping Scientific Excellence

- Strategic scientific management: scientific leadership and management skills;
- Effective governance structure with external committees involved in the progress of the Centre;
- Research agenda focused on the fulfilment of the mission and action program to support the scientific strategy;
- Funding from various sources: public baseline (linked to the development of the strategic plan), competitive (public or private programmes) and transfer returns (services, contracts, licenses, spin-off);
- Organisational design and operation in line with objectives;
- Assessment scheme based on institutional assessment, Scientific Advisory Board Assessment and Research Impact Assessment.

The NCM&CT project is defined on the basis of an aggregation of the scientific capabilities of the partner entities, in order to roadmap the future of the Centre it is strongly recommended to undertake a strategic planning exercise that outlines the vision, mission, objectives, priorities and measures of success focusing on the following aspects:

- Mission, vision and opportunity for the "National Centre for Mechatronics and Clean Technology" in the context of the Bulgarian System of Innovation but also at an international level.
- Scientific agenda -based on current strengths, positioning aims and competitive landscape -scientifically speaking.
- Governance, having in mind that scientific leadership and external[220] Scientific Advisory Board are key elements.
- Organisation at both levels managerial and scientific.
- Fundraising.

Collaboration with other **national innovation and research infrastructure** e.g. Sofia Tech Park and RDI Consortium, National DIHs, Cluster of Mechatronics and Clusters of Cleantech and Circular Economy on:

- Institutional and organisational development
- Industrial collaboration
- Commercialization
- Technology transfer

Technical assistance on:

- International networking
- Open innovation support
- Knowledge sharing

[220] A Scientific Advisory Board is usually formed by external members. It provides advice and assessment on Scientific Strategy (Research Agenda), it assesses both researchers and Centre performance. In general it is formed by foreign members. A different body is the Scientific Committee of the Centre which is formed by the leaders of the different research lines.

- Global visibility
- Strategic profiling

9.5 Centre of Competence CLEAN &CIRCLE - "Clean Technologies for Sustainable Environment – Water, Waste, Energy for Circular Economy"

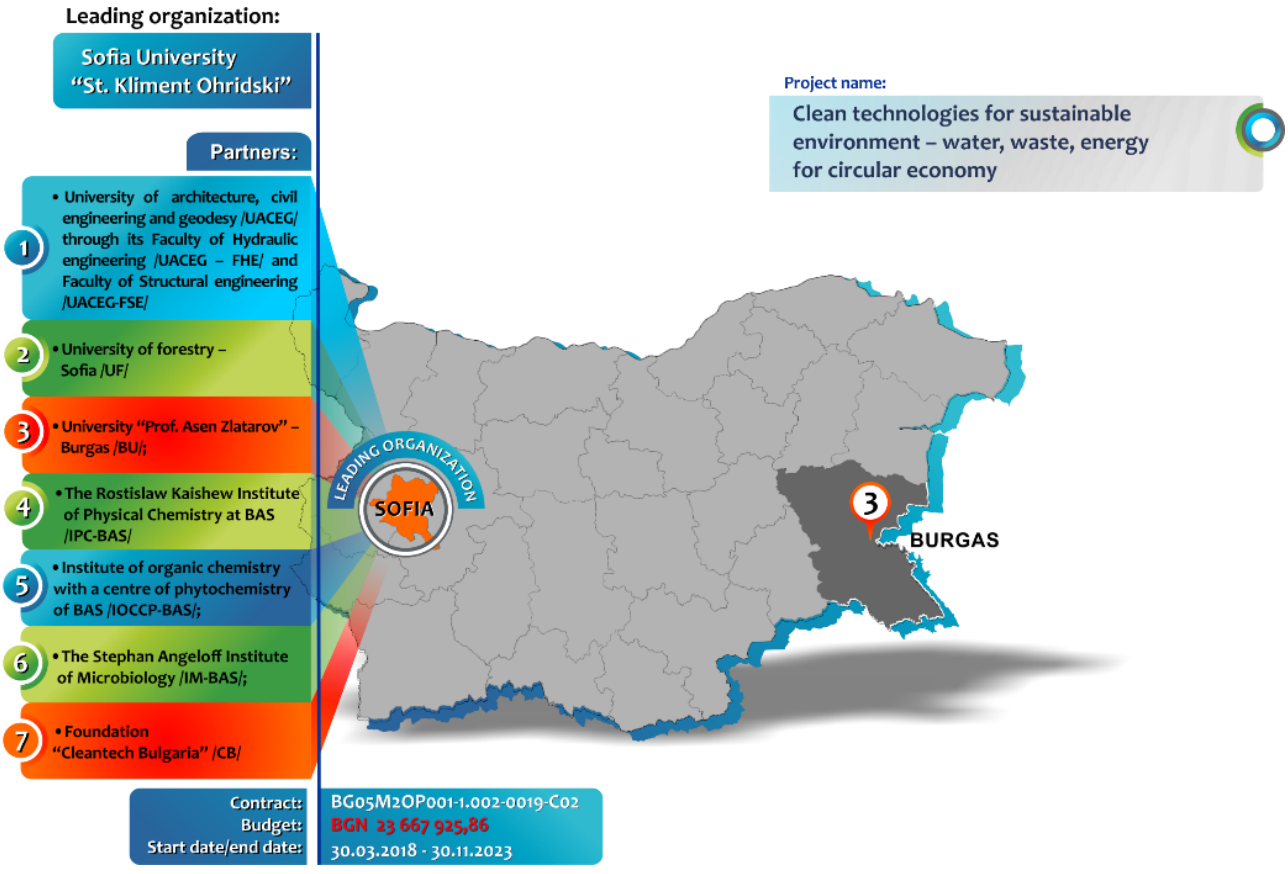
Summary of Centre

Contract: BG05M20P001- 1:002-0019-C02

BUDGET: 23667925.86B1.BGN

Start / end date: 30.03.2018-30.11.2023

The project aims to develop technology and research infrastructure and competence in a variety of sectors related to environmental sustainability from water and wastewater to solid wastes, and recycling. It aims to engage in at least 19 subsectors such as biosensors, advanced treatment materials use (e.g. zeolites), recycling and materials recovery technologies, energy applications, solid and sludge waste, biofertilizers, HFGs (Hydrogen Fuel Cells) for wastewater to H2, and many other diverse technologies. The Centre intends to deliver technologies for wastewater treatment, sludge transformation of solid and construction waste that need pilot testing and then could be applied in the associated partners' facilities and premises.



The project is led by Sofia University (receiving just over 50% of the funding) and has another seven partners and five associated ones. Partners of the Centre of Competence are: Sofia University, University of Architecture, Civil Engineering and Geodesy, University of Forestry, Burgas University, Institute of Physical Chemistry, Institute of Organic Chemistry with Centre of Phytochemistry, Institute of Microbiology at BAS, Cleantech Bulgaria Foundation. Associated partners are: Municipality of Sofia, Metropolitan company for waste treatment, Sofiyska Voda AD, Interplast BG, Energy Agency-Plovdiv, University of Modena, Italy.

The project will be based in a new building within the Campus of Sofia University where the majority of equipment will be housed, providing a distributed equipment infrastructure to the rest of the partners, and connecting all partners through a common information system.

A distinctive objective of the project is the support and promotion of entrepreneurship amongst young environmental specialists.

The partners state to have had numerous collaborations among each other prior to the Centre project and the idea to create it came naturally with a view to target interdisciplinary R&D from idea to commercialised research results.

The Centre combines know-how in biological aspects on the one hand with technical on the other.

Analysis of questionnaire

The answers indicate that partners have common views on certain issues and disagree on others, e.g. certain partners agree for the need of a new legal entity and strong management, whilst others prefer distributed responsibilities without an additional entity, so that partners participate individually in contracts and new projects with prospective industrial partners. However, the majority, including the leading coordinator seem to consider being independent from the founding members and creating a Non-Profit Organisation that is self-sustainable or at least achieves a degree of independence in its organisational structure.

The partners have different appreciation of the competences of the TT Centre especially regarding the aspects of IPR and tech-transfer.

All partners agree that there is a lack of skilled financial and legal expertise in the teams, as well as for complex industrial liaison and that the Centre should be managed by a single leader that is closely supervised by a board.

The majority agree that they have not defined relationships among partners regarding IPR and industry contracts and all expect that the CoC should make at least 15-20% of its income (starting from the beginning of operation) by private sector contracts. However, there are differences among the partners' assessment on sources of income generation, revenue sharing among CoC and founding partners, TT strategies, access to incubators for spin offs, and whether there are or not KPIs already in place at the Centre.

The above assessment on common and non-common views regarding major issues for sustainability, ownership, management, income generation and strategy of the Centre, pose the need, as we will propose later, for:

1. A strategic and Business Plan that all partners will agree on and abide by, scheduled into following two phases:
    a. project period, and;
    b. post-project period

2. Agreement on a legal structure, ownership and governance based on the Centre's priorities, scope, and form.

In addition, it is understood from the questionnaire that (at least) certain partners in the Centre consider there is a lack of clarity/process around how revenues and IP arrangements concerning contract and industrial facing activities and services should be distributed among the partners. Such process should therefore be clarified/implemented, and an appropriate model would be to ensure:

1. Project activities for industry are properly costed with a breakdown for both direct and indirect costs (overheads) which make up the Full Economic Cost (FEC) accounted for. The FEC model should include the administrative costs related to the Centre. In the event the industrial partner is unable or unwilling to pay for the contacted activities at FEC then it will be necessary for the Centre partners to retain scope to derive downstream benefits from the arising IPR.
2. Funds are then directed to cover the direct costs of undertaking the contract activities and distributed to the relevant partners undertaking the research.
3. A profit element from contract research must be included which may be an additional service fee or scope to derived benefits from the exploitation of arising foreground IP; while this would not be sufficient to maintain the Centre on a sustainable basis; it may be usefully recycled to provide resource across the Centre.
4. When contracting for such industrial facing work, there is no need for a single legal entity (although that would not be a problem) as a contract that binds each of the contributing parties and sets out their respective roles and obligations in the project will be an adequate (and indeed common) arrangement.
5. Subsequent agreements concerning the exploitation of foreground IP (if it is not owned by the industrial partner on the basis of FEC Plus consideration) or IP otherwise owned by the Centre partners may also be entered into by each relevant partner and the industrial partner, without requiring the need for a separate legal entity.

Long-term vision

The long-term vision of the Centre is to become a National Centre for a series of interdisciplinary sectors related to sustainability and environment. These include the whole cycle of the water cycle from resource management to effluents treatment, for the solid waste treatment cycle, for the sustainable development and circular economy and the effective use of energy resources and Renewable Energy Systems (RES). The Centre aims not only for excellent R&D activities in these domains and a reference point to the Bulgarian environment protection and management system, but also a strong collaborator with industry providing research and innovative solutions with a practical application, and contributing to the generation of a new pipeline of young scientists start-ups in the sectors addressed by the centre.

Legal Framework of the Centre

The creation of a legal entity and an integrated structure with a degree of independence is necessary for the Clean & Circle CoC. This is a sector of high importance for the EU and for the Bulgarian market. A separate legal entity will enable plenty of opportunities facilitating the

attraction of funding for projects, develop solutions both for the public sector and the market, create a pipeline of start-ups. It may also allow:

- ✓ Participation as an autonomous partner in consortia competing for projects in competitive Research and Development programmes: internationally (HORIZON, LIFE, etc.). In the experience of the independent expert-authors of this report, the calls under HORIZON provide for multiple partnerships, but each partner is evaluated on his own merits. It may not be practical that for instance 7-8 partners from Bulgaria participate in a multinational research consortium usually having 8-15 members according to HORIZON practices. So in order for the CoC to participate and be evaluated properly on its capacity and experience it may be more effective that it applies as a single entity.

- ✓ Participate nationally <u>also</u> as a single structure in ERDF Operational Programmes. In these calls for proposals, legal entity/partners are evaluated from the scientific/technical quality of the proposal on their past experience, capacity, references, and organisational aspects. Having a well-defined structure carrying the legacy of the first period of project implementation, as well as, the capacity to use relevant research infrastructure and engage the competent human capital, can potentially allow the CoC to apply in an integrated way.[221] Thus in the case of CoCs for being funded in the next ERDF period *as CoCs* (legal entities) with even more integrated activity there should be a budget and a call specifically for that action (which is eventually a Bulgaria's decision issue and will depend not only this specific Centre but on the situation of all 14 Centres). Also, for fulfilling cooperative project with industry (but also independent engagements with private sector), a separate legal entity would be useful.

- ✓ For developing and following a concise business plan to which the management will be responsible and accountable, and rewarded for its implementation. The management should also have responsibility and control of an autonomous budget, cashflow and profit and loss (P&L), aiming at increased (if not full) financial sustainability. The form of legal entity should be selected on the basis of having the ability to apply for and any other available funding schemes on national level such as National Science Fund and other national instruments. A status of a separate legal entity - an association which has the right to operate the research infrastructure incl. the equipment, but which does not fully substitute the original partners and their rights of ownership, could be considered.

- ✓ Specific spin-offs could be created at a second stage. Following the latest decree by Council of Ministers universities can create, own and participate in spin-off companies for the purpose of exploiting the research results. It is important to understand that the CoC should have TT capacities to set up those spin-offs, but once the companies are incorporated the role of the CoC/its partners should diminish and remain engaged. mostly as an investor. The equity can belong to the partner/s who generated the technology.

    - The CoC should approach with caution the possibility to create spin-offs itself (as an independent legal entity) due to risks that some partners will have contributed more than others and also because there is a private foundation partner in the CoC raising further issue with state aid if it hasn't contributed itself to the creation of the technology and ends up owning equity in a joint spin-off project.

[221] In the experience of the experts from other EU Member States, ERDF programmes have usually single final beneficiaries. Only in specific cases where partnerships are essential (or targeted) by the nature of the intervention such as clusters, cooperative research between companies and research institutes or the case of CoCs, calls provide for partnerships.

The above proposal for creating a legal entity "equal to public body"[222] is based on the observation that most of the European countries' Environmental research Institutes are either part of public bodies or are heavily funded by national environmental research programmes: as shown in the following European case studies box.

Case Studies of European Environmental and Sustainable Technologies Institute

Finnish Environmental Institute SYKE (www.syke.fi)

SYKE,the Finnish Environmental institute , is a Research and Development Institute and a Centre for expertise providing solutions on sustainable development and active in the areas of climate change, water, sea ecosystems, circular economy. SYKE is an Institute under the Ministry of Environment. SYKE being a broadbased research and expert centre is carrying hundreds of projects in the domains it is active, working for all stakeholders of environment, i.e. Government, Municipalities, Companies, Citizens groups as well as international networks.

Helmholtz Centre for Environmental Research UFZ (www.ufz.de)

Helmholtz Centre for Environmental Research member of the Helmholtz Association of German Research Centres has a very corporate like organisation structured and management and works as a corporate entity (Gmbh) but is supported strongly by the Federal Ministry of Education and Research and the states of Sachsen and Sachsen–Anhalt. With its over 1000 researchers it is active in publically funded research in several environmental, water and ecosystem-related sectors having in parallel strong technology transfer, research commercialisation and private sector services units.

Italian Institute on Ecosystems Study (www.ise.cnr.it)

The Institute, part of the Italian National Research Council is a public sector body, and its basic and applied research activity focuses on water and land ecosystems and its main objective is to generate the knowledge for protecting the environment and providing relevant technological support to government and local authorities. Additionally, the institute supports with its scientific infrastructure and experts the industry and the rest of scientific community as well as facilitates innovation in the environmental area. The Institute is very active with European Horizon and Transnational Interreg-type of programmes in parallel to national research programmes.

Environmental Research Institute of Ireland ERI (www.ucc.ie)

The Environmental research Institute of Ireland, although of national significance, is part of a state University, University of Cork with over 300 environmental researchers of several scientific, engineering and business backgrounds and serving the multidisciplinary environmental challenges, and has under its umbrella three additional specialized centres on Marine Renewable Energy, Atmospheric Chemistry and Aquaculture and fisheries. The Institute is active both on research aiming at new knowledge creation as well as in applied research for environmental problems solving and finally contracted research both for Industry and Government. ERI is a key stakeholder in Ireland related to Climate change initiatives and could serve as a model of how an Institute in a small country balances among several roles as multidiscipline Environmental Centre of Know-how and research active across all private and public domains and vertically from basic to applied and contracted research.

National Environmental Research Institute of Denmark NERI (www.neri.dmu.dk)

NERI is another small EU country successful and efficient Environmental Research Institute operated by Aarhus University although initially it was part of the Ministry of Environment (including the Environmental Protection Agency/moved to Aarhus in 2007 aiming at providing in a more flexible way environmental scientific know how and services to international markets and Organisations such as EU,UN. NERI is active in all sectors of environment and ecology (Atmospheric Marine, Freshwater, Biodiversity, Environmental Chemistry and Microbiology, Biodiversity etc. It's a large institute by the country's standards (with over 500 staff) and is relying a great part of its viability to International

[222] Further consultations may be necessary to explore options particular for this CoC, or if a less integrated option for a legal entity is chosen (with less competences), it could easily exercise its supporting activities as an association/sdrujenie.

research and advisory funding.

It is evident in all cases and regardless of the size of the country or ownership of the Institute that the public sector (international or national) is the main source of funding of research and environmental protective technologies development and application while the institutes make effort to balance their activities by serving industrial clients and promoting innovation and entrepreneurship.

The Centre's partners and in particular Sofia University as the lead partner and major beneficiary should further explore the possible advantages of creating a university institute within the meaning of Articles 25 and 26 (6) of the Law on Higher Education, allowing the pooling of resources and a degree of organisational independence with its own rules of operation and management. Since university-institutes are not necessarily separate legal entities, the option to create a legal entity remains valid even if a university-institute is established, with a view to facilitate the effective operation and development of "Clean and Circle" CoC.

The ownership of equipment could remain in the possession of the initial University / BAS institute project members/partners, whilst the right of use and responsibility for maintenance could be transferred to the new entity. This model corresponds to the "more integrated model" presented in chapters 2 and 3 of this report. An important principle here is that the creation of a separate legal entity should not simply complement the activities of the individual partners but actually manage the research infrastructure in an integrated manner including overall R&D project management and industry liaison management.

An MoU between the Centre's founding members / project partners and the new legal entity and/or the Statute itself of the legal entity could detail all the aspects of new and refurbished laboratory buildings as well as the laboratory equipment transfer of use and maintenance. Depending how the use of the infrastructure will be organised and what powers would be conferred to the management of a common legal entity, a grace period for the use of buildings (eg. five years) and an overhead for new projects could be agreed on for compensation of any expenses carried by the founding members/partners in relation to general operational costs of this infrastructure. This means that there must be a strategy and "business model" for the financial flows and other contributions from all activities with/for industry (undertakings/industry/third parties external to the Centre) as well as internally - between the partner organisations and the new legal entity. It must be arranged how the costs for management/administration of the new legal entity will be covered and by whom.

A detailed business plan will clarify all financial parameters and should be taken into account in its financial sustainability planning.

The Partnership Agreement states that where R&D activity packages are shared, the participating partners "jointly participate in the rights on the research results, benefits and intellectual property". This is further clarified by saying that the results shall be distributed on the "*basis of solidarity proportional participation in the production and their contribution to the creation of a scientific product / service*". This is also the arrangement for most of the 14 Centres at present.

ORGANISATIONAL FRAMEWORK

The way the centre was planned is towards a National Centre of Competence of Environmental Technologies, close to the needs of Bulgaria to adhere with Sustainability and Circular economy

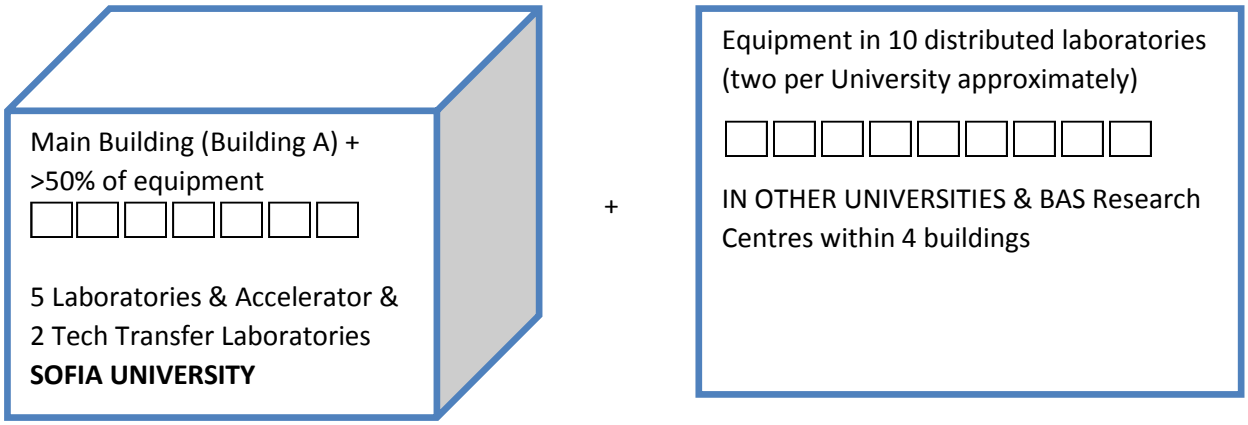
National and International related priorities and in parallel aiming to develop into a close to market organisation with practical mandate and outputs. In addition, R&D to Market, Innovation & entrepreneurship activities for young researchers are included in the mandate of CoC. A conceptual functioning proposal as presented by the researchers is in the following scheme No 2. However, this is taking care only of sectoral specialization (three vertical and four horizontal modules), without linking ownerships/operational and technology development activities and functions.

Thus, we have to picture:

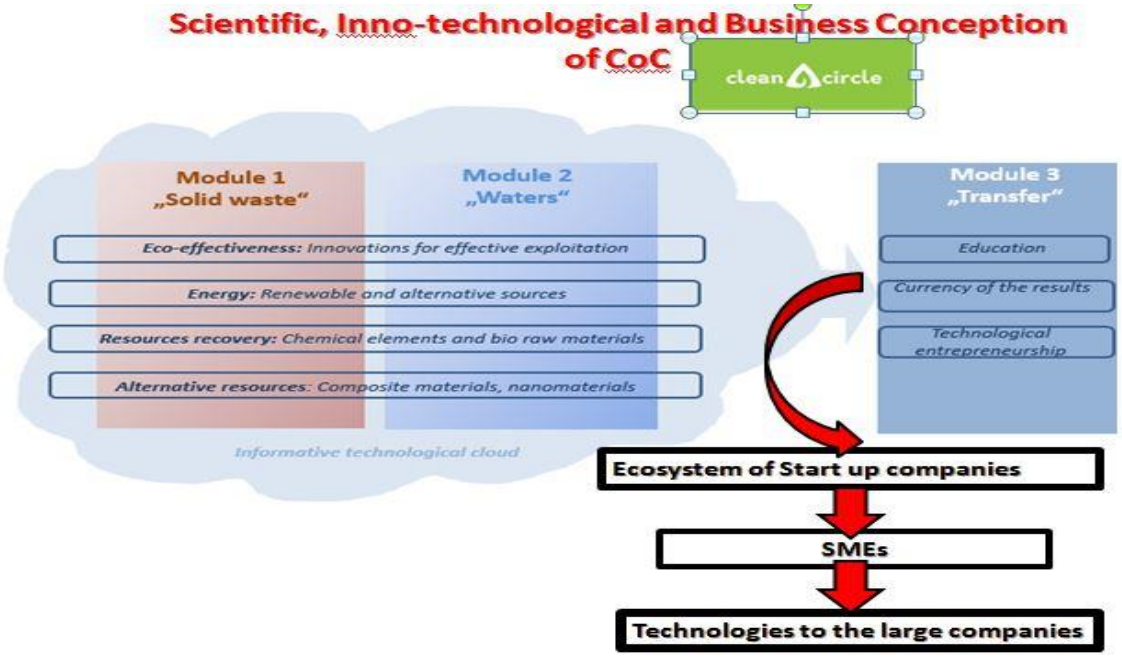
- Current situation in terms of ownership -compare it with: (scheme No 1)
  a) The activities envisaged to be carried by the partners (over 20/scheme 3)
  b) The functioning and future developments vision with the vertical and horizontal modules

Ownership and Organisational Structure

Current ownership (Scheme 1)



Conceptual Organisation by Research Partners (Scheme 2)

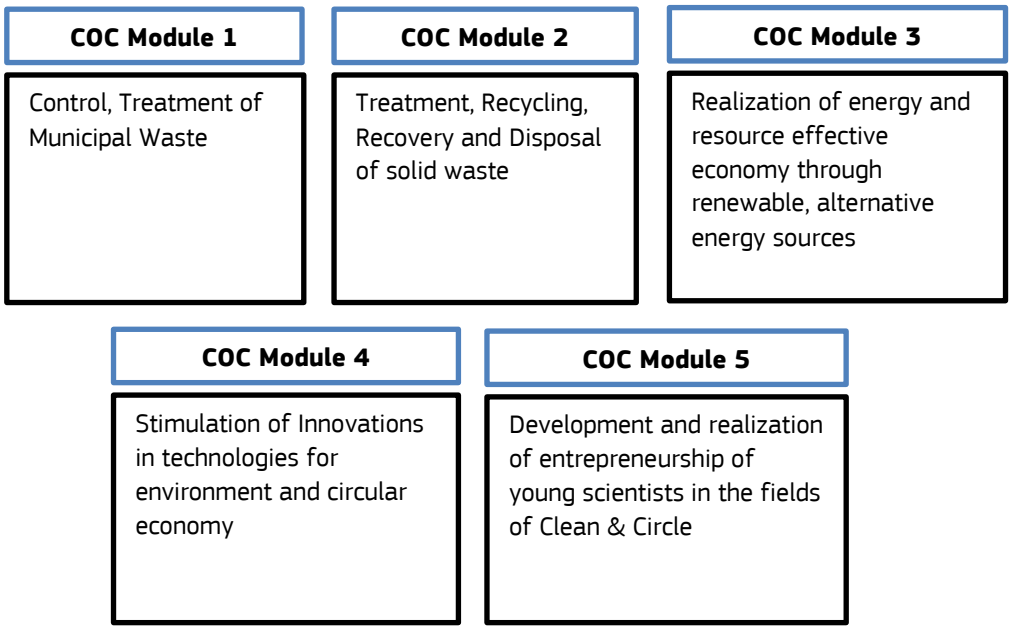


Actions Implementation by partners (Scheme 3)

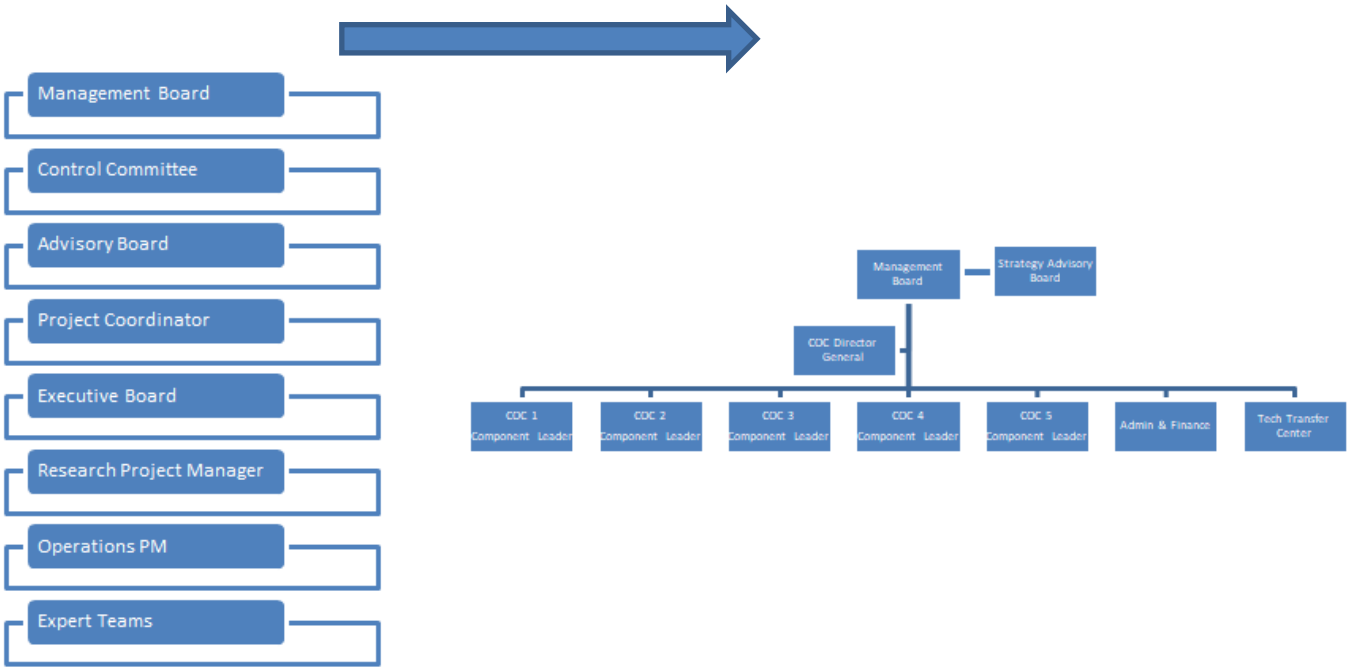
There are at present nine work packages (WPs). Five thematic work packages (two on water, two on solid waste and one on circular economy) and four horizontal/ transversal (admin, TT etc.). The above three "as is" structural, investment and operational modes of implementation of the project CoC will make it very difficult to lead to a coherent sustainable model of a CoC due to high fragmentation of all major components: infrastructure, R&D and technological development and operations and results.

In addition, as described in the analytical text of the project (P 260, 261), there is an organisational scheme carrying the project with several layers (7) which may be necessary for the project period of implementation but definitely in need to be simplified in next post-project period (post-2023). Thus, because of the [too] many management and administrative layers, we suggest that after the completion of the public procurements, human resources are concentrated in R &D activities and efforts in collaboration with industry. The Rectors should not be involved in the operational management but only on strategic & direction level.

Based on the project detailed description, the experts propose a distribution of activities among partners and grouping of works into five modules.



The experts believe that on a long run and post project implementation period the organisation of the CoC could be set around these five modules.



Ownership and use of infrastructure proposal

New building and laboratories created with programme finance could be let for use by primary partners (Universities & BAS) to CoC and respectively CoC 1, 2, 3, 4, 5 divisions will be responsible for carrying the relevant research and innovation development activities. The CoC could have the overall responsibility for keeping infrastructures and equipment in excellent condition whilst Directors (or rather Component Leaders as presented in the graphic) of CoC 1, 2, 3, 4, 5 are responsible for their use, planning of use into various projects.

Overheads of new projects could be used for maintaining of initial CoC infrastructure and equipment.

The proposed model is based on best practice and the current situation of CLEAN and CIRCLE CoC and Bulgarian environment.

The table below gives an overview of the existing arrangement between the partners as to ownership and sharing of research results. The "Clean and Circle" Centre disposes of own IPR Policy and Rules for IPR management. They are based, as stated, on relevant documents and on the good practices from the experienced partners in the consortium.

***Table 14**. Overview - sharing of IP in different situations as per the existing Rules of Management of IP*

Situation	**IP Arrangement**
Activity of only one of the project partners within his work in Centre	Ownership of the result and / or benefits from it, belongs only to this relevant partner
Activity of two or more of the partners within	Ownership of the results and / or benefits of

their work in the Centre	the same belongs to the respective partners distributed among them in a percentage proportion specified with a signed Protocol for the contribution of each organisation, between the partners.
Activity of one, two or more project partners within their work in the Centre and third parties (e.g. industry)	Ownership of the results and / or benefits of the same are property of the relevant partners and third parties in co-ownership. The ownership is distributed among them in a percentage proportion specified with a signed Protocol for the contribution of each organisation and third parties.
Activity of one, two or more project partners within their work in the Centre and individuals (regardless whether they are employees or not of the partners	Ownership of the results and / or benefits of the same are property of the relevant partners and individuals in co-ownership. The co-ownership is distributed among them in percentage proportion specified by a signed Protocol for the contribution of each organisation and individuals.

It is recommended these rules are further developed to provide clarity in dealings with industrial partners and other collaborators that each partner has approved and which may be implemented by them independently or acting as a sole Centre (when the new separate legal entity is created). A useful "tool kit" to enable this approach could be constituted by:

1. Standardised template contracts that are utilised with minimal negotiation.
2. A standardised approach to the costing of projects and the distribution of revenues.
3. A single TT unit used for the negotiation of contracts and to support commercialisation activities.

Multidisciplinary teams from different competence modules (the five suggested modules above) working with one client or on one and the same project can apply cooperation and charging rules of multi-partnership consortia / Horizon projects or could study in more detail the practices of the above presented institutes while preparing the internal organisational and cost charging value creation sharing rules.

With the creation of a legal entity formally uniting the partners of the Centre, these rules should be further developed so that in each arrangement/transaction/contract vis-à-vis third parties (especially undertakings) the CoC speaks with one coordinated voice thus providing a level of legal certainty to the external parties that the activities planned will be completed or respectively – the quality services will be performed. Industry is not interested in the internal arrangements among the partners or between the founding partners and the newly created separate legal entity/structure. Regardless how much power/competences the partners wish to confer to the legal entity, the arrangement should proportionally reflect and allocate the resources contributed to the specific activities by the partners, the revenues received in the course of their execution and the allocation of any created IPRs.

RESEARCH INFRASTRUCTURE

In the project documentation, it is stated that the Centre identified several users of its equipment and services. The infrastructure could work as a specialized laboratory for evaluation of water and waste. All partners will be united in common cloud space, so the CoC Clean & Circle will be able to take requests for determination of water and waste quality. These results will be accompanied with the expert assessment, analysis, evaluation and recommendations, which in the Centre's view is usually the hardest, and the existing private and municipal laboratories for control do not do. In addition, the Centre could offer complete system for control and management of treatment plants.

The Clean & Circle Centre of Competence is considered by the Managing Authority to be one of the moderately well performing centres in terms of its profiled expenditure, with approximately 12% of the budget utilised to date (status Q1 2020). A key part of the research infrastructure investment is the construction of a building to house much of the new equipment to be procured for the project, in particular the Water complex. Other laboratories are spread across the partners in Sofia and Burgas. This building is to be located at and constructed via the budget of University of Sofia as a responsible partner under the OP SESG programme and a future owner of the building. Construction of the building has not yet commenced, but is expected to soon. One potential issue for the centre regarding the new building is whether the University of Sofia would be willing to lease it or make it available to the newly created separate legal entity. It is understood a "sale" of the building by the University to the Centre would not be possible under current rules (it remains ownership of the partner). A sale of the building is highly unlikely to be agreed by the owner-university and also in our opinion is not necessary and not recommended for the effective functioning of the project. It should remain ownership of the university. However, exploring this question of **making the building available for the purposes of the CoC is recommended as the Centre does have a particular opportunity to ring fence its operations as a new entity within the building, i.e. by giving a physical dimension to the Centre's operations it becomes a more tangible concept**.

Other Centres, such as the CoE Mechatronics and Cleantech National Centre have, have enacted separate, more specific rules for the organisation of the activities in the building of TU-Sofia Campus Studentski Grad (in collaboration with several other universities involved). In addition to the building-related infrastructure, it is understood that some of the project partners have now concluded initial procurement activities which will permit the purchase of certain equipment. In due course, some of this equipment is earmarked to be housed in the new building but will be installed in the partners' facilities in the interim, as appropriate.

The Centre expressed in its presentations in September 2019 that it is not clear **who is to be responsible for the exploitation of the laboratories that are not in the main new Centre building** of Sofia University Campus Lozenetz. In relation to this, the Partnership Agreement stipulates that joint R&D projects are planned across the various sites and laboratory locations. Our opinion is that the laboratories located outside the new building should be effectively made available for the purposes of the Centre. These should be exploited based on and in the context of the Centre's needs, activities and projects (independent research by the owner partner or jointly with other partners, public/competitive project funding, collaborative research and research on behalf of undertakings etc.). Clearly, the owner partner will have a sense of ownership but they should clearly commit their capacity to fulfilling the objectives, vision and activities as mentioned just above. Also the above proposed "Component Leaders" will have a say on the R&D&I activities of these laboratories in order to ensure the fulfilment of their component agendas and objectives.

One implication of the long procurement and construction tail is that the Centre is behind where it ideally should be in terms of R&D activities. This has been noted by the centre as being of

particular concern where interactions with business are at stake. Businesses are interested to engage and use the facilities and expertise of the Centre, but the Centre's establishment is a process that has not been completed yet.

The partners have entered into a Partnership Agreement that sets out the facilities & equipment to be acquired/purchased by each partner. This agreement also provides an annex covering intellectual property arrangements, but only generally stipulates the common goal of joint activities across the labs of the Centre, it does not define in detail any joint research activities or shared usage of facilities. As the list of distribution of ownership of equipment by each partnership includes both critical expensive as well as auxiliary common low cost equipment. The partners should develop a smaller list of strategic equipment that could be of common use following the conclusion of this project or even during the project for new additional research projects undertaken jointly or in combination of partners. A separate agreement for critical equipment should rule the utilisation/charging/maintenance as well as the percentage of time that the equipment should be dedicated to new joint projects within the new legal entity and organisational structure on the one hand, and to initial "owner" institution on the other.

Data/ICT system. The Centre envisaged to maintain and operate a data collection, storage and management system. The Centre states that it would need services such as cloud and analytics of collected data being made available to users. It is not clear whether at the time of writing the proposal documents, the Centre was aware of the existence of the Big Data and Digitization Centre led by UNWE (YHCC) which aims to serve researchers from across the country. It is recommended to further explore synergies with them.

The Rules for Access to the Centre's infrastructure state that private individuals may not access research infrastructure, although they provide for use of equipment for projects of third parties with certain procedure and obligations. These rules should be further elaborated in order to allow access to researchers, PhDs or experts of external cooperating partners of the Centre based on mutual projects and/or research agreements as happens with similar centres all over the world.

Link to State Aid rules

To help avoid passing on an advantage to other entities that are primarily engaged in economic activities in situations where a partner or partners in the Centre engage(s) in effective collaboration with third parties from industry, **the terms and conditions of a collaboration project**, in particular as regards contributions to its costs, the sharing of risks and results, the dissemination of results, access to and rules for allocation of IPR, **must be clearly agreed upon and laid down/concluded prior to the start of the project.**

Furthermore, in research on behalf of undertakings (economic activity), the IP created does not necessarily need to be shared (although this would be an ideal situation for the research organisation if it has the bargaining power to negotiate such arrangement), but it can also be fully allocated to the paying organisation that requested the research (conditions apply, see general part of this report in Chapter 4 on State Aid). Where the ownership of, or access rights to IPR remain with the research organisation or research infrastructure, their market value may be deducted from the price payable for the services concerned. The existing Rules for the management of IP of the Centre seem to grant some flexibility in negotiation arrangements.

The Partnership Agreement states that the heads of laboratories are responsible for the coordinated use of the research infrastructure and that "*The answer is to reinvest in basic economic activities of the CoC all profits resulting from the activities of knowledge transfer, which is used in*

the above research infrastructure." Possibly due to wrong translation or a misunderstanding, we must say here that the reinvestment should happen **into the main non-economic activities** (not in the basic economic).

TECHNOLOGY TRANSFER AND COMMERCIALISATION

In developing and justifying the centre, ambitious plans have been set out with regard to patenting (and other forms of IP protection). These include:

- The establishment of a TT unit for the Centre
- The filing of 17 Bulgarian and European trademark/patent applications
- Transferring and spinning-out technologies with a view to commercialisation outcomes

To achieve this, the partners have proposed to develop a strategy for commercialisation and have agreed some form of IP framework as a part of their Partnership Agreement. However, discussions with the Centre indicate this has not been progressed beyond the aspirational at this stage in proceedings (status Q1 2020). As a (presumably) interim arrangement, documentation related to the centre would suggest that it is operating in alignment with the IP and commercialisation framework of Sofia University.

***Table 15**. Overview of planned structures and activities for acceleration and technology transfer according to project documentation*

	Accelerator for Technology Entrepreneurship	**Unit for Tech Transfer**
Activities	Budget: approx. **430k BGN** • Prototyping incl. dedicated laboratory); • Industry validation support; Enable the creation of startups and joint ventures with third parties; • Offering a portfolio of technologies at stage "investor readiness"; Networks of mentors, investors; • Entrepreneurship trainings; • Attract investments	Budget: **220k BGN** • Determine the results of research suitable for commercialisation; • Full liaison with industry, including proactive activities; • Negotiations of licenses etc. • IP Management. • Entrepreneurship training; • Marketing of technologies; • Apply its own Centre-specific regulations for the management of intellectual property

CLEANTECH Bulgaria, which seems to be well-positioned nationally in the clean technology as well as in the provision of entrepreneurship services (Climate KIC Accelerator, Sustainable Energy KIC Regional HUB) environment is a partner that could be considered a potential candidate for taking up part of the technology transfer activities provided an appropriate operational structure can be

agreed. Specific role that Cleantech can play is to organise the venture-building/ spinning off activities of the Centre via the Accelerator programme. However, it would be important that the centre deploy an **internal resource to perform** the actual IPR commercialisation tasks such as identification and protection activities, the building of prototypes, which can be also done via Sofia University, which have a track record in IPR commercialisation.

The centre already has associate partners from industry (Sofia Voda on water, Plovdiv Energy, Plastics company etc.).

It is proposed that during the next stage the Centre systematises its collaborations by **pairing industrial partners and associations, as well as clusters, for each one of the modules of CoC proposed** (i.e. CoC1 water with Sofia water and other water companies) and initiate development of wider partnerships and even new clusters where not in place (e.g. in various sectors of circular economy).

Clearly it is helpful, and a positive indicator, that some provisional thinking has been given to operational structures and arrangements for Technology Transfer and Commercialisation; and that a budget is indicated for that. However, the bulk of work remains to be done to:

1. Ensure the structure proves workable in operation and able to respond to changing requirements over time as the research programme and partner/industry interactions proceed.
2. Recruit and/or train appropriate personnel.
3. Provide a solid basis for sustainability.

To address these, careful thought should be given to the extent outsourced provision is utilised in preference to in-house capacity building. Certainly outsourced technology transfer services may play a useful role in implementing a commercialisation programme but there is always a risk these:

- Do not build robust links with the research community in the same way as in-house approaches may.
- Do not foster "ownership" of projects over their extended lifetime to the extent an in-house manager may.
- End abruptly when the funding finishes.

The respective roles and interplay between the Accelerator Programmes and Unit for Technology Transfer is also important and should be carefully managed – ideally by one manager – to prevent duplication of activities, the development of rivalries and desired activities *falling between the gaps* of the two sections. Having said that, examples do exist of other, leading universities that have adopted this split approach to technology transfer, one such example being the UK's University of Manchester. Furthermore, the Centre's proposal to operate a "cluster approach" in which activities and relationships focus around specific areas of research within the Centre may be anticipated to benefit from the more specialised offering that may be achieved in focusing the skills and role of the two units that comprise the TT function.

Identified Challenges and Needs

There are significant supply side and demand side challenges to the transfer of technology in Bulgaria generally, and these are (naturally) anticipated to impact the Centre in seeking to fulfil its commercialisation objectives. In addition, on a Centre specific basis, the challenges cited (and apparent) are that:

– Not all partners have an IP policy[223] or an effectively operating technology transfer office.

– The research is currently at too early a stage to be contemplating IP outputs, so it is not realistic to expect commercialisation before considerable progress has been made.

– The interface for working with businesses is not operational and this is threatening to undermine the credibility of the Centre with potential commercial partners.

TT Arrangement for the CoC (Strategy, Policy and Process)

As is common to all of the CoCs, some degree of realism and careful management of expectations should be applied in the area of IP commercialisation. This process is challenging and, more often than not, unsuccessful in even the most developed ecosystems. Hence, the centres should avoid seeing TT outputs as a critical component of their sustainability plans. Instead, at this stage, the CoCs should focus on performing excellent research and establishing the correct mechanisms & processes, skills and relationships to provide long-term downstream research activities with the prospect of successful translation. This includes not only executing publicly funded research projects, but also collaborations with industrial partners and economic activities (research on behalf of undertakings and renting of equipment).

Ultimately, the centre may access technology transfer resources through three possible (but not necessarily mutually exclusive) means, as follows:

1. Via the existing TT infrastructure of the partners – primarily the TTO of Sofia University

2. By establishing its own centre TTO (as is contemplated in the Centre proposal and in its Partnership Agreement).

3. Finally, an alternative that the experts propose strongly to assess is to combine the TTO with a CoC of complementary sector such as HITMOBILE for reasons of having a critical mass of tech transfer and IPR activities that could sustain a strong TTO.

There is clearly the need to carefully consider which of these is adopted, but what is critical is that at the point the Centre generates commercialisable research outputs it is able to access best practice support to translate those outputs. It is recommended that a working group is established to review the preferred approach.

Key Points on the Annex 1 of the Partnership Agreement[224]

1. In some instances the Annex already contemplates the CoC as a legal entity, i.e., having employees and having interest in IP rights, which is not understood to be appropriate at this time and will depend going forwards on steps to actually separate the Centre from its parent entities.
2. It is noted that ownership of intellectual property[225] follows "activity" rather than output and this may create an unnecessarily complex picture i.e., there will be increased joint IPR which is generally more complicated to manage and exploit than solely owned IPR.
3. It is noted (clause 5d) that individuals, which may be employees of the Centre, who engaged in research activities have a right of co-ownership. The thinking behind this for Centre employees is not clear but may be at odds with practices which generally provide for

[223] In particular the University of Architecture, Civil engineering and Geodesy, for which we could not find any document on their website. The other partners appear to have an IP policy.
[224] Policy and Rules for the Management of the Intellectual Property Rights of the Competency Centre "Clean and Circle".
[225] See also the section on Ownership and use of infrastructure, above in text.

ownership of employee generated IP by their employer. We also recall that in most cases the rules of Bulgarian public research organisations stipulate that employees performing their usual tasks or given instructions while using the resources of the research organisation, who create an invention in this context, are to receive a "fair compensation" if the technology is commercialised.

It is not clear what arrangements are agreed in terms of access to background intellectual property (i.e., those IP rights of the partners in existing prior to the establishment of the Centre and/or arising from non-Centre research). For this, the Centre could take a look into the Horizon Europe Proposal[226] from 2018.

Whilst it is positive and appropriate that the partners to the centre have established arrangements around IP it is important that these do not become a barrier to future progress when IP rights arise, and the current arrangements, arguably, fall short on this requirement at the current time. A review and revision of IP arrangements, in light of international best practice, is therefore recommended.

Collaboration with industry

(a) The Centre has apparent links with industry (primarily understood to be Bulgarian) who have (according to the Centre Management) expressed interest in using the facilities of the Centre, and indeed frustration at the limited pace of commissioning. Clearly this industrial engagement is a positive, but in order for it to translate into actual collaboration there is an evident need to bring the centre to operation.

(b) One other issue impacting on collaboration with industry is the lack of a professional industrial liaison function at any of the partner institutions. Sofia University has a TTO but this does not appear to provide a sufficient interface with industry, and is primarily administrative. The links which have been established with industry are therefore understood to have arisen through the efforts of researchers in the centre to form networks but this may be missing out on other opportunities that could be secured with a systematic approach to industrial engagement.

Centre Sustainability

The centre aspires to become a national point of reference and serve national needs, whilst it serves to support the achievement of relevant EU targets in the area of environmental sustainability and circular economy. The Centre should also aim to develop its own (more) sustainable operation after the six years of the ERDF project funding expire.

The fact that the centre has its own dedicated building for a major part of its activities is clearly a driver for downstream separation from its parent institutions. A business plan should be developed to explore the viability of this approach.

Recommendations

- Develop a business plan which takes into account the implementation period, the five-year post implementation period, and a vision and strategy for 10 years following implementation. The business plan should analyse market opportunities of working with national and international business partners; national and international R&D support

[226] Proposal for a Regulation establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination, COM/2018/435 final.

programmes; identify potential international collaborators for international R&D and technology development; detail the organisational, governance and reporting structures; analyse the mix of income sources and their evolution while the centre matures and attracts more income from business cooperation and competitive research; and finally, present a detailed roadmap towards institutional, scientific and financial sustainability,

- It is expected that the organisational planning should lead to a scenario so that the project is transformed into an integrated CoC on Alternative Energy Renewable and new Energy Optimisation Technologies.

Partnering with similar sectors Applied Research and Competence centres in EU in view of future calls of competitive programmes

- More focus on training and attracting younger generation
- Define longer term relationship with international partners and with EU programmes
- Better definition of the business plan in terms of operation budget and costs
- Develop a detailed MoU between founding member's project partners and CoC Management for:
    - Use of building and equipment, infrastructure (depending on the existence and competences of a new legal entity there could be a need for a grace period or similar arrangement as well as clear rules on the payment of overheads, which would have to be paid to original owners),
    - Operation of buildings and undertaking operation and maintenance of equipment.
- Upgrade use of equipment agreement in place within project documentation to extend to third parties with detailed charging fee module based on actual costs of equipment bought/depreciation and operation expenses
- Explore in partnership with other CoC in complementary sectors such as environment/circular economy to join in linking with the same TTO mechanism that could become stronger due to critical mass of activities its engages.

ROADMAP ON LONG TERM SUPPORT

First and foremost, the Centre needs to commission its research programme and demonstrate that research outputs of an internationally recognized standard can be achieved. Strong leadership and commitment of all involved is required here. With success, the door should be opened to sustainability, but achieving sustainability should not be the overwhelming focus of the Centre at this stage.

9.6 Centre of Competence "Quantum Communication, Intelligent Security Systems and Risk Management"

Summary of Centre

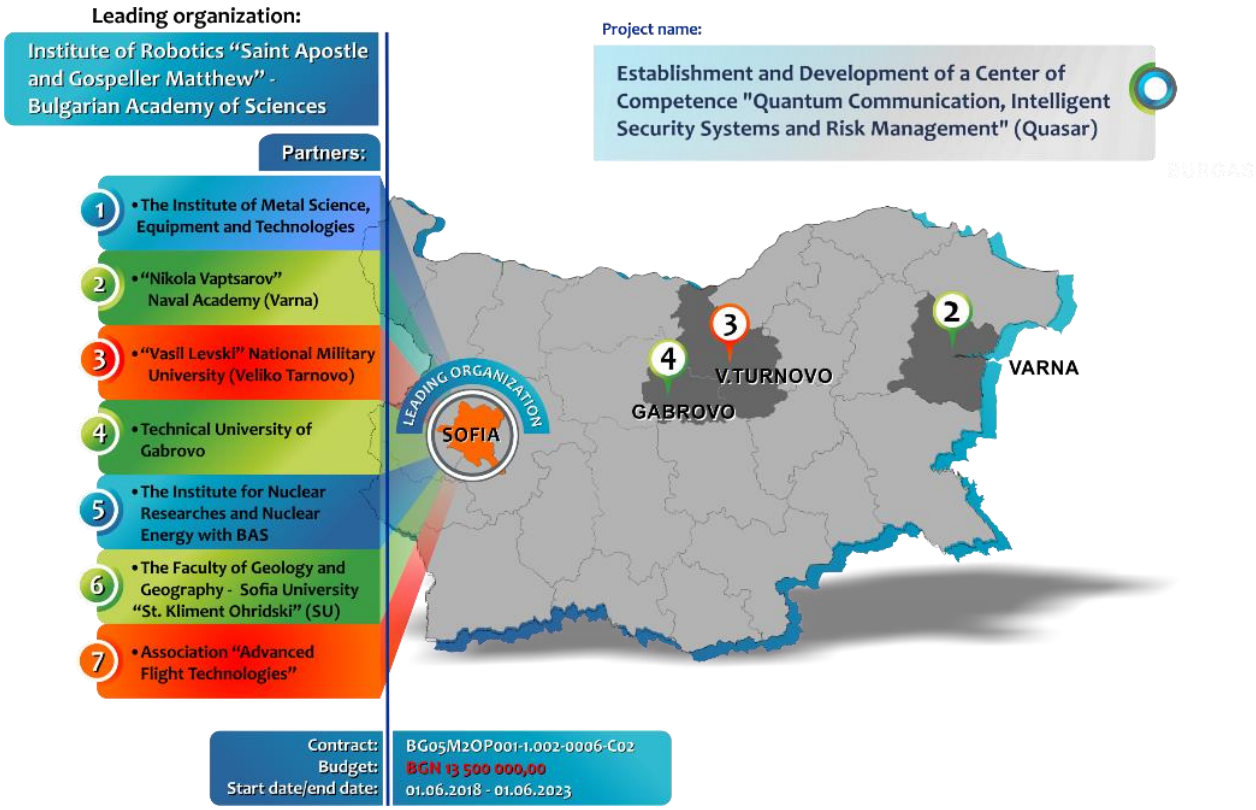
Identification number: BG05M2OP001-1.002-0006

Centre name: Centre of Competence "Quantum Communication, Intelligent Security Systems and Risk Management" (Quasar)

Budget of the project: 13 500 000.00 BGN

Lead partner: Institute for Robotics, Bulgarian Academy of Sciences

Start date: from 01.06.2018, End date: 01.06.2023



CURRENT STATUS

Analysis of questionnaire

The questionnaire was answered by two different members of the Quasar CoC management/project team within a period of about a month. These answers to the Survey have been discussed and approved by the Quasar CoC Management Committee and are representing the single unitary position of all partners in the Centre. Nevertheless, we must note that some answers are different between the two respondents, possibly and/or in part due to the specificities of each partner organisation to which they are associated. Crucial answers regarding the future development and resources needed were further elaborated in an email sent by the Management Committee to the JRC and the independent consultants. The outstanding specifics are:

- The project is centralised, meaning that the lead partner really leads the project (although the funding is not concentrated in one or two partners but dispersed across all partners each getting between 5% and 28%). It concentrates the legal and financial power. The whole management and scientific personnel are employed by the Lead partner (although they come from all partner organisations). The administrative functions are outsourced.

- The equipment under the project belongs to the partner organisation that has procured it. The equipment can be only used for the purposes of the CoC Quasar. In the future, it is imagined that the equipment and research infrastructure would be owned by the new legal entity if such is created.

- CoC decision-making at high level is provided by the Management Board (MB) that consist of the top representatives of each partner organisation. For operational issues there is a lower-level body with delegates (expert staff) of each partner organisation. The Research program is managed by the Scientific team.

- There is a strong belief of the CoC that:

    - a new legal and/or organisational arrangement should be established. It should be managed by a single leader (or executive committee) with substantial decision-making power and supervised by a common supervisory board. The Centre should be largely independent in its management, operation, collaborations with industry and international R&D&I projects.

    - to develop the Centre towards the vision of an internationally renowned and sustainable CoC, whether eventually organised as a legal entity or not, necessary administrative measures related to the creation of this institutional environment must be secured, namely sufficient human resources, trainings, system for management and monitoring etc. But they have expressed the fear that this is not possible due to the limitations of the project.

    - the incorporation of CoCs and CoEs needs to be envisaged as a legal form in any relevant existing Bulgarian legal acts, e.g. law on the encouragement of scientific research. The experts note here that the Centres have been included in the National Roadmap for Research infrastructure with the idea to provide targeted funding for operations.

- To facilitate management of the use of equipment and real estate the CoC is already implementing a unitary product lifecycle management IT system.

- There is a 150 000 EUR budget and an internal administrator dedicated to technology transfer. This TTO will decide the equity or royalty split (revenue sharing) between partners on a case-by-case basis. The majority of the TTO activities will be (has already been) subcontracted to an external organisation based on a public procurement order.
- The Centre already has a basic IP policy and strategy. The strategy for technology transfer is focusing on consulting and training, IP licensing, various forms of collaborations with firms and spinouts.
- There is an insufficient number of skilled financial and legal experts for the business planning, controlling, contracting and monitoring of the use of the research infrastructure.
- There are not enough skills and resources to deliver solutions to industry in time acceptable for the industry, for contemporary incremental spin-off development, nor for attracting and closing early stage investments (pitching, valuation, negotiations, etc.).
- There are KPIs set, but only those that were set by the public call rules. The KPIs are monitored monthly but only by the Managing Authority.
- One of the respondents indicated that no separate accounting system has been implemented yet (in their partner organisation).
- One of the respondents indicated that the "accounting of the CoC manages only the project grant". Because the research assets belong to the partners, they apply the depreciation, VAT recovery etc. according to their own policy.
- One of the respondents indicated that no budget is allocated for technology transfer in the project and that the Centre will use the already establish Technology Transfer Office to one of the partners. Note: we believe that this answer may be either due to misunderstanding (as there are funds for that) or it may be that this partner does not recognise the benefit of the central TTO for their partner organisation.

Identified needs and challenges

The needs that were identified by the Centre's representatives are:

- Need for advice on the appropriate legal form: to be able to easily build brand, participate in EU funded programs and also be feasible for national financing.
- There is an insufficient number of skilled financial and legal experts for the business planning, controlling, contracting and monitoring of the use of the research infrastructure.
- Lack of capacity on how to manage IP portfolio and how to implement the state Aid rules.
- Lack of knowledge on "PR" for industrial partners abroad.
- The biggest barrier for the successful technology transfer in general is the lack of knowledge of this process in Bulgaria – both on the side of the research institutions and the companies – i.e. how to "sell" inventions to the industry and how businesses can take advantage of scientific research.
- Making sure that the Centres are recognised as structures not only under the National Roadmap for RI but also under other relevant instruments.

The needs and challenges that were identified by the expert panel:

- Business development skills to collaborate with international corporations – top/experienced, seasoned international manager required.
- Legal (and organisational) arrangement that would allow for (more) flexible scaling of personnel and other resources and streamlined/quick commercial decision making.
- Technical assistance on different kinds of collaboration with industry and development of accompanying agreements. Sustainable collaboration with industry cannot be driven by change, but requires a systematic business development effort and a research agenda that is in tune with the needs of industry.
- Technical assistance in accounting: Separate accounting system for economic and non-economic activities, analytical costing so that overhead costs can be properly allocated to each activity, setting price for external users of the equipment.
- Training on the formal channels of Technology transfer, TT procedures, sources of translational funding and on contemporary spin-off development.
- Support for application of the new decree by the Council of Ministers allowing the creation of companies by universities only for the purposes of commercialising their results (this should normally be done by the TTO/contractor).
- Systematic and supported "networking" to approximate potential partners, introduction of technology scouts or brokers that can bridge the gaps between academia and industry.
- There are no KPIs monitoring the performance in terms of commercialization and TT and its effectiveness in terms of income.
- Grounds for the income planned in the financial sheets are unclear and unrealistic.

Extracts overview from the dedicated letter prepared by the Centre and sent to JRC (Q1 2020):

> 1. *"Legal personality is an important element in the process but just replacing the "Partnership Agreement" with "Act of NGO" for example would in no way guarantee a higher integration of the partner organisations in the Centre so that it can start performing the functions of a unitary organisational unit"*.
>
> 2. "*The envisaged budget for the admin personnel is set in the projects according to the needed number of hours for project administration and not for the administration of a complete newly created organisational unit. Most people are engaged only part-time. Therefore the Centre believes that it is necessary to hire qualified people, engaged full time, with competences and experience in various fields such as "State Aid", European Law", "Commercialisation of scientific research", "Management and integration of Innovations", "Planning, monitoring and execution of business plans", in which fields the individual partner organisations experience difficulties at the moment"*.
>
> *3. The Centre would like to hear recommendation on similar "Capacity Building measures" in other countries. In the Centre's view, it is necessary to create an integrated/complete institutional environment for its operations.*

Brief reflection answers by the experts:

- An example of capacity building, specifically in the field of intellectual property was the Patent Booster project aimed at raising the basic knowledge of IP and technology marketing for own personnel as well as associated companies in the KIC ICT Labs under the European Institute of Technology (now rebranded KIC EIT Digital). This was organised as a multi-annual series of 1-day lectures at all nodes of the KIC. Lectures on patentability were given by the European Patent Office. Lectures on techno-marketing by seasoned professionals working for the member organisations.
- To be considered: the capacities of the Centre inevitably reflect the existing capacities of the founding partner organisation (which are to be increased as a result of the project funding in the period 2018-2023). It follows that the founding partners should also aim to increase their own capacities (understand not only for the purposes of the Centre project period) as this will impact the future activities of the research organisations, in particular in the field of industrial liaison and technology transfer.
- In another example, Centres in Slovenia did proactively establish informal association where a part of the activities was knowledge transfer in the field of efficient management of the operations. This Association was in fact also a "syndicate" representing Centres' interests and facilitating the dialog with the MA.

Long-term vision

The Centre's long-term vision is clear and ambitious. This is an impression expressed by some of the participating experts built on: the Centre's performance so far (they completed most of equipment procurements), on their answers to the survey, the Centre's proactive problem solving as well as personal interaction and discussion during the physical meeting.

They see themselves as a sustainable legal or organisational entity and regional leader strongly collaborating with industry and competence Centres across EU on the execution and commercialisation of applied research. Its financing plan is made for 10 years ahead, where financial analysis was made even up until 2043.

One more opinion expressed by some of the participating experts and based on their experience concerns the long-term vision of similar quantum computing infrastructure projects. While there certainly is interest in basic research from major manufacturers, the application of real quantum computers (other than so called "quantum annealing" computers) is a long way from the market. Quantum communication (quantum key distribution) may be however closer to the market.

Legal Framework

Current legal framework

The Quasar CoC is currently constituted by the Partnership Agreement between 8 partner organisations according to terms and conditions of the public call defined by the MA. The Centre has developed and adopted its own rules for access to the equipment and intellectual property policy. The IP Policy (2019) states that there is a TTO structure in the Centre, which manages the IP and licensing. From the document "Structure of the TTO of Quasar", it seems that the CoC are not sure yet if to keep the TTO as a unit of the Centre or to shape it as an independent legal entity (at present it is not) and the document remains flexible on the options.

Recommendations

In line with the statement of the Quasar management board, and considering that the CoC has four Work Packages (WPs) which appear to be very much interlinked and involving several partners each, we recommend the establishment of a new legal entity (possibly an association, similar to the one created by HeritageBG CoE) under the NGO-law/not-for-profit and in private interest:

- Depending on the model chosen and the competences granted to the legal entity[227], this new entity, fully owned by the public research organisations, shall ideally receive a mandate and gain sufficient rights to effectively manage (or at least closely coordinate the use of) the equipment and infrastructure purchased within the project so that the objectives of the Centre be achieved and the value-adding joint R&D&I activities realised as well as collaborations and negotiations with industry - streamlined.

- This new structure would also facilitate joint applications for EU framework financing (Horizon) and could also become a member of European research networks. The CoC itself could (since legal personality is normally an eligibility criterion), but does not necessarily need to apply for participation and funding under its own name. Nothing prevents the partners to jointly apply for EU Framework Financing (as long as they meet the usual eligibility criteria);

- It is not recommended that the ownership of the equipment and real estate is transferred to the new entity. The depreciation costs are substantial and would most likely cause negative balance sheets, which consequentially closes the access to EU framework financing. Please note that the transfer of equipment and research infrastructures is not per se *required* for the sound operation of the CoC. It is perfectly feasible that the institutes contribute the equipment to the CoC by means of an agreement.

- Such setup could also enable internationally competitive salaries to attract experienced and skilful international experts needed to realise the Centre's ambitious vision.

- Establishing a single legal entity would also facilitate development of the CoC's brand and closure of technology transfer and commercial deals with industry due to more straightforward administrative processes. It is ultimately up to the partners to decide on the level of integration that they wish to achieve. We note however that what we observed in the case of Heritage.BG, which already created a legal entity/association, is that the partners are obliged to contribute where necessary to the expenses of the association, including financially. For QUASAR, we are not convinced that the private partner (Association Flight Technologies) will be willing and/or able to provide a monetary contribution (this is valid for all Centres which feature private partners receiving funding for equipment).

Organisational Framework

Ownership structure

Currently, the activity packages are spread across the partners in four cities Sofia, Varna, Gabrovo, Veliko Tarnovo with an average of three partners participating in each work package. Each work package is led by one or two of the respective partners. All aspects relating to each of the four work packages have a level of independence and particularity within the framework of the Centre

[227] See Chapters 2 and 3 of the report on Legal and on Organisational structure respectively where the two potential models are discussed (less integrated and more integrated).

and the project documentation reflects this by describing each section separately most of the time for each of the four work packages. This level of granularity is not achieved by most of the other CoCs/CoEs. This means that the Centre needs **a level of integration in its activities and that projects with external partners/industry will most likely require the involvement of two or three partner organisations.** Thus, any change in the future organisational structure must clearly reflect the **responsibilities of the leaders of the four work packages** vis-à-vis the partners participating in them as well as vis-à-vis the Centre (when the separate legal entity is created).

As mentioned, besides the public partners from BAS and universities, the Centre has an association in private interest as a partner and beneficiary under the project. Association "Advanced flight technologies"[228] is contracted to receive approximately 540 000 BGN, most of it going for purchases of equipment including a laboratory with 3D printers, CNC, software for drones and the aerial vehicles themselves such as airplanes and a helicopter.

Governance and decision-making management of the tangible and intangible assets of the Centres

The manager of the newly created separate legal entity (organisational structure) should be a single full-time leader with broad mandate needed to achieve ambitious goals. He/she should also be accountable and responsible for results and be periodically monitored by supervisory board.

Currently:

- CoC decision-making at high level is provided by the Management Board (MB), consisting of the top representatives of each partner organisation. The Chairman of the MB is to organise the development of an annual plan of the Centre as well as to maintain relations with third parties and external organisations such as companies. The Project Management team's main work seems to be rather administrative than focused on R&D.
    - ➢ The experts are of the opinion that in the future the chief executive or main person responsible for the development of the CoC's activities shall have a degree of independence but also of accountability and shall push for overall implementation of the project with a focus on R&D&I activities. The CoC also expressed that it imagines having a single leader with substantial decision-making power and sufficient competences to initiate and engage on projects with industry.
- The Project Research Team consists of heads of the work packages and other researchers; however, the described tasks do not reflect R&D activity but merely technical acceptance, training and administration of the equipment. The manager of the Research Team is said to coordinate the implementation of all work packages to ensure synergies.
- The Managers of the four work packages are to manage, organise and control the implementation of activities within a specific work package of the scientific program of the Centre. The individual managers are to ensure the organisation needed to implement the activities of the work package in execution of the approved annual work plan, including to delegate rights and obligations, and allocate specific tasks to researchers involved in the implementation of the package.
    - ➢ In other Centres, we recommended a similar structure by calling these managers "Component Leaders", who have a key role in the successful execution of joint and synergetic activities. See Chapter 3 of this report on Organisational Framework.

[228] http://2020.eufunds.bg

Ownership Rights of Research Results – current arrangement

The Partnership Agreement for the Centre states the following:

Art. 7. (1) The Parties agree ownership rights to the results and benefits of the project, including intellectual property rights as a result of the implementation of the project, to be enjoyed by the partners according to their contribution to the implementation of the work packages.

Art. 9. The Parties agree that in their relations with each other and in their relations with third parties they will apply the Rules for access of external users to the scientific infrastructure and equipment by external organisations (based on the Rules of the Sofia University, Faculty of Geology and Geography), an integral part of this contract - Appendix 3.

RESEARCH INFRASTRUCTURE, STATE AID RULES AND MONITORING

Management of the infrastructure and state aid rules

During the visit to the Centre in September 2019, the Centre expressed that one of the biggest challenges for the present report to address is to help the Centre find a balance between the commercial operations and the correct application of EU state aid rules in R&D&I. During the meeting in February 2020, it expressed that by selling its services and access to its equipment it will be able to generate very high revenues.

We remind that "research on behalf of undertakings" (this includes contract research, research services) is considered an economic activity and should constitute a maximum of 20% of the overall capacity of the infrastructure in addition to being of ancillary nature.

Numerous conditions apply in the context of EU State Aid law for an activity to be classified as "effective collaboration" and therefore non-economic. Please look at Chapter 4 of the general part of the report.

In general, the Centre needs to build skills for negotiation with industry so that the maximum possible benefits (revenues, IPRs etc.) remain with the Centre together with skills in applying and observing EU state aid rules.

At an in-person meeting in November 2019, Prof. Georgiev raised the issue of how to calculate and monitor state aid to remain within the boundaries set by both the Grant Contract and the State Aid rules. As elucidated by Prof. Rumenin during the February 2020 visit, the Centre has since purchased a dedicated Product Lifetime Management software solution with comprehensive functions with which the use and working time of all machines will be monitored. As far as a technical measure goes, from the panel's perspective, this should be a step in the right direction. We take it that all data is stored by the system in an immutable way.

Furthermore, according to project documentation, an Electronic Register is envisaged to be implemented for the usage of the infrastructure and services provided to third parties, to help with the overall management and provide useful information to potential interested clients and partners.

Recommendations

During the in-person meeting and expert visit on site which took place in Q1 2020, the representatives of Quasar expressed some concerns as to the State Aid issues relating to the use of the research infrastructures. The experts first wish to point out that this topic will be dealt with in more detail in the main part of the report (Chapter 4). However, in light of the interest expressed by industry, the Centre regards state aid issues as a major obstacle. Therefore, some specific questions are answered here.

The Centre expressed the wish to have some support on the calculation of man-hours and in general the capacity usage of the equipment in respect of the boundary of 20% ancillary economic use. The State Aid rules do not offer much guidance to these practical aspects. However, a reasonable explanation, as shared during the meeting, is that only the operationally available capacity (e.g. available machine time), needs to be taken as a basis for the calculation of the 20% of the yearly capacity of the research infrastructure.

As a rule, the calculation of capacity usage depends on the nature of activity and the type of resources required. Capacity can be calculated on the basis of time accounting [human resource capacity measured in employee working hours], inputs [such as material, equipment and fixed capital] and other elements relevant to the specific activity on the level of the relevant entity in the respective research organisation.

A second question was raised pertaining to the amortisation and depreciation costs of equipment and other elements of research infrastructures. In general, it is important that where the "full costs" for a service are necessary to be established, all relevant costs have to be property accounted for including the depreciation costs as well as the overhead costs (based on analytical costing). It falls outside the scope of this report to look into Bulgarian accounting practices, but the experts are of the opinion that a reasonable method for amortisation and depreciation will be acknowledged under EU State Aid rules. We suggest following the advice of local accountants and the usage of standard/routine accounting practices. For the situations which require "full cost" method of price formulation please see the general part of report.

Furthermore, from the survey, we received a separate question on the nature of some specific activities with external parties that are not companies.

"In the area of security, there may be future activities based on the analysis and scenario development to check the security plan of one regional administration, to provide security training of specific target groups from administration etc. This kind of activities will be contracted and the question is whether this falls out of EU State Aid Law and how is it to be classified and/or counted."

The described partner entities (municipality, administration) do not seem to qualify as entities engaged primarily in economic activities. Therefore, there is some room for non-economic forms of collaboration. Secondly, if the public research organisations (universities, BAS institutes) have to fulfil mandatory orders and requests from state/governmental/judicial authorities, **where the State exercises its public powers**, then these activities would be likely non-economic.

Examples of public powers exercised by the State include:[229]

- maritime traffic control
- police

[229] State aid & Infrastructure, presentation by L. Balta, DG for Competition, European Commission, 2015, https://ec.europa.eu/regional_policy/sources/conferences/state-aid/prague/1400-1520w1-lida-balta-state-aid-and-infrastructure-prague.pdf

- customs
- anti-pollution surveillance

However, where such public entities operate like any private undertaking would, e.g. in purchasing goods or services, the provision of such services is usually an economic activity. Moreover, where the universities/institutes participate in open tender procedures where they compete with private sector companies in tenders for the provision of these specific services, then it would be likely that the exercised activities and services provided qualify as economic.[230]

One of the respondents to the survey indicated that no separate accounting system has been implemented yet [probably it is meant: in their partner organisation]. We note that if this partner engages in economic activities it may be necessary to implement an appropriate monitoring and accounting system, which is also an obligation for all beneficiaries under the present program (see general part of report, Chapter 4).

One more question was asked in the presentation in November 2019 and namely how the capacity of the usage of the infrastructure is to be monitored after the end of the project period. We should say here that after the formal expiry of the Centre project (2023) the state aid rules continue to be valid in the same way as during the project which means that if the economic activities are conducted also the separate accounting system should continue. The monitoring of the capacity usage may be necessary in order to prove that the capacity used for economic activities is 20% or less of the overall annual capacity.[231]

As a general recommendation, the expert team recommends to build capacity on the implementation of the state aid rules, i.e. planning, controlling, centring and monitoring of the use of the relevant infrastructure.

Technology Transfer and Commercialisation

Centre's TT strategy outline and expectations

The Centre already has a general IP policy and strategy.

Currently, the IP Policy of Quasar states that:

In the event that the Centre of Competence (CoC) is a contractor or a partner in a team to carry out a task financed by an external institution, the rights on intellectual property shall be regulated in a preliminary agreement between the financing institution and the contractors as well as between the partners in the team.

The strategy for technology transfer is focusing on Consulting and Training, IP licensing, joint ventures with firms and spinouts. The TTO external contractor is supposed to further develop all commercialisation strategies and IP rules and adjust them as necessary to the needs of the partners and the Centre as a whole. In April/May 2020 we received a copy of the newly developed rules from 2019 (which include a number of separate documents, strategies, implementations plans etc.). In our opinion, these rules and documents need to be consolidated and streamlined to avoid repetitions (and sometimes contradictions) and provide more clarity including from organisational perspective.

[230] See Commission Notice on the notion of State aid as referred to in Article 107(1) of the Treaty on the Functioning of the European Union, C/2016/2946, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52016XC0719%2805%29

[231] At least until full depreciation of the RI and equipment purchased and paid for under the Contract.

- **Document: "Structure of the TTO of Quasar"** (and detailed Strategy for TT). These provide that the market applicability and relevance is seen only for technologies having TRL 6 or higher. The strategic position of the TTO unit as illustrated in a graphics is *between* the Manager of the Centre of Competence, the Head of the Scientific Team (on the one side) and the Project Management Unit and the Scientific Team (on the other side). The staff of the TTO unit will comprise 3 people hired either under labour contract or under contract civil services: Director, Investment experts, Marketing expert. After the expiry of the Centre project (2023) the TTO unit will finance its activities mostly from the income generated from commercialization and exploitation, through an **internal fund which receives a small a percentage of those revenues** (majority goes to inventor and to Centre). Additional services to business by the TTO can be rendered at market prices.
- Another document named **"Report for the development of services"** describes a potential more comprehensive structure with an association formation (legal entity) with 3 subunits and a larger staff and providing more comprehensive support incl. mentoring by entrepreneurs and business plans development. At least 15 ideas/technologies will be evaluated for the project duration and at least 15 plans/prospects for at least 15 research results that could be commercialized. This action plan, despite being still too general, seems to go one step ahead of most other Centres at present.

Budget for Tech Transfer activities

The budget for the external contractor engaged for technology transfer is roughly between 375 and 460 thousand BGN (depending on the different sources and documents) for the whole duration of the project, to be used for nearly all IP- and TT-related activities. The listed activities include creation of a structure/unit for TT, elaborating in more details the existing IP and commercialization policies of the Centre in order to adjust them to the nature of the specific activities of the Centre; **support for overcoming the "death valley"** [this is clearly recognized as one of the main objectives of the Centre as a whole]; development and introduction of: pilot models and innovations; creation of spin-off companies, licensing of IP.

According to the financial plans, the first income in the amount of 129 000 EUR is planned for 2020, where the income in 2023 should reach already more than 500 000 EUR. The most significant source of income should be from external use of infrastructure/equipment[232].

Identified Challenges and Needs

- There is general lack of knowledge, skills and experience of current staff about the necessary internal ecosystem that would enable and promote TT, formal channels of technology transfer, TT procedures and sources of translational funding.
- There is an insufficient number of skilled and experienced financial and legal experts for the business planning, controlling, contracting and monitoring of the use of the research infrastructure.

[232] According to the Innovation Policy Platform the "Technology transfer and commercialization (TTC) occur via, both, formal and informal channels. Formal channels include training and education, hiring students and researchers from universities and PROs, **sharing of equipment and instruments**, technology services and consultancy, sponsored research and R&D collaboration, and other mechanisms."
https://www.innovationpolicyplatform.org/www.innovationpolicyplatform.org/content/technology-transfer-and-commercialisation/index.html

- There are not enough skills and resources to deliver solutions to industry in time acceptable for the industry, for contemporary incremental spin-off development, nor for attracting and closing Early Stage Investments (pitching, valuation, negotiations, etc.).
- The IP policy and TT strategy are lacking sufficient motivational levers that would encourage researchers to engage in commercial activities.
- Although the plan for the support of 15 projects/technologies including with entrepreneurship mentoring can be seen as a positive step, the strategy to internally promote commercialisation and to build necessary skills and capacities of researchers should be further elaborated and strengthened, while regular programs that would support start-up creation - maintained and further developed once initial experience is built.
- Grounds for the income planned in the financial sheets are unclear and unrealistic
- There are KPIs set, but only those that were set by public call rules. The KPIs are monitored monthly but, only by managing authority.
- The Centre clearly recognized the lack of Proof of Concept (PoC) support for the Centre's researchers and their projects. The latest documents submitted to the experts in Q2 2020 indicate that the Centre contemplates how to address this issue (in part, through the targeted support for the 15 projects/technologies mentioned above).
- It is believed that the partners have previously had research results with great potential on international level, however the IP was often protected only in Bulgaria due to lack of funds for EU/international patent filing (e.g. as in the case of sensors described in the project documentation to have happened in the past).

Recommendations

(a) TT Arrangement for the Centres (Strategy, Policy and Process)

- The experts perceive the existing IP policy document as very generic and in need of much more detail. After we received the latest documents probably prepared by the external contractor, we obtained a better idea of what the Centre contemplates. As already mentioned, we believe these have to be consolidated and, after several years of operations, also updated. We note that all original document both from the project inception in 2017/2018 and the latest from 2019/2020 were written in Bulgarian and some elements might have been lost in translation.
- As we mentioned, part of the funding for the six years project period envisaged for tech transfer and commercialisation (in total approx. 400 000 BGN) will be dedicated to support specific Proof of Concept (PoC) projects. It is important that this action is implemented by experienced professionals and that projects originating within each of the four work packages of the Centre will be supported. From the latest documents we understand that 15 projects/technologies will be supported, including through mentorship.
- Build a structure to bring the research agenda of the CoC in tune with the needs of industry. However, due to the operation of the EU state aid legislation, industry should not be able to exert decisive influence on the research agenda as this would endanger its (or its partners') status as Research and Knowledge Dissemination Organisation using no more 20% of its capacity for economic activities.

- While the interface with industry is of course of paramount importance to the Centre, please note that the Centre may (and should!) also perform its own independent research. Often, specific government grants are available for research leading to societal impact. A sound innovation ecosystem should not neglect the societal need for research for which there is an effective market failure.

- Create commercial awareness with the Centre's personnel, including the research staff. A good academic researcher does not necessarily qualify as a good industrial researcher. Research in an industrial environment must be offered under clear legal and commercial conditions and executed in a timely manner. The management of customer expectations can sometimes be a challenge!

- Likewise, capacity building on Open Science, Open Data, FAIR and Open Innovation principles is required. While these generally do not impair the exploitability of research results, a basic understanding of these principles is required when executing projects under e.g. the Horizon Europe programme.

- Build capacity on how to manage necessary internal ecosystem that would enable and promote TT including neutralizing inhibitors and implementing motivational levers that would encourage researchers to engage in commercial activities

- Build capacity on how to foster formal channels of technology transfer, TT procedures, sources of translational funding and spin-off development.

- For contracting in the university-industry interface, a number of model contracts are available, e.g. the Berlin Contracts and the Lambert Agreements. The experts recommend a careful study of these models for use adjusted to the Bulgarian context.

- Build capacity on how to manage IP-portfolio.

- A clear system of Invention Disclosure Forms (IDF) should be created. IDF's should be filed even where the right to file for a patent was contractually assigned to another entity.

- Do not blindly copy others' TT Strategy, Policy and Processes, but instead use these as inspiration to develop your own custom arrangements based on the local context, considering inhibitors and motivators of local researchers and the drivers for local industry and investors. Where required with the support of international experts.

- There should be a clear description of the role of the TTO. Although under the State Aid rules technology transfer activities may be regarded to be of a non-economic nature (on the conditions that all revenues from knowledge transfer activities are re-invested into non-economic activities)[233], no public funds should be used for continued support to already spun-off companies.

(b) Collaboration with industry

Before listing the recommendation we must note that the potential users of the research generated through the Centre are recognized to be not only the banking industry, but also public authorities responsible for defence/military/national security and crisis management.

- Collaboration should be developed based on the industry needs and trust.

[233] If the revenue is reinvested as described, then the activity won't count towards the 20% capacity threshold. See also Chapter 4 of this report for all questions relation to State Aid rules.

- Even the latest strategies and plans that were additionally submitted in Q2 2020 remain rather general and more work is necessary to explore the particular situations in each of the four work packages, as regards the market, the needs of industry, the possible collaborations and the specific opportunities for commercialisation.

- The most reliable way to build and develop trust is through traction, i.e. by successfully delivering a number of services and bringing the Centre's research agenda in tune with the needs of the industry. Addressing the "low hanging fruit" with existing industry contacts (regardless of potentially being small in value) will build traction and Centres brand.

- It is important to focus on industry sectors that absorb inventions. In this respect, sectors that fully depend on trust e.g. banking will opt for well tested, highly reliable and scalable technologies which are usually not characteristics of highly innovative. Any mismatch here could lead to unmarketable research results. However, due to the operation of the EU state aid legislation, industry should not be able to exert decisive influence on the research agenda.

- Considering the work packages and partners within the Centre, the insurance and defence sectors could have a demand for technology being developed within Quasar. Establishing agreements with international agents and technology scouts within these industries could enhance the commercialisation performance.

- Considering the State Aid rules and past experience of CoC partners, the most favourable form of collaboration should be collaborative research, followed by contract research and consultancy. It should be noted that (based on state aid rules) the contract limits economic activities (e.g. contract research and renting out of research infrastructures) to 20% of the overall yearly capacity. "Effective collaboration" is regarded to be a non-economic activity.

- Build capacity on Academia-industry interaction, contemporary business development methodologies, contemporary incremental spin-off development and on attracting and closing early stage investments (pitching, valuation, negotiations, etc.).

- To create a funnel of spin-off ideas, focus on campaigns that promote an entrepreneurial mind-set. Identify early adopters, secure individual financial and soft support for their entrepreneurial projects and promote the champions.

- To support spin-off creation, it is highly recommended not to develop own incubators or similar support but to find synergies with existing institutions and support programs (see below).

Synergies and Complementary Initiatives

- To avoid duplication and use already available support for the spin of creation, the soft support available of the Sofia Tech Park incubator and newly established GroWorking[234] programme for researchers could be used.

- Sofia Tech Park also announced a financing scheme for very early stage high technology startups, offering 75 000 EUR of funding and also free access to laboratories and innovatorscommunity. In fact, the Centre has already in 2017 identified concrete joint

[234] [234] https://groworking.space/

collaboration activities and specific projects to be executed jointly with Sofia Tech Park meaning that there is no duplication but complementarity.

- Financial support for Proof of Concept or development of prototypes is also available by the Innovation fund, in addition to the small funding contained in the project budget.
- Regionally recognised private venture funds and accelerators stationed in Sofia offer smart money for spin-offs in ICT sector.
- Test possibility for collaboration with regional innovation Centres, and especially the companies within them.

KPIs

Straightforward KPIs demonstrating the effectiveness of activities for commercialisation but also the final financial results should be implemented:

- The Centre's output in terms of protectable IP should be monitored. In this respect, a clear system of Invention Disclosure Forms should be created. IDFs should be filed even where the right to file for a patent was contractually assigned to another entity. Published patent applications should be considered as scientific publications by the (co)-inventors.
- Business development efforts of the TTO should be measured by:
  - The number of generated leads and qualified leads as well as by the acquisition costs involved.
  - Cost benefit indicators of IP: cost of protection vs. income from IPR.
  - Indicators of market conversion: leads, hot leads, income.
  - Indicators of effectiveness of marketing channels: income / vs cost of marketing channel.
  - A periodical knowledge position audit should be conducted by independent expert evaluators against criteria to be formulated by the Centre itself. IP positions should be part of this evaluation.
- Social impact: number of services/programs with social impact implemented, number of beneficiaries (institutional partners), number of end users.
- Start-up funnel: Number of ideas, number of pre-seed stage teams, number of start-ups, investments raised, value of exits.

It is worth noting that IP related KPIs such as number of patents or patent applications is not always the best indicator when the Centre does not want to disclose its exclusive knowledge, which is frequently the case when working with defence industry. Furthermore, in certain branches of industry, e.g. process technology, trade secret protection is often favoured over patenting as any patent application will be published ex officio 18 months after the first filing. Finally, not all branches of industry are as IP-driven as for example pharmaceutical research. Therefore, IP-related KPIs should not be used as the sole determinant of excellence of the Centres. Commercial activity does not always require the generation or use of IP. Furthermore, scientific and technical excellence can also be derived e.g. from the number of articles published in scientific magazines, their citations and the impact factor of the magazine.

CENTRE SUSTAINABILITY

Requirements and Expectations

CoC expects that there will be available resources within the next Operational Program. The Centre wishes to have more funding for personnel and consumables, as well as possibly for further strengthening the administrative capacity of the Centre.

Overview of existing plans of the Centre on finance and sustainability:

- The Centre expects that it can be self-sustainable having 300 000 BGN income from donor-funded projects a year, which can cover the basic operational costs for staff salaries and materials.
- The income from commercialization is expected to be at the amount of approximately 200 000 BGN average per year of which 165 000 BGN from spin-offs while from license of intellectual property 32 500 BGN.
- The external use of infrastructure/equipment is expected to bring an average of 205 000 BGN per year.
- Contracts (not specified) are expected to generate an average of 185 000 BGN per year.

We must say here that the projected expected income, in particular from spin-offs is unrealistic as these entities do not usually distribute dividends in their inception and growth stage. It may be more realistic to arrange softer conditions, like turnover-dependent royalties. Thus, it is much more likely that the Centre receives direct and immediate income from licensing to existing corporates, depending on the nature of the technology.

Recommendations

The expert panel distinguishes between short-term and long-term sustainability. For short-term sustainability, the experts consider it of paramount importance that the CoC focus on identifying short and middle-term needs with local and regional industry, fine-tunes its R&D agenda to those needs, and exerts targeted business development efforts aimed at local and regional industry to secure contract research assignments. However, it is very unlikely that the CoC will soon reach self-sustainability therefore it should seek for National, European and International public (research) funding which is also planned in the long term financial projections. Such independent or collaborative research projects may be used to initiate subsequent or simultaneous contract research. Effective collaboration activities with undertaking/industry are non-economic and could also provide stable source of income as well as generate IPRs. As to the public funding of research infrastructures, please note that normally state aid is only allowed for creation of research infrastructure, but not for its continued exploitation, for which the possibilities are very limited.

A separate entity with own legal personality should be established to facilitate the organisational structure and sustainable operations of the Centre in its four interlinked work packages as well as vis-à-vis third parties (industry).

The Centre explained during the visit in February 2020 that in their view, to be eligible for national funding grants, they need to be either an association or a company. We have explained, in the general part of the report that “eligibility for national funds” is not among the reasons for the

creation of a legal entity. The 14 Centres have already been recognised under the National Roadmap for RI. A common legal entity might help for the better organisation and consolidation of the common work packages, as well as for visibility vis-à-vis third parties. Participation in larger European consortia with multiple members could also be facilitated with a joint legal entity. An association with availability to use (or at least a mandate to coordinate the use of) all infrastructure and equipment of the CoC could thus bring added value to the existing partnership. A new joint legal entity may also serve the participation in Horizon Europe projects. A company structure is not an option for the general operations of public research organisations in Bulgarian context but can be created for specific purposes (e.g. commercialisation of a particular product/result).

Bringing one more layer of a structure is recognised also by the Centre to complicate the existing status and it would need clear and specific legal arrangements. A possible option that could work (and which has been mentioned during the meetings) is to form an Association in private interest and having a Statute similar to, and/or resembling, the Consortium Partnership Agreement.

Regarding commercial income, the general recommendation is to use contemporary approaches to business modelling as the way to develop an offering of the new entity, which is based on the needs of the market. In this manner, the discovery of clear target segments and their needs is the first step, followed by the development of clear value proposition in the form of appropriate innovative technology, service or product. Substantial resources are only engaged when there is a very high certainty that the result can be commercialised.

ROADMAP ON LONG-TERM SUPPORT

- Evaluations of similar programs in the Balkans region showed that progress in the performance of research and innovation ecosystem is only visible in the long run. The main reason for that is the huge gap between the academia and industry, but also between academic partners. Centres have the potential to act as boundary spanners, but provided that there is enough time to develop trust among actors. Therefore, the next national OP 2021-2027 should extend the support for the Centres including the following new features:
    - capacity building in terms of soft skills for
        (a) contemporary bottom-up business development (technology marketing)
        (b) Academia-industry interaction
        (c) Targeted Global networking
        (d) Strategic management and development of IP
        (e) Non-linear TT process
        (f) Contemporary spin-off development and attraction of early stage investments
    - Foresee financing for limited number of DEMO projects selected upon interest demonstrated by industry
    - International independent advisory and evaluation
    - To enable a more active role and clear benefits for the industry
    - Integration with Regional Innovation Centres

9.7 Centre of Competence "Personalised Innovative Medicine" (PERIMED)

Summary of Centre

Identification number: BG05M2OP001-1.002-0005

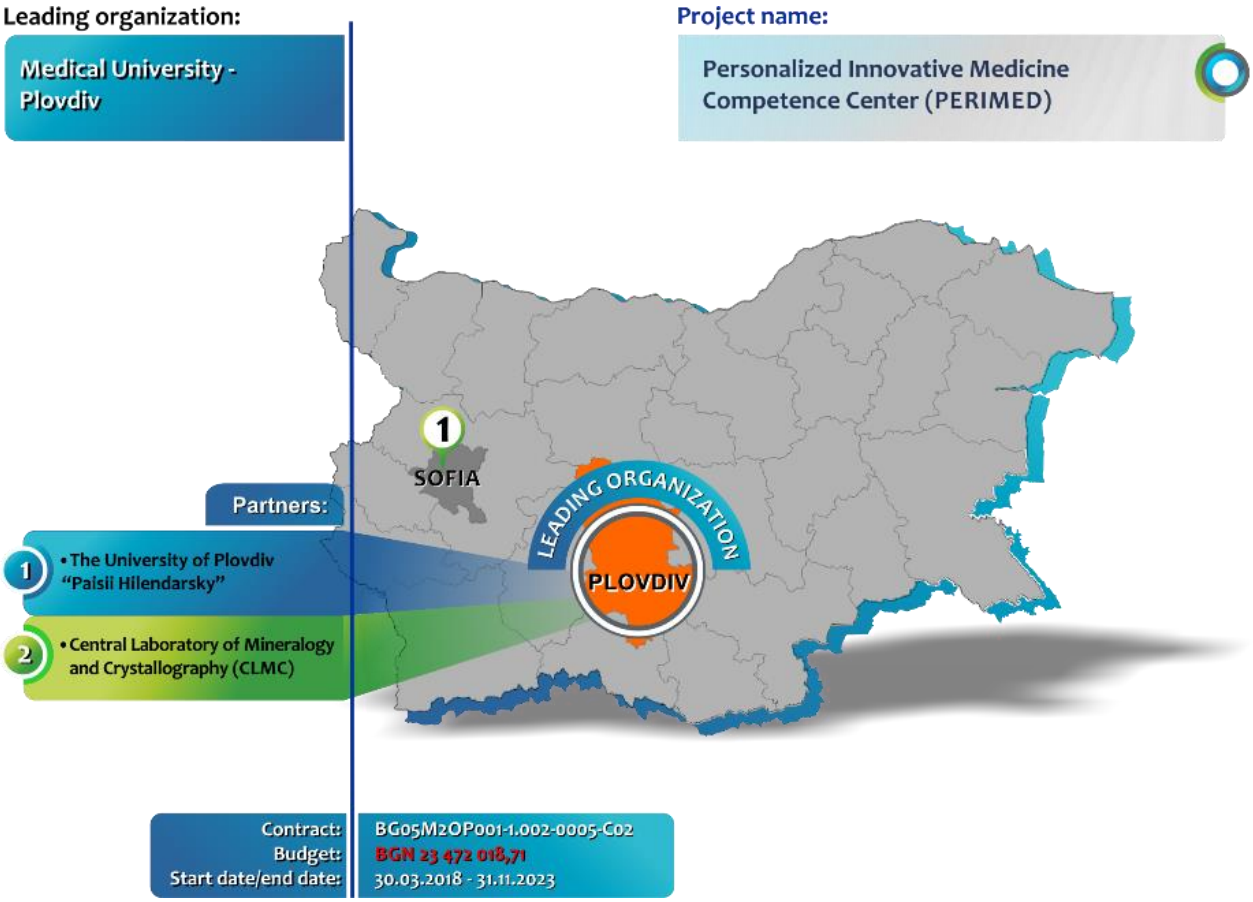
Budget of the project: BG 23 472 018.71

Centre name: PERIMED project – joint collaboration of:

- Medical University – Plovdiv (Leading organisation)
- Plovdiv University "Paisii Hilendarski"
- Institute of Mineralogy and Crystallography, Bulgarian Academy of Sciences

Objective:

- To develop health care-related technologies.
- The activities in CoC:
    i. are in line with patient-oriented strategies in health care
    ii. refer to Component 3: "Healthy Life and Biotechnology Industry" of the Science and Education for Smart Growth Operational Program
    iii. are in direct connection with Priority Sub-Area "Personalized Medicine,
    iv. Diagnostics and Individual Therapy".



Global aim:

- Implementation of methodologies in the field of personalized medicine,
- Focus on oncology, haematology, intensive medicine, innovative drug delivery for target therapy, bioengineering technologies and biosensors.

Focus & priorities – major scientific pillars:

- Biomarkers for the prevention, diagnosis and prognostic assessment of oncological diseases;
- prediction of therapy response.
- Technologies for targeted delivery; controlled release of therapeutic agents.
- System for management of critically ill patients in individual therapeutic and diagnostic sectors
- Innovative nano-structured polymer materials; Biosensors for biomedical analysis and
- pharmaceutical industries.

Future results from the project:

- Implementation of 12 large-scale research programs (Work Packages, WPs) that shall bridge fundamental research and clinical practice.

CURRENT STATUS OF CENTRE

Analysis of questionnaire

The PERIMED Centre of Competence was established in March 2018. The Lead Partner has organisational, administrative and financial commitments and responsibilities. Formally, the equipment is assigned to the CoC, but legally the equipment is owned by the partners. The key findings from the questionnaire were:

- The management team, which includes representatives of all partners, is responsible for the implementation of the planned activities. The plan to introduce advanced technologies for communication, sharing and exchange of information should help to improve the interaction and the collaboration between the members of the joint management team.
- The Management Board, which will take decisions by qualified majority, governs the activities of the management team and the Scientific Council, each member shall have one (1) vote. In the team's general meetings decisions are taken by simple majority. This simple approach should streamline decision-making and make for rapid translation of proposals into actions.
- The partnership indicates a preference either to have two legal entities, one company and one not-for-profit or to remain a loose consortium of partners. If a separate legal entity were established the partners agree that it should have control over its own budget and that the equipment and research infrastructure should be owned by the Centre.
- In order to function effectively the Centre should have, in addition to administrative staff, research staff but non-permanent and only based on projects. This would help to contain fixed costs.
- The annual allocated budget for research is EUR 303 241 (there seems to be budget only during the six years project duration and not thereafter (see section on sustainability below).
- The number of skilled financial and legal experts for the business planning, controlling, contracting and monitoring of the use of the research infrastructure is considered insufficient.
- Only partial progress has been made so far in defining relationships between founding partners and the Centre regarding IPR and sharing industry contacts and leads. This is a potential weakness.
- The Centre needs legal and economic guidance on properly distinguishing contract research (economic activity) from collaborative research (non-economic activity). They have not yet implemented a separate accounting system for expenditure and for revenues for economic activities on the one hand and for non-economic activities on the other hand. Separate accounting is a mandatory obligation under the Grant Contract and under EU State Aid rules for organisations performing economic activities.
- The price for external users (companies) using the equipment at or services provided by the Centre is set on the basis of the market research, experience and practice of partner IMC-BAS.
- The TTO has dedicated personnel, but to meet their long-term objectives the number of staff will need to increase and their levels of competence and experience to improve.

- The TTO team has a reasonably focussed activity to identify potential inventions and a highly focussed activity for filing and prosecuting patent applications but is less focused on securing translational funding for proof of concept, marketing technologies to secure licensing deals with companies, particularly outside of Bulgaria. They have engaged in Bulgarian Patent applications in the past 12 months but not in international filings or other forms of IPR exploitation.

- Availability of Government and EU Grants is fairly high but no responses are provided to the questions regarding other foreign grants and private sector sponsorship. A modest amount of Angel Investors is indicated but no VC interest. It seems more work could be done to build the team's awareness of other funding opportunities.

  The most significant barrier to successful technology transfer overall is considered to be: lack of experience in intellectual property protection internationally - rules, finances, treaties; insufficient capacity to create technology (documentation, experimental production, implementation in real production conditions and product marketing); lack of legislation and organisational experience at universities to regulate the confidentiality of the process.

- No current revenue sharing mechanisms were identified.

- Though no indication is given of specific valorisation projects such as Proof of Concept projects, Joint ventures with firms or Industrial PhD and Knowledge Sharing programmes there are strategies targeting Technology transfer through: Consulting and Training, Material sales (biotechnology), IP licensing and Spin-offs.

KPIs (Key Performance Indicators)

- A monitoring system is in place: University Quality Committee; internal and external auditors; a functioning university quality system.

Long-term vision

During the visit in Plovdiv in February 2020, the expert team was welcomed by the Rector of MU-Plovdiv and their partners from Plovdiv Uni, all of whom showed commitment to the project and clear engagement on the highest university level.

A long-term vision of the CoC is very ambitious and clear. The Project is part of a long-term development strategy for responsible inter-institutional cooperation to support science in Bulgaria and its transformation into economic development based on knowledge and innovation, in line with the best international standards and practices. In addition, as CoC PERIMED will enable research on public health issues there will be direct benefits to the health sector which itself is a strong motivation for continued support also from the public sector. If, in addition, the CoC is able to leverage the IP developed on an international scale, as seems plausible, they will be able to contribute commercial revenues to help at least partially to cover their running costs.

Legal Framework of the Centre

Currently, the CoC is operating as a consortium of three partners (Medical University of Plovdiv is the Lead Partner) within the frame of a Partnership Agreement and four associate partners. Within the Consortium, each of the partners preserved its legal autonomy and identity.

The future legal form of the Centre should allow the Centre to apply and receive funds from the next programming period (as expressed by CoC representatives). Additionally, the future legal form should also allow the Centre to attract income from both economic and non-economic activities, and from IP commercialization, both nationally and internationally. That said, we elaborate briefly on the different options proposed by the Centre itself. While a commercial company is not a suitable model for the general operations of the Centre, the nature of the CoC's mission is perfectly compatible with continued public sector support and therefore an NGO/not-for-profit model might well be appropriate for the separate legal entity.

During the visit in Plovdiv in February 2020 and the meetings with the experts, the Centre expressed that the following three options are being considered:

1. Commercial joint stock company with own revenues and expenses
2. Non-personified company (not a company, rather a civil partnership) under Obligations and Contracts Act where the partners will retain their independence in terms of property rights, and
3. Free association where each partner signs each contract and is responsible for its own actions while only for the purpose of joint R&D projects and activities decision-making power be delegated to a General Management.

Forming a commercial company is not necessary for the general operations of a public research organisation in the health domain conducting primarily non-economic activities. Here, it is very important not to mix the spin-off company formation possibilities under national law with the legal form of the Centre itself. If there is valuable IP created out of a specific R&D activity, which can best be commercialised via the formation of a spin-off, it is perfectly possible that one or several of the three partners unite and jointly participate in its capital structure. This is not connected to the legal form of the Centre itself and spin-offs in the case of universities can only be created for the commercial exploitation of IPR and not for general economic activity.[235] Therefore, the option to form a commercial company for the Centre itself is not suitable and should be excluded.

- A conference call was initiated in May 2020 by representatives from Plovdiv University. They shared with the expert team that they have observed example from EU where the public research organisations (PROs) create a wholly-owned "Innovation companies" to manage their IP. While the TTO can be either an internal part of the PRO, it can indeed also be formed as an external company owned by the PRO. We also understood that the Board of Plovdiv University has recently decided for the creation of a university-owned company that will take over the responsibility for commercialisation effectively functioning as a TTO and industry liaison office, to manage all relations with industry. In this case, we note that the university will have to observe all conditions contained in the recent Decree by the Council of Ministers and explore further whether it allows the commercial activities performed by the company to be broader than just spin-off creation for the realisation of research results. If Plovdiv University decides to established the TTO as a separate for-profit company it is imperative that it becomes a wholly (100%) owned subsidiary of the university. Such company then can act as a TT Office of the Centre provided a legal agreement is in place stipulating the distinction of the activities and tasks for the university and for the Centre, together with the associated revenues generated.

The second option which the Centre considers is the formation of a non-personified civil partnership ("grajdansko drujestvo") in civil law. This is already done in one of the other Centres (Heritage.BG)

[235] See Decree of Council of Ministers: Постановление на Министерски Съвет № 61 от 2 април 2020 г.

which have registered a "drujestvo" in parallel to an association ("sdrujenie"). If a "drujestvo" is formed, the same rules will be valid on state aid including in relation to the limitation of 20% capacity usage of the infrastructure. The legal form for the Centre is irrelevant in terms of EU state aid rules. Thus, while in the presentation of the Centre it is stipulated that "no obstacles for economic activity" are expected, we remind that the same rules will be valid as for the current partnership (which is not registered). We are not convinced that the "grajdansko drujestvo" option gives any benefits compared to the present situation.

The third option – to establish a separate legal entity (association) appears to be the most appropriate to consolidate the activities of the Centre and facilitate its development including after 2023. One other Centre has already registered an association – this is Heritage.BG. While we agree that each partner should be responsible for its actions and for signing each contract, it also seems reasonable that some decision-making power be transferred to the common organisational structure (joint R&D projects). The high-level decision making on joint R&D programs and projects should also be exercised in a more coordinated way. In additional to the legal entity, framework contracts could also be used (BAS institutes already have this practice to coordinate with each other). If the CoC eventually decides for creating a separate legal entity Chapters 2 and 3 of the report present two options for an association (one less integrated and one more integrated) which should be further explored with representatives of the partners, as well as corporate lawyers and accountants to assess their applicability and added value to this CoC. The Centre has only three partners whose coordination should be relatively easy to achieve by laying down clear rules, responsibilities and competences. It may be reasonable that the project starts performing its R&D activities as it is and after several years of operating experience in executing joint R&D&I projects and projects with industry the CoC conducts a reassessment of the needs and possibilities. The partners should assess whether it would be more appropriate to establish an association ("sdrujenie") of a less integrated or a more integrated model. The less integrated option mostly serves to support the activities of R&D coordination, joint promotion and visibility and formal representation of the Centre vis-à-vis third parties, while the more integrated one also transfers the use of the research infrastructure to the new separate legal entity (integrated organisational structure which sets the research agenda and has its own staff and employed researchers). Both options could be relevant for the operational execution of individual R&D contracts.

- (!) Important is that all legal requirements for data protection related to healthcare and patient's data are strictly observed by the managers of all projects. This and other specificities of the healthcare related sector (such as the management of university hospitals) will influence how much competences the partners are willing and actually able to transfer to the separate entity that would be created for the Centre.

The TTO representatives expressed that they believe a legal structure is necessary in order to "*use the equipment more effectively with business*". While from strictly legal and state aid[236] perspective there is normally no difference whether the industrial party negotiates & concludes a contract with:

- one single university/institute or jointly with several,
- the TTO office part of the university, if it is a separate legal entity

[236] This means that in principle the same conditions and requirements apply from State Aid rules point of view 1) to the research organisation/research infrastructure and the limitation of capacity usage to 20% for ancillary economic activities and 2) to all engagements, contracts and projects with industry, both in economic activity context (for instance the formation of prices/fee for services) and in non-economic activity context. Refer to Chapter 4.

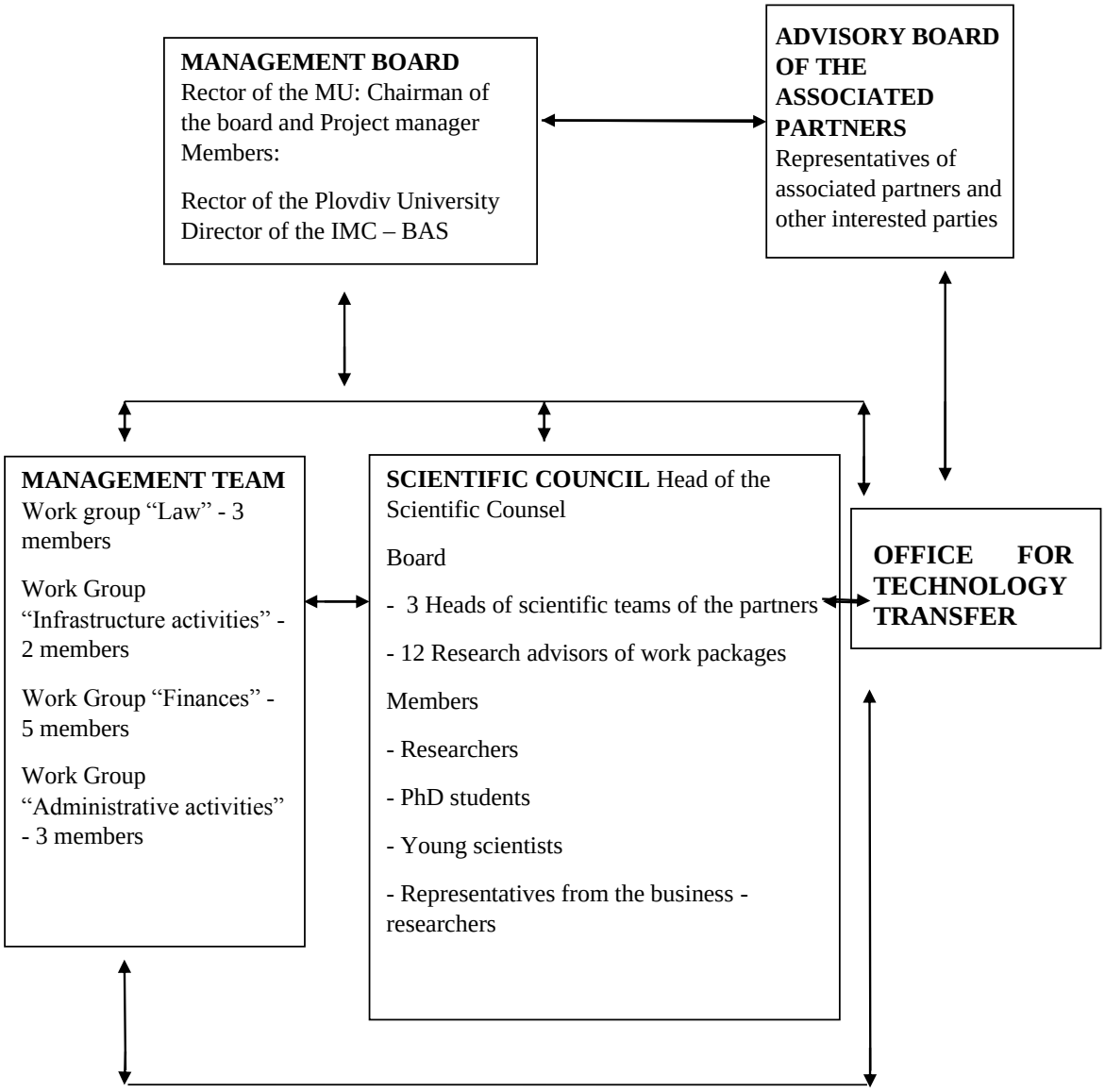
- the Centre in the form of an association as a separate legal entity.

having a dedicated legal entity with its own structure, clear mandate and capacity will indeed facilitate and streamline the Centre's R&D collaborations with industry. A separate legal entity could be useful from an organisational, efficiency and representational perspective. A strong Industrial Liaison Office for the CoC will help the individual partners to "speak with one voice" and in a coordinated manner regardless how they are legally structured among themselves.

ORGANISATIONAL FRAMEWORK

Ownership structure

Current Organisational chart as provided in the questionnaire response:



The R&D activities are structured in 12 Work Packages/Programs (WPs), five/six led by each of the two university partners and one led by the BAS partner, roughly corresponding to the funding the partners receive for infrastructure/equipment. The Project Justifications states that "*The developed organisational structure of the Centre ensures independence of the research teams in the conduct of the research studies and at the same time assists the connections, the interaction and the*

collaboration between the separate research teams." The 12 WPs are grouped into 3 main groups: methodologies for personalised medicine, drug delivery systems and bioengineering. Synergies between WPs/research teams have also been listed so that each WP team is a [potential] partner with multiple other WPs/teams. Each of the 12 WPs have been described together with the role of each partner. The three Heads of the Research teams of the partners are members of the Scientific Board of the Centre and are tasked to coordinate the interaction between researchers from different work packages as well as monitor the implementation of scientific tasks and results. The funding for R&D for each of the 12 WPs is distributed exclusively (100%) to the respective partner leading the particular WP.

To this structure described well in the documentation we have the following comment. After the procurements have been finalised, and the closer the CoC gets to the end of the project funding period (2023), the more prominent role should the leads of the three main "components" have 1) methodologies for personalised medicine, 2) drug delivery systems, 3) bioengineering. We have recommended similar "Component Leaders" in other Centres where this was relevant and the idea is to effectivity consolidate R&D&I activities to achieve the objectives of the CoC.

Thus, regardless of the choice of legal entity, the management of the Centre should have a sufficient level of process ownership, responsibility and accountability to execute the business plan. The person should be selected competitively and his/her performance should be monitored and future be in a way connected with the success of the project. International experience and an existing network of international contacts would be a significant asset in this role, in order to drive the international commercialisation activities. The rectors of the universities and the director of the BAS institute should remain very committed and provide the strategic guidance and direction.

Governance and decision-making; management of the tangible and intangible assets of the Centre

Within the Partnership Agreement, all partners have the following rights regarding the infrastructure (equipment) and intellectual property rights (IPRs) and other intangible assets as follows:

i. Infrastructure: the right to [use the] information of all partners; the right of access and the possibility to use the acquired research equipment from the other participants in the partnership; and the right of ownership on the infrastructure created/installed by the respective partner.

ii. IPRs and other intangible assets: "the right to share" of the intellectual property created in the CoC; and the right of access and use of new methods introduced for research, training and education.

Within the Partnership Agreement, there are several additional documents (Annexes) that regulate some important issues:

iii. Rules for allocation of the intellectual property rights between the partners

iv. Policies/rules for access to the equipment by external organisations

v. Allocation among the partners of the rights to the equipment and the fixed assets obtained during the implementation of the Project

vi. Rules for the use and the commercialization of the research results

Even though these documents are formally put in place, there is still a lack of practical implementation and management of intangible assets (an adequate IPR management and protection, and technology transfer activities). This will require preparation and implementation of some additional guidelines and rules that will resolve these issues. Below we outline several aspects identified from the documentation to help us understand the current arrangements.

TTO and Management: The Technology Transfer Office at Plovdiv University is planned to be used also as an office for technology transfer for the Centre. The Office is supervised by the Management Board of the Centre and will work closely with members of the research teams. The office will be an independent unit that reports directly to the Management Board. It will apply the IP and Commercialisation Rules of Plovdiv University to the activities of the Centre.

Mandatory ownership share for the Centre: The Project Justification states that [in the context of internal relations within the Centre e.g. between staff and employer, so not vis-à-vis third parties] the ownership of the objects of IP created with resources of the Centre is to be governed by the Management Board and the Centre should preserve a compulsory share of between 10 – 50%.[237]

Ownership sharing of IPR: The Partnership Agreement states that the ownership of the results and the benefits of the Centre project, including the IPR resulting from its implementation, belongs to/is to be used by the partners according to their contribution to the realization of the work packages (WPs).

Utilisation of Revenues from IPR: Then, the Rules on Allocation of IP further provide that in the first 10 years the benefits and revenue from the implementation of developments will remain "for common use" by the Centre. After that period, the benefits and revenue may be distributed among the partners in accordance with the shares of the partners (45%, 47% and 8%), unless there has been an outstanding contribution by one partner for certain activity.

Research Infrastructure and State Aid rules

Management of the infrastructure, the access process and the in-house research

Managing Authority put CoC PERIMED in the 1st group of Centres that performed best in terms of budget verification (51,55% of the overall budget is verified up to date). There is a strong and integrated partnership in the CoC, strong institutional support with a highly qualified team. The infrastructure of the two larger university partners is located in one city – Plovdiv (with a small part in Sofia of the BAS institute). There are 12 research and scientific programs that have been started in the Centre (described above).

The Rules on Access stipulate that the acceptance criteria in the evaluation of requests for access are the scientific achievements, the technical feasibility and the resources available in the laboratory.

The Project Justification states that CoC will apply various models of charges for access to research infrastructure tailored to its specifics, so it could to be able to cover the costs, supplies and depreciation of equipment, and to help achieve financial sustainability.

Further guidance on State Aid rules can be found in Chapter 4 of this report but in the specific case on this CoC the experts did not see any major cause for concern, provided the access is monitored closely and economic and non-economic activities are appropriately accounted for.

[237] Without a separate legal entity the Centre cannot "own" itself, only the three partners can.

Recommendations on the plans for utilisation of research infrastructures (financial plans, access rights and IPR arrangements)

The Centre states that the access to its research infrastructures (RI) is in line with the grant and consortium agreement under PERIMED, the relevant documents related to access to RI and other legal documents. According to the current Access policy, PERIMED RI access will be granted based on "excellence-driven", "market-driven" and "wide" criteria as follows:

- PERIMED consortium partners (up to 100% of the time, e.g. Access Unit)
- Users from academia (up to 20% of the time, e.g. Access Unit)
- Business, industry and public services (up to 20% of the time, e.g. Access Unit)

Administration connected to requesting and granting the Access to RI should be kept to a minimum.

Research infrastructure should be utilised in a way to assure the future involvement in new national and international projects. Acknowledging the applied financial model, costs need to be covered by the project while fees for access to non-consortium partners (academia, industry, 'wide' users, etc.) need to be set to optimise revenues to raise the necessary funds to contribute to the financial sustainability of the Research Infrastructure and PERIMED as a consortium. Several questions were asked by the Centre's representatives during the meeting in February 2020 and we briefly answer these below:

- **How to calculate the fees for the external users? Should the fees be increased or should they be "market-driven" to remain competitive?** In general, the fees charged to industrial clients should correspond to a market price (or the equivalent of a market price for which further conditions apply; one of the possibilities is to charge full costs plus a margin, please refer to Chapter 4 of this report). Thus, the price charged for the use of the infrastructure can be negotiated by the Centre to find an optimal balance provided that, as a mandatory minimum requirement that has to be fulfilled, the price corresponds to a market price thus ensuring that no state aid is passed on to the other party (i.e. the industrial partner). When the price/fee formulation is based on the principle of full costs plus a margin, then the overhead costs shall also be taken into account.

- **Does the project allow to have benefits/profits?** Firstly, the economic activities should be ancillary in nature and the capacity used for these activities should be limited to maximum 20% of the overall annual capacity at the level of each partner organisation's relevant entity that actually carries out the economic activity in question: at the level of the respective departments, sections. Secondly, in case for instance a very successful licence or a spin-off is created which produces significant revenues, the Grant Contract with the MA obliges all beneficiary organisations under the projects for the creation of the Centres to **invest this income into the main non-economic activities** of the infrastructure (for example in independent research).

- **Does the Centre have to keep a particular percentage (mentioned was 75-25/80-20%) division/share for external users?** We are not sure if we understand the question, but from the perspective of EU state aid rules the provision of services and the renting out of equipment to external undertakings is an economic activity. It may however be the case that the research organisations/Centre/the partners have a joint project with industry in the form of "effective collaboration" in which case the activity is non-economic and consequently does not count towards the 20% limitation. It is very important not to confuse "revenues" with "access" to the RI. See Chapter 4 of this report for further guidance.

- **The Centres envisaged to have income from the fifth year from industry. What are the state aid implications of this?** Firstly, if the Centre/its partners engage in economic activity, separate accounting system(s) should be implemented and where/when necessary the capacity usage for economic activities should also be monitored to ensure and prove that it remains equal or lower than 20% and that the economic activities are ancillary. Secondly, all contracts, transactions, projects and activities with third parties (from industry) should charge appropriate prices that avoid the passing on of state aid in the form of an advantage to private undertakings (see Chapter 4 of the report).

- **In the presentation from November 2019, the Centre expressed that it has difficulties in the allocation/assignment of IPR in joint projects with business organisations**. This question is first of all closely related to the state aid concept and there are (minimum) obligatory requirements to be fulfilled as a base-level. These requirements are valid in different situations: contracts research and research services for industry, but also in the context of collaborative research. Secondly, we must say that in general contracts should be carefully negotiated to obtain the maximum economic benefit for the research organisation(s). For this, the Centre and its partner need to build capacities. See again Chapter 4 of this report which explains the rules.

Transparency

The Research Infrastructure will have a site link ("single point") providing clear and transparent information on the Research Infrastructure itself, its services, access policy, data management policy and the terms and conditions. Where applicable, information should be provided on the available equipment, costs, fees, contractual obligations, health & safety and environment rules and procedures, intellectual property rights and the legal settlement of disputes.

Legal conformity

Comply with national and international law and agreements, particularly, but not only, in areas such as intellectual property rights and the protection of privacy, ethical considerations as well as safety, security and public order regulations.

On page 13 of the Project Justification it is stated that: *"All proceeds from the main non-profit activities carried out with the equipment purchased under the Project will be reinvested in the main activity of the Competence Centre".* We must say here that the reinvestment requirement usually refers to the revenues from the knowledge transfer activities (see Grant Contract).

The implementation of economic activities is said to be entrusted to the TTO, which is to serve a broader role rather resembling an Industrial Liaison Office (managing requests for services, joint projects and relations with industry clients and reports on activities and results).

Monitoring Mechanisms

The Project Justification states that *"The MU – Plovdiv will bear the overall responsibility for the execution and implementation of analytical accounting traceability of the implemented economic and non-economic activities under the Project both by the Medical University – Plovdiv and by the partner organisations – the Plovdiv University and the IMC – BAS."* Then the accounting systems of the three partners have been described. The monitoring is to be carried out by the Finance Work Group to the management team, consisting of three accountants, one from each partner. The partners will maintain separate accounting that will enable the monitoring of and the distinguishing between the economic and non-economic activities of the Centre (this commitment had not been implemented as of Q4 2019 when the questionnaire answers were submitted).

A specific question was asked in the presentation of the Centre whether a unified multifunctional electronic platform between the partners should be developed to reflect the online processes. Some of the other Centres in Bulgaria have implemented such systems and it could be useful including for the coordination, but the system is only a means for the effective monitoring of the capacity usage (which can be done in various ways) and not a goal in itself.

TECHNOLOGY TRANSFER AND COMMERCIALISATION

Centre's TT strategy outline and expectations

Budget: The budget under the Centre project dedicated for IP protection, exploitation of research results and commercialization is approx. 200.000 BGN overall for the six years duration split between the two university partners Plovdiv MU and Plovdiv Uni. The Centre is planning to set up at least 3 spin-off companies (as in Project Proposal). An IP expert is to be appointed in the staff of the Centre. Part of the budget will also be used to conduct targeted activities under Work Package 8 (Drug delivery and Personalized medicine) to make experiments in industrial conditions of the developed technological models, with the help of distinguished researchers from abroad and industry partners (Neofarm Ltd). The partners claim to have experience in administration of intellectual property rights and each of them has registered patents.

Potential users of results: The expected potential users of the research products and the research results will be both public and private companies (incl. pharma and biotech), hospitals, clinics, research organisations and universities.

Rules on Commercialization: The Rules provide that the Centre, through the Technology and Knowledge Transfer Structure (TTO), shall be the applicant for registration and protection of the objects before the Patent Office of the Republic of Bulgaria. The Rules also state that "*the commercialization on the basis of contracts with external assignors includes transfer of research results [...] or licensing*." However, according to best practices it is advisable to transfer IP in an appropriate way depending on the nature of IP.

Overall, the Rules on Commercialization seem to regulate only the relations internally in the research organisation and not vis-à-vis the industry partner. We recommend using as a basis the EU state aid principles and rules to avoid passing on state aid to the external (industry) partner.[238]

There is a history of technology transfer activities that were supported or managed by the GIS Transfer Centre and their involvement may again be sought. Still the main internal body responsible is the Technology Transfer Office of the University of Plovdiv. As said already, the TTO of Plovdiv University will function as a TTO of the Centre and will be entrusted with broader industry liaison tasks and not just the transfer of technology.

Of particular concern is a lack of experience in the internationalisation of IP exploitation. In this field a specialist with hands-on experience of international IP exploitation would be an invaluable asset and the recruitment of such an expert is strongly recommended. Also, partnering with other internationally oriented organisations in the medical and life sciences sectors could yield synergies and help to fast track the development of an international network of potential commercialisation targets.

[238] Please note that there are specific EU rules both in the context of research on behalf of undertakings (economic activity) and in collaborative research context (effective collaboration, which is non-economic).

There is an IP Policy put in place. However, its implementation in terms of IPR arrangements is not quite clear. There is also a gap in necessary steps needed for successful IPR protection and management that can be resolved by defining certain relevant guidelines and protocols.

Identified Challenges and Needs

- Lack of practical experience in IPR protection, management and exploitation.
- Lack of practical experience in management and implementation of technology transfer activities.
- Lack of entrepreneurial culture at the University level among researchers.
- Need for creation of the systematic approach for implementation and management of the overall IPR and TT activities.

Recommendations

(a) TT Arrangement for the Centres (Strategy, Policy and Process)

- ✓ Centre should provide a capacity building of the current staff and rely on the TTO of the University of Plovdiv for implementation and management of overall TT activities. There is no need for the creation of the new TTO within the Centre provided a binding Service Level Agreement be in place.
- ✓ Centre should create and enforce clear rules and protocols on how to manage and implement IPRs and technology transfer activities.
- ✓ Provision of the capacity building of the current TTO staff on the main topics relevant for successful implementation of TT activities with particular emphasis on the international context.
- ✓ Focus on the internal TTO staff for managing the overall technology transfer process and outsource certain activities for which the TTO at the moment does not have necessary expertise, but at the same time enable the learning-by-doing process for these activities.
- ✓ The relevant preconditions (both regulative and infrastructural) for implementation and management of TT activities exist, but the relevant framework and coordination among them is needed.

(b) Collaboration with industry

- ✓ Identify "marketable" products based on Centre's portfolio.
- ✓ The Centre should connect with the relevant industry both in Bulgaria and abroad.
    - Identify key target companies for future collaboration, both in Bulgaria and abroad.
    - Set up Key Account Managers to liaise with target companies.
- ✓ The Centre should strengthen the internal capacities of the TTO in order to be able to manage an overall technology transfer process and/or to outsource activities in which there is still no expertise.
    - Perform a detailed training needs analysis and develop a comprehensive training plan.
- ✓ The Centre should provide clear guidelines and rules related to implementation of TT activities.

- ✓ To the question how to motivate researchers to work on external (industry tasks) there are no simple solutions to this problem but certain steps can be implemented:
    - it is important that the partners try to align their regulations to allow researchers to work with industry and to communicate a coherent policy on research collaboration with industry
    - provide clear incentives – both economic and non-economic (e.g. peer recognition)
    - reward success in applied research projects with industry
    - recognise IP generated on research projects with industry, so that it has the same kind of recognition as academic publications, also in terms of career progression
- ✓ Synergies and Complementary Initiatives

Potential collaboration with the Centre Fundamental, Translational and Clinical Investigations on Infections and Immunity.

KPIs

KPIs should be in line with the JRC Report Knowledge Transfer Metrics - Towards a European-wide set of harmonised indicators.[239]

CENTRE SUSTAINABILITY

Requirements and Expectations

This CoC seems to be developing well and it is a reasonable expectation that the set-up project will be completed satisfactorily. The long-term sustainability of the Centre will depend on the commitment of the key stakeholders to its continuing operation and success. Given the existing and growing importance of personalised medicine to the health sector both nationally and globally, there is every reason to believe that there will be significant interest in use of the infrastructure for both academic and applied research, and that results of interest both to the national health care providers and to the international health and life sciences sectors could be obtained. How much this hoped-for research success will contribute to the sustainability of the Centre will depend on the management's ability to guarantee continuity of the research and international commercialisation of its results. We believe that the key ingredients in this long-term sustainability will be:

- the extent to which national government support (direct or indirect) continues;
- how much European funding can be obtained by successfully partnering on significant European funded projects;
- how well the technology transfer capability is strengthened, particularly in its capacity to generate projects and revenues internationally.

The Centre's vision for the future financial sustainability is to have 40% of the funding coming from university, 25% from competitive projects, 25% from contracts with the industry and 10% from the national Roadmap funding.

[239] Campbell, A., Cavalade, C., Haunold, C., Karanikic, P., Piccaluga, A., Knowledge Transfer Metrics. Towards a European-wide set of harmonised indicators, Karlsson Dinnetz, M. (Ed.), EUR 30218 EN Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-18885-8, doi:10.2760/907762, JRC120716 . Available at: https://publications.jrc.ec.europa.eu/repository/handle/JRC120716.

In our opinion, determining the legal structure of the Centre is much less critical in achieving its long-term sustainability than the partners seem to believe, as several different options are workable. The focus should instead be on attracting the funds from different sources and on continuing the high-quality research that will provide valuable research results with market potential.

Looking in more detail at the financial forecasts (Financial Analysis document), we note that the operating income from non-public sources (incl. contracts, commercialisation and renting of infrastructure) is planned to reach approx. 50.000 BGN in the sixth year and 90.000 in the following years. Then, we observe a striking difference in the foreseen operating costs during and after the six years formal lifetime of the Centre project. During the first six years the costs are approx. 950.000 BGN per year (incl. staff costs, costs for materials and indirect costs) while after the end they are reduced to approx. 10% (97.000 BGN) overall per year. It is indeed true that the expenses for organisation of the procurement and installation processes in the initial phases of setting up the Centre require an additional number of specialists and administration, however we cannot expect that the Centre will continue its sustainable functioning without strong support from public sector/university/competitive national and international projects in the absence of which the activities of the Centre will be frozen. The problem that becomes obvious is that the 40% funding from university is actually not envisaged in its budget, the budget being mostly based on the number of students. One opportunity, in addition to winning competitive projects, is to get national funding based on excellent research (national ranking system exists already for this purpose putting Plovdiv MU on 5th place out of 45 higher education institutions).

As a rule, PERIMED should aim to become a partner on the future EU funded and other national and international projects to assure the long-term sustainability.

ROADMAP ON LONG-TERM SUPPORT

- ✓ Centre should have a competent manager.
- ✓ External expert support for preparation and implementation of relevant documents (rules and guidelines) for overall management of TT activities.
- ✓ Education of both researchers and other relevant staff (TTO staff) on IPRs issues and TT activities.
- ✓ Support for Proof of Concept, prototyping and bridging finance.
- ✓ Greater attention to international commercialisation opportunities.
- ✓ Dedicated key account managers to target and work with key industry partners both nationally and internationally.

9.8 Centre of Competence "Personalised Medicine, 3D and Telemedicine, Robotic-assisted and Minimally Invasive Surgery"

Summary of Centre

Identification number: BG05M2OP001-1.002

Centre name: CoC Personalised Medicine, 3D and Telemedicine, Robotic-assisted and Minimally Invasive Surgery

Partners: Medical University Pleven, Medical University Varna and Institute of System Engineering and Robotics (BAS). Lead Partner beneficiary: Medical University Pleven

Budget of the project: BGN 23.7M, verified expenditure BGN 10.8M with further 7.5M spending planned

The main objective of the project is to increase the level of research in precision medicine sector and improve the market orientation of the research activities of the three partners using the knowledge accumulated within the Centre of Competence via interactions with foreign international research centres and industrial partners.

Leading organization:

Medical university - Pleven

Project name:

Center of competence in the field of personalized medicine, 3d and telemedicine, robotic-assisted and minimally invasive surgery

Partners:

1. Medical University – Varna
2. The Institute of Robotics - BAS

Contract:	BG05M2OP001-1.002-0010-C01
Budget:	BGN 23 695 179,29
Start date/end date:	26.07.2018 – 31.12.2023

Overview of specific project goals:

1. Modernization and upgrade of the existing research infrastructure accredited and aligned with current market demands based on the industrial business partners' feedback.
2. To exploit the synergies arising between the participating institutions based on the common professional interests identified, resource sharing and the existing long-term cooperation in the sector.
3. To create and support a sustainable workflow of innovative projects with high commercial and economic potential in the field of personalized medicine, 3D and telemedicine, robotic-assisted and minimally invasive surgery.
4. To acquire competences and special training in frontier methods for young researchers through close collaboration with national and international industrial partners.
5. To establish strong connections with business using the network of local industrial partners already attracted: Georgi Stranski Pleven UMHAT; Sveta Marina Pleven MHAT; Sveta Marina Varna UMHAT; 5th Degree Innovative Solutions Company; Florida Hospital Gynecologic Oncology, Cancer Institute.
6. To establish strong connections with hospitals (public and private), laboratories, medical universities and scientific institutes with a view to provide the researchers with the opportunity to work outside the research environment and to implement the discoveries into medical practice.

The proposed infrastructure is a distributed state-of-the art biocluster with focus on precision medicine and world-class research facilities. The project involves the construction of high-tech scientific laboratories and their accreditation. The project suggests significant synergies arising from the established cooperation of the participating institutions uniting the clinical teams of MU Pleven and Varna with the technological expertise of the Institute for Systemic Engineering and Robotics (ISER) BAS.

Current Status of Centre

Analysis of questionnaire

The uniform questionnaire, sent to all Centres included in this study to collect centre-specific data, was answered by the management of the Centre. The centre-specific characteristics arising from this questionnaire are:

- The current arrangement is governed by a partnership agreement between three public entities led by MU Pleven. The Agreement allows the partners to carry out independent fundamental research, industrial research or experimental development and/or to disseminate the results of these activities through teaching, publication or knowledge transfer. The partners have established a long-term partnership, agreed terms and conditions, and implemented a number of joint activities and projects with the selected associate partners, which include public academic institutions and one privately owned Bulgarian IT infrastructure and software development company. All associate partners will participate in the implementation of specific project activities but will not receive funding and/or privileged access to research results and products.

- As part of the CoC activity, the partners are expecting to create spin-off companies using own funds. Partners will also carry out own business activities, such as sales of services, fundraising and seeking of grant financing as individual organisations.
- The partners believe that no legal entity should be incorporated and the CoC should remain a loose consortium of partners governed by a single project leader closely supervised by the board.
- The CoC should be independent in its management and execution of operations but should agree its strategy and budget with the individual partners and report to them regularly.
- The partners believe that each of them should be responsible for its own activities and arrange contractual arrangements separately.
- The partners envisage to employ **permanent senior management** and contract researchers from partner organisations on project basis.
- The partners have agreed on a unified policy between their organisations and CoC with regards to IPR protection, technology transfer and sharing industry contacts and leads.
- Distributed equipment and research infrastructure assigned to CoC are owned by the individual partners and should remain in their ownership in the future.
- There is an insufficient number of skilled financial and legal experts to carry out business planning, compliance, control and contracting functions, and monitoring the use of the research infrastructure. There are no agreed KPIs or monitoring activities for the CoC.
- The partners have not yet agreed on whether they should participate more in collaborative research (non-economic activity) or contract research (economic activity). The partners do not have procedures to monitor the annual capacity of CoC to distinguish between capacity usage for economic and non-economic activities. The partners can clearly differentiate between their own activities and activities of the CoC and the separate accounting system for expenditure and revenues for both economic and non-economic activities within the CoC has been established.
- There is no dedicated TTO for the CoC, however, the certification/ accreditation, protection of the IPR and transfer of knowledge and technology will be outsourced to MU Varna's TTO and a small budget is allocated for these activities. This TTO has some skills in certification/ accreditation, identifying inventions, securing grants and EU funds, and also in technology marketing. There are few/no competences in filing patent applications, international IPR protection, raising investment funds (private equity/ venture). No information was provided on the availability of dedicated personnel with competence and experience needed for proactive commercialisation through established channels of knowledge and technology transfer.
- According to the management, the main barrier is the unclear framework for the operation of CoCs and CoEs. According to the rules, the main aim of the project is to create top-level research intended to be disseminated on a wide scale through teaching, publication or knowledge transfer, which, in the their view, cannot lead to enough commercial activity to generate sufficient revenue to ensure the CoC's self-sustainability.
- The CoC does not have any projects yet and has not yet made any industry contacts. In the future, the CoC is expecting to have one project a year on average.

Identifed needs and challenges

The challenges that were identified by the centre's representatives are:

- Legal Framework, Organisational and Management Framework, Decision-Making
    - Constantly changing national regulatory framework
    - Difficulty in conducting and implementing innovative and internationally relevant scientific research
    - Difficulty in establishing multidisciplinary research teams and creating career perspectives for researchers as well as professional development of students;
    - Difficulty in establishing long-term cooperation with leading European partners and dissemination of the research results;
    - Reversing the trends in the increasing age of staff within the areas of health and medical education;
    - Unclear organisational and management framework.
- Access to the Research Infrastructure
    - Sustainable development and financing of local infrastructure and access to pan-European infrastructures are challenging.
- Technology Transfer and Commercialisation
    - Difficulty in accelerating transfer of research to business included in the Technology and Innovation Transfer Program
    - Difficulty in increasing private investment in public R&D and complementing public spending with public-private partnerships and projects providing solutions to pressing public issues
    - Market relevance of the research results and addressing the socio-economic challenges in the fields of medicine and health prevention
    - More effective use and promotion of the benefits to society as a whole
    - Ensuring potential for improvement across the entire value chain.

The needs and challenges identified by expert panel are:

1. The absence of a separate legal entity could make hiring, governance and strategic direction of the CoC challenging even in the presence of the procedures and rules detailed in the Partnership Agreement. This is especially valid for the period post-2023 when the project financing will come to end. The necessity for separate decisions and resolutions from each partner under a loose consortium could negatively affect the formation of strong business relationships as this is normally seen as too complicated, difficult to govern and prone to delays and additional legal hurdles for every action, especially in long term contracts. Since the CoC has only three partners, the CoC can easily start its operations using its current partnership structure. It can make a reassessment of the needs of the three partners within the framework of the CoC according to the two options/models for competences of the legal entity proposed in Chapter 3 of the report (one less integrated and one more integrated model).

2. Due to the experience of collaborative and contract research activities of each partner university and their wish to retain control over their own established procedures, the potential economies of scale (i.e. a common back office, procurement, legal/ regulatory counsel, TTO, accounting, etc.) will not be achieved and the level of competence of this CoC is unlikely to exceed the level of competence within the partner institution.

3. The absence of a common back office/ independent single governance and coordination mechanism will lead to unclear management framework within the CoC. The proposed second project management unit to be run for the first 6 years by an external contractor may mitigate the problem somewhat in terms of strategy development and the pressing need for TT expertise but is unlikely to resolve the management and governance challenges (see point 1). The relationship between the separate project team members and the external management team is not regulated properly and such lack of regulation may cause ineffectiveness and even disagreement with doubtful benefit to the project.

4. The absence of a back office and dedicated permanent staff may also make it more difficult for the CoC to react effectively to the frequent changes in the regulatory environment, especially in the situation where the communication between the individual partners in the CoC is not formalised or managed.

5. The unified IPR policy is not clear and easy to use, and, in particular, does not include clauses on the right of researchers to publish in the various scenarios when interacting with industry. This becomes important in the scenario of industry-sponsored research where the full access to the dataset and the researchers' ability to conduct analyses, interpret the results, and submit the manuscript for publication is often restricted by the funder. Sponsored clinical research in essence is an outsourced activity resembling a business transaction, and, as such, bears the potential for conflicts of interest including those regarding the publication of clinical trial results, especially in cases where the publication of favourable results is a part of the company's marketing strategy. This means that industry-sponsored trials are less likely to be published than those not sponsored by industry, especially if the direction of the results is unfavourable unless the 'right to publish' is assured, which can be challenging to do but the Centre should always (as a good practice) try to preserve the right to publish.

6. The partners have developed comprehensive procurement sheets covering both research-grade equipment and consumables. However, as the infrastructure will be distributed among the partners - the monitoring procedure for the capacity usage for CoC's activities is not clearly described. In addition, the partners do not have a procedure to monitor the annual capacity that clearly distinguishes between capacity usage for economic and non-economic activities within the CoC.

7. Lack of dedicated TTO and commercialisation *internal* personnel with skills and experience in formal channels of technology transfer and procedures leads to challenges in aligning research with current market demands and socio-economic challenges, difficulties in securing additional translational funding and the lack of close academia-industry interaction. The proposition of hiring an external contractor who will conduct TT activities with two hired external specialists is a short-term solution, which may not necessarily lead to the development of internal expertise.

8. Lack of KPIs monitoring the CoC's performance in terms of commercialisation and technology transfer and its effectiveness in terms of income will make accounting and financial performance reporting difficult.

Long-term vision

The CoC is envisaged as a non-profit organisation and the plans are drawn for the 20-year period with the detailed financial analysis for the first 10 years and financial justification for the initial 6-year period.

The activities related to technology and knowledge transfer are expected to be performed by the partner organisations (including their relevant departments and/or any potential future structures; i.e. transfer of knowledge from the research organisations to the Centre to create joint IP and/or synergies to enable CoC's operations, knowledge exchange and training activities), and all revenues from these activities are expected to be reinvested in the main non-economic activities of the research organisations. The economic activities provided at market prices will include the provision of paid services, contract research.

Legal Framework of the Centre

Current legal framework

The current legal structure is a contractual agreement between two partner medical universities and one institute of the Bulgarian Academy of Sciences. The agreement between participants is concerned only with the project at hand, and even though representation, distribution of funds and functions, use of equipment and future IP rights have been discussed, none of these arrangements are designed to survive the duration of the project.

Since the partnership is not a legal entity, the CoC itself cannot hire personnel under labour agreements, so is in no position to acquire permanent senior staff. The leading partner, Pleven MU, under the current Partnership Agreement, has a mandate to operate the external project management unit operating in parallel for the initial 6 years (and so can hire any expert or scientist under a consultancy agreement - i.e. civil contract as opposed to employment contract). For some activities, this arrangement is expected to be sufficient however it does not provide a long term solution such as the one expected to be achieved with the establishment of a separate entity with own legal personality.

After this mandate expires (post-2023), the only option the partner organisations will have is to cover (pay) the expenses for management and development of the Centre from their own budgets. One option is to utilise the freelance-type contracts (grajdanski dogovori) for hired experts or scientists, however the downside is that this option may not be seen as sustainable or as an attractive arrangement for the researchers in the long run. If the hired experts or scientists retain an employment contract with a 3rd party, the CoC would only be able to offer a part time working engagement.

Recommendations

Institutes within the structure of the Bulgarian Academy of Science generally have wider discretion in terms of forming commercial or corporate relationships and could therefore participate easily in a broader range of commercial activities. Provided the cooperation between the members of CoC proves to be a fruitful synergy it **would be more efficient for them to form a separate legal**

entity such as an association.[240] In any case, the founding partner organisations would have to sign a more detailed partnership agreement with clearly defined functions, distribution of rights, commitments as well as any additional funding contributions (either monetary or in-kind) to be provided by the partners in the period post-2023. Updating these arrangements represents a necessary step in the direction of forming an integrated legal and organisational structure.

With the creation of a separate legal entity the CoC should establish a common and continuously functioning back office with the necessary qualified human resources and capacities, hire independent senior management and construct own TTO to benefit from increased flexibility, improved communication between partners and vis-à-vis industry, economy of scale and growth in expertise level. This will also allow the **CoC to hire a general manager and provide him/her with broad mandate needed to achieve its ambitious goals.** It is recommended to attract an experienced TT professional by offering a competitive salary and a full-time position. The general manager should be **responsible for the CoC's operations and performance as well as business development, establishing networks and sales of services** and could also support similar activities of the TTOs of the participating partners. The activities of any existing parallel structures involved in the management, such as the externally contracted PMU that the Centre planned to engage for the first six years of operation, should be exercised internally thereafter, together with **development of stronger internal capacities.**

As the CoC is focused on providing variety of products and services within precision medicine sector, which requires the **alignment with both EU and national patient rights and patient data protection laws**, the Centre should have access to an experienced legal counsel to ensure compliance with international regulatory rules for product certification and health data protection, which is likely to require a full-time engagement.

Such setup will enable the CoC to ensure effective performance, improve its business model sustainability, and engage in capacity building. The expert panel stresses that only common management and highly qualified leadership, including financial and legal expects, could direct the efforts of all the members in the commonly useful direction and provide coherent cooperation and development strategy.

The rest of the personnel could be contracted on a need basis from the partner organisations for research activities and from the market for administrative/ support services (e.g. accounting).

Organisational Framework

Ownership structure

The partners of the CoC are:

1. Medical University Pleven (MU Pleven) as the lead organisation
2. Medical University Varna (MU Varna)
3. The Institute of System Engineering and Robotics of Bulgarian Academy of Science (ISER BAS).

[240] See Chapter 2 and Chapter 3 of this report for the two models described for competences of the separate legal entity (one less integrated and one more integrated).

Governance and decision-making; management of the assets

The project is being implemented in a decentralised manner, meaning that legal, financial and administrative resources as well as the equipment and infrastructure are distributed among partners. The scientific personnel coming from different partner organisations remain employed by their parent organisations. Procurement is distributed and carried out by each partner separately. The contracts resulting from the CoC operations will also be carried out by each partner separately unless two or more partner organisations are jointly engaged in a common project with external/industry client/user/collaborator.

Movable and immovable property is distributed between the partner organisations and with free access granted to the partners only for the purposes of the project. Although the partners have agreed to ensure the sustainability of the partnership for a period of five years following the project completion, it is possible to envisage that **mid- to long term, in the lack of a dedicated legal and organisational structure for the Centre, and in the lack of dedicated funding for joint activities, the partners might no longer be pursuing common goals** or principles despite the synergies offered by the combination of engineering capabilities of BAS Institute and the clinical facilities of Pleven and Varna MUs. The right to access to the infrastructure of the other partners is a general one (contractual only) and is actually not opposable to any future owner of the building (should such appear in the future).

The main focus of the CoC activity within the project is to develop and upgrade the research infrastructure. It follows from the partnership agreement that the partner universities and the institute do not expect the activities of CoC to generate sufficient income beyond maintaining the existing equipment or real estate. Therefore, after the end of the formal project period (2018-2023) each partner will likely continue to use and maintain its own equipment. In the absence of a common legal and organisational structure laying down clear rules, responsibilities and commitments and entrusting a common management with specific accountabilities in developing the Centre, there will be no legal mechanism to enforce the rights of the partners to use/access equipment of the other partners. Similarly, there would be no mechanism to guarantee that the interests of the Centre are pursued There is a risk that some of the equipment will eventually fall out of use as consumables will no longer be purchased after the termination of funding for the Centre-project.

Generally speaking, legal mechanism to ensure fairness of the distribution of expenses and burden of maintenance on one hand, and the opportunity to use the equipment and benefit from the results – on the other hand, can only be achieved through the formation of a separate legal entity to which the use of assets could be transferred (made available) together with IP rights.[241]

RESEARCH INFRASTRUCTURE AND STATE AID RULES

As apparent from the Project Justification and from the presentation made in the autumn of 2019 to present the challenges, **there appears to be a confusion about the nature of economic and non-economic activities in the Centre**. Independent science and research activities including joint activities in which the research organisation participates in "effective collaboration" as well as the wide dissemination incl. by means of teaching, publication are all **non-**economic activities and

[241] A more detailed and comprehensive partnership agreement could in part also achieve this by setting clear commitment of the top management of the partners stipulating the conditions and consequences of each activity, however this may be a less efficient solution from both administrative and legal perspectives.

belong to the main activities of a research organisation (with minimum 80% of the capacity usage). These activities do not constitute state aid at the level of the research organisation.[242]

Non-economic activity in terms of EU state aid rules should not be equated with "not-for-profit" activity in its common meaning.[243]

Furthermore, it is not entirely clear what is meant by "it is planned that 20% of the capacity to be accessible by external organisations" on page 142 of Project Justification. Please note that activities such as renting out equipment or laboratories to undertakings, supplying research services to undertakings or performing contract research for industry are all economic activities and together should take no more than 20% of the overall annual capacity. This seems to be correctly pointed out on page 161.

Technology Transfer and Commercialisation

Centres' TT strategy outline and expectations

The CoC has developed long-term IPR protection and technology transfer policy and code of researcher ethics adopted from the MU Pleven and the innovation strategy from the MU Varna, which all partners are in agreement with. The financial plan has been made for 20 years and the detailed budget was drawn for 10 years. The costs provided are reasonable and include the necessary expenditure aligned with the purposes of the project including IP protection, training and publication costs though the certification costs for Good Laboratory Practice (GLP) and Good Clinical Practice (GCP) do not seem to be accounted for as well as annual inflation.

It is expected that only 20% of the capacity of CoC will be used for economic activity. According to the financial plans the first income of BGN2.2M will be generated in 2021 and should reach BGN4.2M in 2025. In ten years from the beginning of the project, the income from sources outside the national budget and the EU budget is expected to reach BGN 23.3M. The largest source of income is envisaged as revenues from commercialisation, mainly licensing, reaching BGN9.8M. The income from publicly funded research projects is expected to reach BGN8.3M, while the rest of the revenues are expected to arise from lease of the equipment and "knowledge and technology transfer" which translates into income from training and sales of products. No income is expected from private investments or dividends/ exits from spin-off companies created within CoC despite the intention of the management to create spin-off companies. While it takes time for some spin-offs in healthcare space to become commercially successful, digital and telemedicine technologies are the exception to the rule and viable companies can attract seed funding within 24 months, and are expected to exit via a trade deal within 8 years or go public within 9.5 years.

The CoC would be able to operate commercially as envisaged without forming a separate legal entity. The partner universities could either participate together in each and every agreement and contractual relationship as separate parties - where necessary and according to their own contribution to each specific project.

The Higher Education Act allows universities to perform commercial activities related to their core business and to achieve realisation of the IP rights obtained through its activities. Therefore, under the preferred arrangement, any agreement signed by each university relating to the creation of a commercial entity (company) or the participation with shares in such should meet both of the

[242] However, conditions apply for "effective collaboration" projects to avoid passing on state aid in the form of an advantage to third parties. See general part of the report - Chapter 4 on State Aid.
[243] We note that the translation from Bulgarian language of the project documentation may have been inaccurate.

described criteria together with a couple of more specific conditions contained in the Implementing Rules (Decree by Council of Ministers) enacted in March 2020.

Identified Challenges and Needs

Grounds for the income planned in the financial model are unclear and seem unrealistic as the projections on commercialisation results do not seem to be supported sufficiently by market research, existing contracts, current commitments or past performance. Thus, the income projection in general appear to be misaligned with current market needs and existing competence and traction of TTOs of partner organisations:

a) The revenues from the commercialisation of R&D results are expected to reach BGN18M as a result of the commercialisation of at least 7 patents, utility models and/or copyrights. These are projected as a result of the commercialisation of patents as royalties' payments on net sales and milestone payments which translates into BGN2.5M per each patent, an unrealistic expectation. Given the activity described in the business plan, it would be challenging to gain even the BGN10M required for the maintenance of the infrastructure.

b) The timescale is also unrealistic. It is more likely that only one of the seven technologies patented will create such interest from industry. In addition, typically, in this sector it takes 4-5 years for the early stage technology to reach maturity level suitable for manufacturing, another year to negotiate a license agreement and then at least 6 more months before the first royalty payment from the sales will be achieved.

c) The assumptions and expectations seem to be based on the ambitious ideas without any substantial evidence provided of the market research confirming the industry interest from a selection of companies or prices the potential licensees and industrial clients are willing to pay; the proposed links with manufacturers of equipment for the Minimally Invasive Surgery (MIS) and robotic surgery are similarly not sufficiently substantiated).

Thus, the challenges and needs are:

- Lack of knowledge, skills and experience within the internal ecosystem that would enable effective TT though established channels, procedures and sources of translational funding, both internal and external. The lack of access to translational funding is the major challenge, which needs to be addressed first.
- Lack of knowledge, skills and experience of the contemporary business development methodologies, incremental spin-off development and on attracting early stage development funds from the market sources (crowdfunding, business angels, early stage venture, etc.)
- An insufficient number of skilled financial and legal experts for the business planning, compliance, control and contracting functions, and monitoring of the use of the research infrastructure.
- The absence of a common legal structure will prevent the CoC to increase their expertise level in TT and commercialisation activities, hire highly qualified business and legal personnel and create coherent long-term cooperation and development strategy.
- Change of senior management of each partner is prone to risk and instability in CoC. Additionally, it should be kept in mind that universities and BAS institutes respond to different higher management.

Recommendations

(a) TT Arrangement for the Centres (Strategy, Policy and Process)

- Establish internal and identify external sources of translational funding (university venture, Proof-of-Concept funds) and close the expertise gap in securing external translational funding (provided by national research councils, patient organisations, national health service, EU funding e.g. Horizon programmes). To put it in context, translational funding, needed to bridge a 'gap' in development between early stage academic research and its commercialisation is particularly important in medtech and biotech applications due to significant effort required to move the technology from the laboratory to commercial space, and high costs associated with this. Translational funding allows reducing the risk of technology failing commercially for potential partners, thus making the opportunity more attractive for commercialisation and the creation of a viable product or service more likely.
- Create a working internal ecosystem that would enable and promote technology transfer, establish formal channels, procedures and identify likely sources of additional translational funding.
- Build capacity on creating and managing the IP portfolio, particularly patents and licensing agreements.
- Build capacity on implementing the state aid rules, i.e. planning, controlling, contracting and monitoring of the use of the research infrastructure.
- Build capacity on meeting the sector compliance requirements, with focus on the requirements for products and services used outside of the research environment.
- Establish a database of industry contacts to use for strategic marketing search, identifying potential early adopters and seeking pilot partners.
- Invest in training technology transfer personnel and talent acquisition.
- Further increase and diversify its proposed commercial and business activities in addition to developing the main sources of public research funding, and other state and EU support; and substantiate the revenue projections in the current financial model accordingly. The current financial model is unlikely to result in self-sustainability.
- Increase the proposed capacity. The proposed capacity (1 project a year) is unlikely to make it self-sustainable or support the revenue projections in the current financial model.

(b) Collaboration with industry

- Considering the State Aid rules and the past experience and expertise of CoC's partners, the primary focus of the activities and well as of the business model should be on collaborative and independent research, teaching/ training activity, followed by a smaller share of research on behalf of undertakings. Thus, it is important to leverage the existing industry links already achieved by the founding partners.
- Consider scientific equipment lease supported by own personnel as a service, e.g. for carrying out short tests and one-time measurements for client companies on the *ad hoc* basis.
- Build capacity on academia–industry interaction, contemporary business development methodologies and incremental spin-off development.

- Collaboration with industry with commercialisation (creation of new products and services) as an aim is also very beneficial to both the CoC and its partner institutions and the industrial partners; however, to ensure the maximum benefit to all parties, industry needs and gap as well as the public benefit should be taken into account. Unlike in contact research case, where the industry needs are communicated clearly to the investigator, the information of what kind of products and services are likely to sell needs to be proactively collected. The best way to gauge the industry needs and gap (also known as 'pain points') is to carry out primary market research to inform the most suitable commercialisation strategy on a case-by-case basis.

- It is important to focus on industry sectors that absorb inventions and approach companies within these industries that are known for growth strategy based on innovation. Approach potential early adopters for feedback.

- Due to lack of experience of existing TTOs at partner institutions, hiring international agents, medical and technology scouts within these industries will ensure wide technology exposure to industry, the valuable industry feedback, and build CoC's brand recognition in the first instance. This does not mean that the CoC should not hire and train own workforce at the same time. While outsourcing complex tasks is a viable strategy to address the pressing short-term needs, the CoC should endeavour to build internal capacity in TT going forward. Working alongside external high calibre specialists on the simpler tasks and activities while gradually moving to more complex issues is one of the fastest way to acquire expertise and will allow CoC to be able to internally manage the entire project by the end of the 6-year period.

- In addition to general TT specialists, consider hiring an experienced Medical Science Liaison (MSL) officer to train an internal specialist. MSL is a specific role within the pharmaceutical, biotechnology, medical device, clinical/contract research organisations (CROs) and other health-care industries. The responsibilities of an MSL is to build relationships with key opinion leaders and health care providers in the industry, national and regional societies and socially and politically important organisations, providing critical windows of insight into the market and competition. Usually, an MSL specialises in a particular territory/ country, particular therapeutic area and has scientific knowledge related to it, particularly with regards to clinical trials.

- Build capacity of fundraising activities focused on attracting venture capital investment into early stage companies (the spin-offs that the CoC plans to create in the domain of 3D prototyping and tissue printing and cancer diagnosis panels will require specific training in fundraising strategy which the CoC ideally should be able to provide and/or facilitate) including investment proposition development, pitching, IP and start-up company valuation, term sheet negotiations, etc.

- Develop robust procedures for quantitative project evaluation for commercialisation based on industry need, commercial potential of the technology, capacity of the research team to deliver results, and the strength of the business strategy. The procedures used by early stage funds to evaluate projects for investment would be a useful collateral material.

- To support spin-off creation, it is highly recommended not to develop own incubators or similar support but to find synergies with existing institutions, accelerators and support programs.

- To attract leading researchers in precision medicine, the infrastructure itself is not sufficient, easy access to patent cohorts and national medical facilities will be required which usually require establishing close collaboration with several public and private hospitals and the national health system. A well-trained TTO would be able to assist with this task.

- Consider creating industry guidelines, best practice documents and offering consulting in biocluster development as additional revenue streams.

Synergies and Complementary Initiatives

- Sofia Tech Park also announced a financing scheme for very early stage high technology start-ups, offering €75K of funding and free access to laboratories and innovators' community which can be utilised by spin-offs to supplement translational funding.

- Financial support for Proof of Concept or development of prototypes is available from the Innovation fund. A new innovation voucher scheme is also being developed.

- Regionally recognised private venture funds and accelerators stationed in Sofia such as BrightCap Ventures offer investments for spin-offs and early stage companies in medtech sector.

- Explore the possibility for collaboration with regional innovation centres, and especially the companies within them and with other bioclusters in the EU offering the exchange of expertise, access to research facilities, or access to specific patient cohorts.

- Bulgaria joined EATRIS-ERIC[244] in late 2019 with the national node based at Sofia University[245]. The Centre could consider the possible added value of taking part with some of its infrastructures. The EATRIS-ERIC is focused on biomarkers, vaccines, imaging platforms, small molecule therapeutics and ATMPs/biologicals. Though EATRIS-ERIC does not specialise in diagnostics or medical devices including implants, their expertise might be useful to CoC in immuno-oncology projects and in development advanced imaging platforms, and, especially, when the partner MUs will start using 3D printing in tissue engineering to provide the suitable microenvironment for cells to induce cell proliferation and differentiation toward the functional tissue. Whether CoC plan to 3D print using cells (when cells are contained within bioink) or create 3D cell-laden tissue scaffolds for implantation, EATRIS-ERIC will be able to help with regulatory, cost-benefit issues, and protocol development to assist with a difficult task of moving these important inventions from the testing stage into clinical practice.

KPIs

Straightforward key performance indicators demonstrating the effectiveness of activities for commercialisation but also the final financial results should be implemented:

- Cost benefit indicators of IP: cost of protection vs. income from IPR exploitation

- Indicators of market conversion: leads, hot leads, contracts, income from sales

[244] https://eatris.eu/

[245] See here the ppt. from the kick-off in Bulgaria: https://www.uni-sofia.bg/index.php/bul/content/download/217929/1465182/version/1/file/Intro-EATRIS-1.pdf as well as the FAQ: https://www.uni-sofia.bg/index.php/bul/content/download/217928/1465178/version/1/file/EATRIS+framework.pdf

- Indicator of licensing: number of licensing agreements reached, income from royalties
- Indicators of effectiveness of marketing channels: income vs cost of marketing channel
- Indicators of effectiveness of scouting activity: income vs cost of customer acquisition
- Start-up funnel: number of ideas, number of pre-seed stage teams, number of start-ups, total investments raised, total value of exits, total value of equity share.

CENTRE SUSTAINABILITY

Requirements and Expectations

The CoC expects that there will be available national and EU funding (BGN 8 Million) mostly for operational costs and specific R&D projects but possibly also within the next operational program. As there is no availability of private sector sponsorship, angel investors, and / or venture capital for translational funding, the Centre expects to use national, EU and other international grants instead. The other major wing for the Centre's planned income - from commercialisation activities (mostly patent licensing) amounting to approx. 9-10 million BGN in revenues for the first 10 years – are unrealistic for the Centre despite the potential for high returns in precision medicine on theory.

a) The largest revenue is expected to arise from publicly funded research, over 40% of the CoC total revenues, reaching BGN21M.

b) Given the exaggerated projections, it is unrealistic that the CoC will meet its target revenues of BGN52M over the projected period of 20 years even if the project survives beyond the first 6 years. Even with the revenues accepted at their inflated value, the financial net present value of the capital is negative (BGN -189 056) which makes the investment into CoC unattractive even with the support of the EU structural funds. With the revenues corrected, the project is unlikely to generate sufficient income and raise enough funding from external sources to cover its projected operating costs and to accumulate sufficient financial resources to meet the needs for periodic replacement of the equipment after the end of its useful life.

Recommendations

Part of the challenge associated with the lack of a separate legal entity could be overcome with an intermediary step – structuring a more detailed partnership agreement, with clear views on participation in costs, maintenance, management, distribution of rights and obligations, etc. The clear commitments of the partners could be embedded in a suit of supporting (short- to mid-term) contracts. These could be used, especially if there is provision that the commitments specified by these agreements supersede a change of management. It is, however, strongly recommended that the partners agree to create a separate legal entity, in particular of the less integrated model[246] while funding and institutional support is still available. Without a separate legal entity, the achievement of the common goals of CoC for the period post-2023 can hardly be completed as, in the lack of funding, the partners would fall back to their organisations' own needs and programmes. The CoC should make a reassessment of the structural needs once it builds more developed joint activities and clear relations with industry. The benefits of a separate entity will

[246] The less integrated model for a legal entity entails the conferral of a set of limited number of specific competences to the new entity such as: promotion, coordination, relations with industry, representation however it does not entail the transfer of the use of the infrastructure (which is the case with the more integrated model). The less integrated model can be implemented also before 2023 since it does not require significant structural changes. For more information see Chapter 2 and 3 of the report.

include the ability to hire permanent management and achieve sustainability though focused development strategy.

- In the absence of a separate legal entity and/or where this is not an acceptable solution for the partners, a suit of short/mid-term agreements may provide adequate basis for most scenarios; however, to be effective these agreements must be reviewed and updated on the regular basis, and extended as appropriate to cover the post-2023 period. In addition, the Partnership Agreement should include a strong and clear clause that the partners commit to supporting the activities of the Centre for the purposes of joint projects and research for a period of minimum 5 years after completion of the project in line with the partners' obligation under the Grant Agreement.

To achieve its ambitious goals, and especially the sustainability, it is vital for CoC to focus on identifying short- and middle-term needs of local, regional, national and international industry players, align its R&D effort with these needs, and target the business development efforts to secure contract research assignments. At the same time, the CoC should seek national, European and international public (research) funding to support its operational costs and independent or collaborative research projects that may be used to initiate subsequent or simultaneous contract research. Such approach will result in organic growth in commercially viable technologies in the CoC's pipeline without jeopardising its commitment to 20% limitation on economic activity.

The general recommendation on commercialisation is to use contemporary approaches to business modelling as the way to develop several well researched product and service offerings based not on the general market need and global technology trends but in the specific requirements of the relevant industry players. These needs should be specifically focused on the unsolved problems of national or regional importance and provide provable patient benefit. All product and service offers developed (if any) as well as any inventions should be supported by value propositions, detailed business plans and financial modelling including the costs of the technology, product or a service to market and the expected commercial or economic/ patient benefit derived from the technology implementation. To deliver fully on its social and economic promise, CoC could consider improving its TT capabilities and acquire expertise to allow it creating and growing spin-off companies. The early stage technology companies require significant help with growth and market strategy, customer discovery, value proposition, commercial strategy, business case development, and financial modelling accompanied by financial support and management consulting to create a successful company. However, a successful spinout in telemedicine, genetics-based diagnostics, digital pathology or digital microscopy could provide the CoC with potentially valuable equity. This is a long-term game, but current valuations of successful precision medicine companies make it an attractive low investment with potentially very high returns.

ROADMAP ON LONG-TERM SUPPORT

Access to information on the development of similar initiatives in the EU, their strategies and their comparative success could be useful as a part of knowledge sharing. For example, the development of similar programs in the UK showed that progress in the performance of research and innovation ecosystem is only noticeable in the long run and self-sustainability can only be achieved after the desired level of expertise has been reached. Even in the fast-growing industries, such as precision medicine and immersive VR/AR/XR technologies, this process usually takes 6-8 years and continuous state support is necessary for an independent CoE to bridge the gap between scientific research and full-scale commercialisation.

9.9 Centre Fundamental, Translational and Clinical Investigations on Infections and Immunity

Summary of the Centre

Identification number: BG05M2OP001-1.002-0001

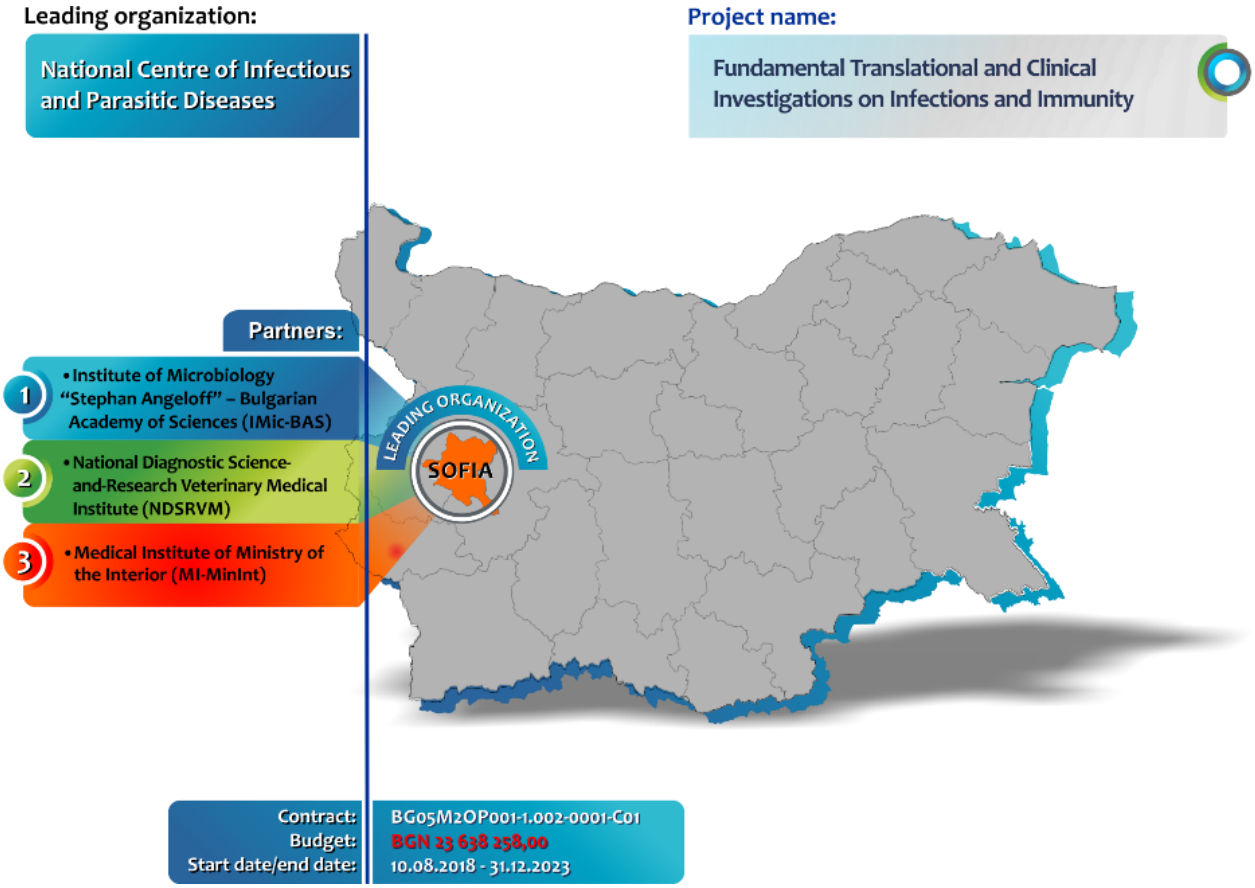
Centre name: FUNDAMENTAL TRANSLATIONAL AND CLINICAL INVESTIGATIONS ON INFECTIONS AND IMMUNITY

Budget of the project: 23 638 258.00 BGN

Beneficiary: National Centre of Infectious and Parasitic Diseases

Start date: 10.08.2018. – 31.12.2023.

Main project goal: Fast and efficient transfer of basic research data in the field of infections and immunity to clinical practice for the needs of individual and public health.



Strategic objective of the Centre:

- Fast and efficient transfer of basic research data in the field of infections and immunity to clinical practice for the needs of individual and public health.
- Translation of fundamental knowledge into clinical practice under the form of diagnostic algorithms, methodologies, conceptual models of diagnostic, therapeutic and prevention preparations, and expertise.

Overall aim of the Centre:

- Creation of unique for Bulgaria research complex in the field of infectious diseases and immunology (reconstruction and re-equipment)

The Centre research programmes:

- Precise and exhaustive definition of etiological agents from the host and the environment
- Molecular epidemiology of infections with significant social impact
- Drug resistance of pathogenic microorganisms
- Characterization and restoration of protective immune response to pathogens

CURRENT STATUS OF THE CENTRE

Analysis of questionnaire

There was one questionnaire respondent from the Centre. Based on this source, some insights have been provided as follows:

- There is clear interest to establish the Centre as a legal entity, but current activities and outputs do not support this.
- Staffing is a challenge in terms of specialist TT skills.
- Current KPIs do not adequately cover downstream target outputs.

In terms of detailed outputs of the questionnaire, the following was reported:

- As in most other Centres, there is not a sufficient number of skilled financial and legal experts for the business planning, controlling, contracting and monitoring of the use of the research infrastructure.
- In addition, the Centre has just started and is in its very early stage so it is still not possible to consider it advanced or indeed even fully operational.
- The most effective way the Centre should be managed is by a single Leader (closely supervised by a Board).
- Regarding the extent to which the Centre should be independent from the individual partners, similar to most other Centres, there is a belief that the Centre should be independent in its management and execution of operations but should agree its strategy and budget with the individual partners and report on outputs annually/quarterly.
- At the moment the partners are able to clearly differentiate between the activities and projects of the Centre on the one hand and of the individual institutes/partners on the

other hand, although formal and defined procedures to manage this may be outstanding.

- The individual partners in the Centre are responsive; communication between them is organised through regular meetings and updates.
- Since the establishment of the Centre, there was no engagement on projects with industrial partners. However, the Centre on a yearly basis predicts to perform 5-10 projects with industrial partners.
- There is no dedicated personnel for technology transfer activities at the Centre.
- In the past 12 months, there were no invention disclosures, Bulgarian patent applications, Patent Cooperation Treaty (PCT) applications and/or foreign patent applications, non-disclosure agreements (NDAs) with commercial partners, or Translational funding grants.
- Availability of Government and EU Grants is mostly available, while other sources of translational funding such as other foreign grants, private sector sponsorship, Angel Investors and Venture Capital are poorly available or not available at all.
- The most significant barrier to successful technology transfer overall is the absence of significant previous experience of each of the partners and the undefined legal form of the Centre.
- The strategies targeting Technology transfer at the Centre are: Consulting and Training, Material sales (biotechnology), Valorisation projects (Proof of Concept projects) and IP licensing. There are no Joint ventures with firms, spin-offs or Industrial PhD Programmes and Knowledge Sharing programmes bringing revenues.
- The role of the IP in the previously mentioned Technology Transfer strategies is considered to have a moderate role in the Centre. The planned activities to better shape the conditions for TT are:
    - Changing (internal) entrepreneurial culture,
    - Institutional & legal framework incentives,
    - (Re)shaping the research capabilities and orientation towards the market demand.
- Technology transfer follows a specific institutional IP policy and this policy covers the TTO strategy of the Centre, but the policy is moderately clear. There is no preference for either licensing IP to existing companies or the setting up of spin-off companies. The Centre does not have access to an incubator for spin-out companies.
- There is an awareness of support programmes (grants, subsidies, soft support) that could be utilised to facilitate interaction with industry.
- The support in the setting-up of spin-off companies with the participation of Centre researchers or of the partner institutions is being considered**.**
- KPIs are number of researchers, number of collaborative projects, etc.

An associated monitoring system is in place. Monitoring of the performance will be conducted by the Managing Authority of SESG-OP for the period of project implementation.

- From the questionnaire responses and from the personal meetings and presentations made, it becomes clear that the Centre does not monitor the overall annual capacity in a manner that clearly distinguishes the capacity usage devoted to economic activities from the capacity used for its non-economic activities and needs advice on that. We note that this is a requirement under the Grant Contract (see also Chapter 4 of this report).

It is not clear from the questionnaire if the Centre has (enough) dedicated personnel with competence and experience in the following areas:

- working with SMEs or corporations

Even though there are no dedicated personnel to technology transfer activities at the Centre there are certain technology transfer activities identified as meaningful, such as, identifying potential inventions (disclosures) and filing and prosecuting patent applications while securing translational funding for proof of concept is identified as average meaningful. Marketing technologies to secure licensing deals with companies is indicated as an activity that is currently minimal.

Identified needs and challenges

The Centre believes there is a clear need for the establishment of a legal structure, as well as a management structure, for the Centre. A centralised management structure is recommended, but we also recognise that it is difficult to implement for this specific Centre. Hence, the Centre's aim should be to establish the management structure that will be, on one hand more autonomous (since the partner beneficiaries are obliged under the Grant Contract to reinvest all revenues generated from knowledge transfer activities into the non-economic activities of the research infrastructure) and, on the other, more flexible (especially with a view to the next programming period).

Challenges:

At the moment there is a lack in communication between the Centre and all relevant stakeholders so it is advisable to ensure smoother communication. To achieve this, a dedicated staff member should be given this role.

LONG-TERM VISION

The long-term vision is to have the Centre established as a not-for-profit organisation and as a key recipient of Bulgarian Government and Global Research Funds related to infectious diseases, with additional economic activities further providing for a degree of autonomy and supporting sustainability.

LEGAL FRAMEWORK OF THE CENTRE

Legal structure

The Centre is currently operating as a consortium under a Partnership Agreement. There are draft proposals or ideas to eventually create a not-for-profit organisation (as a legal entity) within which to maintain the Centre going forward. A detailed analysis of existing structures as well as of potential revenues streams and associated funding strategies is required, in the first instance, to examine the viability of proposals for the future development. First we will look at the main arguments presented by the Centre.

The main argument for creating a legal entity expressed by the Centre is the lack of budgetary autonomy of all partners (excluding the institute of BAS which is autonomous) from the respective ministries. Important here is that if, for instance, IPR is created from the activities of the Centre (or its partners) and subsequently a licensing agreement is signed with a corporation, the Centre is obliged under the Grant Contract (point 6.15) to reinvest all revenues from knowledge transfer activities into the main non-economic activities of the Centre. Should the Centre make such an invention which proves very profitable it should use these funds for its own development and research activities and not transfer these revenues to the State through the ministries. Even if we accept that this requirement is valid only for the duration of six years project period, there is a general obligation to ensure the sustainable operation of the infrastructure for a period of an additional five years. The obligation of reinvestment does not seem to require per se the creation/existence of a separate legal entity but as a minimum the understanding of the grant conditions by the ministries and commitment of the latter to abstain from withdrawing funds accumulated from the knowledge transfer activities of the Centre (if such funds happen to accumulate). The partners have entered into legally binding obligations for reinvestment (with the MA Agency) and the respective ministries, on which the partners depend e.g. Ministry of Health, should honour these obligations. A solution should be found from accounting/financial perspective to somehow separate the revenues from knowledge transfer activities of the Centre from the main budget of the Centre (its partners respectively). The reinvestment requirement under State Aid rules continues to be valid also after the six years project time and will help keep the economic use of the infrastructure under 20%.

Another argument by the Centre to create a legal entity is the current dependency on ministries that complicates the management and requires coordination of all decisions about the future of the Centre with these corresponding ministries. To address this, we propose that in parallel to the new separate legal entity to be created, an inter-institutional agreement between the three ministries is signed to guarantee a degree of autonomy in relation to the operational decisions in the Centre.

The Centre expressed that the equipment and activities from the side of the leading partner National Centre of Infectious and Parasitic Deceases (NCIPD) and the BAS-institute can be clearly separated to form an autonomous [research] organisation in a possible new legal entity. This is a positive indication for the creation of a separate legal and organisations entity and structure. However, the question comes then who will undertake to provide operational funding to this new legal entity for research and for its management costs. Here it may be useful to consider the approach of the Heritage.BG Centre that has already created a not-for-profit association with the possibility to use the equipment and find out that the members/partners agree to make regular budgetary and in-kind contributions to this association. We recommend a re-evaluation of the situation and possibilities, taking into account the several existing structures for commercialisation within the leading partner NCIPD and whether these structures are relevant for the development of the Centre. The Centre can then also assess the applicability of the two models/options proposed in the general part of the report (one more- and one less- integrated, see Chapter 3 – Organisational Framework).

A clear and robust business case has to be demonstrated that justifies the establishment of the Centre as a separate legal entity. The current partnership arrangement provides a good basis to initiate effective R&D operations and can be maintained until the partner organisations clarify the role of existing structures and institutions in relation to the activities of the Centre. These are in particular

- the BulBio company,

- the Department for Scientific information, Organisational and Methodological Activities within the lead partner and
- the Joint Innovation Centre at BAS, the TT specialists at the Microbiology institute
- the Ministry's role and the relationship with the NCIPD

After the six years project period, this arrangement should be revised and expanded either embedded in the Statute of the new legal entity or through more clear and operational procedures between (and commitments by) the partners, including a plan for the organisation & management after 2023, the role of the leading partner (which gets 85% of funding), the overall responsibility for the Centre's activities, and a revised financial plan.

While a legal entity can be created already at the present stage, it would only have a concrete function and a clearly defined set of competences such as coordination, representation, industry liaison – i.e. any more significant structural changes for the Centre should only be undertaken after 2023.

It must be noted, there is significant international precedent to demonstrate that sustainable research collaborations can also be constituted as a partnership – operating under an agreement. Key to sustainability is not the legal structure, but rather will follow success in attracting funding and demonstrating meaningful research outputs of an internationally recognised quality.

International best practice

The structure of the Centre may draw parallels with multi-institution research partnerships/programmes operating elsewhere in the European Union. For example, reference is drawn to:

- The Beacon Project in Wales[247] which brings together the Universities of Aberystwyth, Bangor and Swansea to create an innovation ecosystem with relevant industrial stakeholders in the area of biomass processing.

ORGANISATIONAL FRAMEWORK

Ownership structure

Ownership is currently with the independent partners. The Centre itself has no legal rights of ownership at this time as it is not a legal person.

Governance and decision-making; management of the tangible and intangible assets of the Centre

The Management of the Centre Project is carried out by The Head of the Centre (representative of the leading partner), an Administrative Council of 9 members and in parallel a Scientific Council which includes the heads of the four Work Packages (WPs). The Director of the lead partner NCIPD is engaged to the position of Head of the Centre at 50% FTE, showing that the Centre's management and the management of the lead partner is basically the same and that the larger part of the Centre is intrinsically embedded as an internal part of the lead partner organisation and its activities. This comes natural having in mind that 85% of the funding goes to the lead partner. Decisions are taken by the Scientific Council and/or Committee for Coordination of Activities. The

[247] http://beaconwales.org/

Committee consists of the four chairs responsible for the implementation of the work packages and project tasks.

***Table 16**. Overview of described existent complementary roles and activities of the 3 partners, which together receive approx. 15% of the funding (Lead Partner NCIPD receives 85%)*

NDVRI /NDSRVM	Activities are similar to those of the leading partner but in animal health, incl. studies on biology, morphology, immunology and biochemistry of pathogens causing the so-called zoonoses.
IMic-BAS	Demonstration and research on microorganisms by modern genetic and visualization techniques to support activities in general microbiology and microbial genetics, as well as in vitro and in vivo modelling of immune-pathological processes (e.g., allergies, sepsis).
MI-MinInt	Practical application of research results in a large hospital to improve usage of antibiotics as a strategic task in the hospital.

From the above table, it appears that the most common joint R&D project would be between the lead partner NCIPD and the BAS-institute (the other two partners are more specialised). We suggest that roles and responsibilities of the partners are more clearly stipulated in the partnership agreement.

Under the Partnership Agreement, the partners appear to:

- Own, as individual entities, the equipment purchased by them using their allocation of funding.
- Collectively own (or have rights to), the intellectual property arising from the research of the Centre, but their commercial exploitation requiring *a* prior approval of the partners.

Below we present the form and structure of one of the associated partners: BulBio.

***Table 17**. BulBio Company*

Company Name and legal form	BulBio-NCIPD, Private Limited Liability Company
Main business activity	Production and commercialisation of vaccines, serums, diagnostic medical devices, sale of products
Ownership	100% public, Ministry of Healthcare
Role and functions	Created in 2000-2001 on basis of the production department of the NCIPD for producing bio-products. Commercialisation is one of the activities explicitly stipulated in the contract between BulBio and leading partner NCIPD. The medical department of BulBio acts as a structure to transfer the

	results of the research of NCIPD. The vast majority of its products are related to the research at NCIPD. BulBio commercialises on the internal and international market a long list of bioproducts, most of which are the result or research projects realized by the leading partner (NCIPD).

There are various ancillary documents to the Partnership Agreement, comprising:

- Management Regulations of Intellectual and Industrial Property, Use and Commercialisation of the Research Results at the National Centre of Infectious and Parasitic Diseases.
- The Centre plans to apply the existent Policy and Rules on IP of the leading partner organisation.
- Policy and Regulations for Operating and Commercialisation of the Research Results in the Centre of Competence. This policy says that the leading partner is to take the lead for commercialisation with or without the other units (understood to mean - partners).
- Policy & Rules of the Centre of Competence for access to external organisations to the Competence Centre's equipment and databases.
- Strategy for the application of research results at the Centre.

These documents fall short of best practice in terms of providing clarity and comprehensive coverage of matters that may arise in respect of the Centre's assets, rights and obligations, particularly concerning intangible assets. Joint ownership of the created research results/IPRs between the four partners most probably does not reflect the actual contributions into each R&D activity giving rise to the results in question. Therefore, the Centre could arrange, similar to many if not most of the other Centres of Competence in Bulgaria, the signature of a Protocol of Contributions stipulating the respective percentage. In the case of only one partner in the Centre creating IP it would belong 100% to this partner only (that would most often be the lead partner alone) or it could be that the IP is (partially) allocated to one or more of the other partners, for instance if it was a result of a joint project with the participating BAS institute or the partner doing research on animal health.

Then, regarding the relations of the Centre/its partners vis-à-vis third party (industry) EU State Aid rules can provide numerous answers on the formation of licensing prices, allocation of IPRs and other basic principles to be observed.

Research Infrastructure, State Aid rules and Monitoring

Management of the infrastructure, the access process and the in-house research

The Centre is considered by the Managing Authority to be performing moderately in terms of its profiled expenditure (6.47% of the budget has been utilised to date, as of Q1 2020). Procurement of equipment leading to novel research activities is therefore impacted.

One issue may be a lack of full-time leadership with experience of running such a project. This is clearly a highly demanding role, and its success will require a profound understanding of how to best mobilise the resources of the Centre in view of regional and global opportunities, and the attainment of credibility with relevant stakeholders.

Recommendations on Research Infrastructures

It is recommended the research infrastructure is utilised (where possible) to pursue further involvement in international consortia, beyond its existing involvement in EATRIS, targeting infectious diseases in order to position the Centre as an international player.

As stated in the section above, access Rights and IPR arrangements currently lack clarity in particular regarding joint projects with industry and do not adhere to best practice. The Centre should look to update its IPR framework with expert input.

Link with State Aid rules

Most of the challenges experienced by the Centre are similar to the other Centres and are of general nature. Therefore, for this topic we refer to the main chapter of this report on state aid.

Nevertheless, there are some particular issues identified.

Notably, the Centre states it does not plan to conduct any economic activities within the duration of the Centre project (six years), as evident in page 15 of Project Justification. The plan of the Centre is to support its sustainable development after the sixth year through the commercialisation of one part of the research results such as immunotherapy and vaccine preparations. Several aspects need to explained here:

1. It is true in practical terms that technology transfer activities (such as licensing or spin-off creation) may only be expected to start after several years of R&D activities within the Centre as time is required for the development and demonstration of these technologies.

2. Knowledge/Technology transfer activities (the activities leading to licensing, spin-off creation, but not the actual licensing or sale of IP) are considered non-economic (and not counting towards the 20% capacity limitation) on the condition that all revenues from these activities are reinvested into the main non-economic activates. Then, the actual licensing of IP should conform to certain requirements to avoid passing on indirect state aid to third parties (see Chapter 4 of the report).

3. The six years duration of the project does not impact the requirements under EU State Aid rules – these are valid in the same way during the project and after it has ended.

4. IPR can be created both in the process of non-economic activities (independent research, effective collaboration) and in performing research on behalf of undertakings (research services and contract research are economic activities).

Therefore, the Centre should not limit itself by not performing any economic activities until end of the six-year project period, provided it has implemented an effective separate accounting system and it is able to monitor the usage when necessary.

Similar to other Centres, the Centre talks about non-for-profit activities and we would like to remind that non-for-profit activity in the common sense is not the same as “non-economic” activity in EU state aid law (see again Chapter 4).

Monitoring Mechanisms

In the responses to the questionnaire the Centre expressed that it has not yet implemented a separate accounting system for economic and non-economic activities and that it does not monitor the usage of the capacity of the infrastructure. This would be fine in principle if the Centre does not perform any economic activities. However, under the Grant Contract the Centre is obliged to implement these mechanisms. Both the Contract and the EU State Aid rules limit the economic

activities of the Centre in that the "economic" use of the research infrastructures shall not exceed 20% of the overall annual capacity (estimated at the level of the relevant entity). In addition, the economic activities shall remain ancillary in nature. While the experts believe that this is normally not a serious impediment for research organisations, it requires a careful and correct application and a separate accounting system. The Centre has stated that it does not employ separate accounting, neither analytical costing. This is necessary to measure and keep track of the actual operational use of equipment and of the overall capacity of the infrastructure. The capacity can be calculated on the basis of time accounting [human resource capacity measured in employee working hours], inputs [such as material, equipment and fixed capital] and other elements relevant to the specific activity of each relevant entity of the Centre. Although this should be verified with local accountants, the experts believe that, depending on the specificities of the particular machine/equipment the basis for calculation of the 20% threshold could also be the actual operational capacity, e.g. the actual available machine time. PLM-type (product lifecycle management) software could be helpful here to be used as appropriate if standard administrative software does not provide this functionality.

Technology Transfer and Commercialisation

Centres' TT strategy outline and expectations

In the Project Proposal, the Centre envisages to select potential business partners "according to established criteria, i.e. time-tested large companies with rich and versatile portfolio including unique products and own patents", which later in the documentation are more precisely identified as biotechnology companies for development and production of diagnostic testing kits, vaccines etc. and companies organising preclinical and clinical trials. These could be granted licenses to develop production and market realisation. The Centre clearly recognizes that its main users are the various ministries and hospitals within the country in the first place and industry comes second.

The existing Policy and Rules for Intellectual Property of the leading organisation NCIPD are planned to be applied also to the activities of the Centre.

In addition to the need for access of the Centre to competent TT resources, it could be beneficial to engage professional support staff, or outsource as appropriate, business development resources aimed at delivering additional grant capture (particularly on the wider European and international stage). The Centre already expressed that it plans to hire experts/consultants with experience in the industry and engage them as "entrepreneurs in residence" to help streamline the portfolio of the industry partners. However, we note that the overall budget for knowledge transfer appears to be smaller than in other Centres: 50.000 BGN granted to leading partner only and for the whole duration of the project (six years).

We list three different channels for possible technology transfer that are either existing, planned or mentioned as being relevant for the operation of the Centre. We must take into account the very limited budget of 50.000 BGN for six years meaning that additional funding will be necessary either from the project partners or from specific projects to help organise and manage the Centre's research results.

1. The Department for Education, Scientific information, Organisational and Methodological Activities is the structure for transfer of knowledge and technologies at NCIPD. This existing structure is planned to be further developed and adapted to the needs of the CoC.
2. BulBio state owned company located at the Centre. The medical department of BulBio acts as a structure to transfer the results of the research of NCIPD. BulBio commercialises

bioproducts, most of which are the result or research projects realized by the leading partner (NCIPD).

3. The Innovation Centre at BAS, which is a cross-sectoral unit supporting all BAS-institutes.

It is understood the Centre has also considered accessing TT support through the GIS TC and this may prove a viable approach that is worth further exploration.

The existence of these three bodies for the provision of technology transfer is potentially a beneficial resource; however, their individual roles and responsibilities require some element of overall coordination in order to avoid duplication and/or omissions of support. In the first instance, it is recommended a **working group is established from the three bodies to examine their respective capacity and mechanisms** to support the technology transfer requirements of the Centre. This working group should have the ultimate aim of ensuring demarcation of roles, alongside appropriate coordination and leaving in place a management structure that ensures appropriate and comprehensive support is afforded to the Centre.

Recommendations

TT Arrangement for the Centre (Strategy, Policy and Process)

a) The Centre should take steps to implement clear arrangements concerning IPR – there are many international precedents that should be available to provide guiding principles including:

   - the division of background and foreground IPR
   - The avoidance, to the extent possible, of shared ownership of foreground IPR[248] that is generally recognised as an impediment to efficient commercialisation.

b) The Centre should ensure it has access to a full spectrum of TT services comprising:

   - The identification of invention disclosures and potential IP
   - The screening of inventions for commercial and patenting potential
   - Translational activities
   - The identification of potential commercial partners
   - The establishment of spin-out companies
   - The negotiation of licensing and spin-out agreements

Collaboration with industry

- It is important that the Centre engages proactively with the (albeit limited) stablished industry in Bulgaria related to the activities and outputs of the Centre.
- The Centre should also engage proactively overseas with companies, foundations, and other stakeholders in the international community.
- The Centre should identify "marketable" products and services

[248] The Rules on IP already provide that "*When carrying out collaborative research with other research organisations, ownership of the foreground should stay with the party that created them, but can be provided in various countries (inaccurate translation, we understand - to various parties) on the basis of a contractual agreement concluded in advance, adequately reflecting the respective interests, tasks, financial and other contributions to the project*" (Article 22. (1)).

- The Centre should employ a specialist in TT activities earlier (as soon as possible) and assign this person responsibility to work for future sustainability and for the coordination and implementation of TT activities. In other words, this person should have their own resources to monitor and conduct TT activities, or should act as a coordinator between the Centre and the institution that implements TT activities for the Centre – e.g. GIS TC.

- The Centre should also seek funding to support technology development and proof of concept activities that help to position research outputs as useful to commercial entities. A degree of "in-house" funds that can be directed to small scale activities would be beneficial, with larger scale programmes accessing externally awarded funds on a competitive basis.

- It would be helpful if a template contract (or series of template contracts) could be developed (potentially for use by all Centres) to provide an appropriate framework for collaboration and involvement of commercial associates. These templates would have the objective of streamlining and facilitating negotiations with companies when engaging with partners for the purposes of research. Suitable example template contracts may be accessible through the Lambert Toolkit[249] and adjusted for Bulgarian laws.

- Fundamentally, the Centre should focus on demonstrating that its research activities are able to deliver excellent scientific outputs and that should provide the best foundation and basis for sustainability, i.e., the outputs and quality are more important than the precise model at this stage.

Synergies and Complementary Initiatives

(a) The Centre may have greatest synergy with the Centre for Personalised Medicine (Plovdiv).

(b) The Centre should engage internationally with entities such as the WHO, the UK Welcome Trust, the Bill and Melinda Gates Foundation. To do this, an international conference could be considered, as well as trade mission type activities to other territories.

(c) To avoid duplication and use already available support for the spin of creation, the soft support available of the Sofia Tech Park incubator

(d) Sofia Tech Park also announced a financing scheme for very early stage high technology start-ups, offering 75.000 EUR of funding and also free access to laboratories and innovators community.

(e) Financial support for Proof of Concept or development of prototypes is also available by the Innovation fund, albeit at a level which is insufficient to achieve substantial outcomes.

(f) Test the possibility for collaboration with regional innovation Centres, and especially the companies within them.

KPIs

Current KPIs do not align with the demonstration of successful research outputs with the potential to create impact in the wider world. Common KPIs used to demonstrate translational and impactful

[249] https://www.gov.uk/guidance/university-and-business-collaboration-agreements-lambert-toolkit

research outputs should be adopted. A working group should be established to explore this recommendation and its implementation.

It is noted, that some of the members of the Expert Group for this report have reviewed KPIs with ASTP Proton and JRC and recommended harmonisation across Europe in relation to definitions[250], from which the Centre should select those deemed relevant.

Centre Sustainability

Requirements and Expectations

The Centre recognises that "the activities supported by the research project tasks are experimental and are less related to market applications and are therefore less profitable". Since the Centre's activities will have direct impact on the quality of healthcare in the country its R&D activities and particular projects, that are recognized as vital for the country, should continue to be funded with operation budget after expiry of the six years project duration.

According to the Project Justification for the Centre, its sustainability will be sought via the revenues generated from economic activities, which shall be 20% (or less) of the Centre's overall activities and from knowledge and technology transfer (KT and TT) activities where the revenues from such activities are reinvested into the main activities of the Centre.

Identified Challenges and Needs

One key challenge for the Centre concerns the limited industrial base in Bulgaria for its infrastructure and research outputs (it was highlighted in discussions with the Centre there was only one vaccine company in Bulgaria). Any strategy concerning sustainability is therefore unlikely to be able to rely on local sponsorship of research by the Bulgarian industry.

Another challenge highlighted was the cost of operating the equipment being installed, which will require ongoing support from the Government for maintenance purposes.

Recommendations

The Centre should re-examine to what extent sustainability can be achieved via revenues from economic activity. It may be helpful when doing this to investigate how public and thematically related (e.g. infectious diseases) health research bodies in other territories are funded. Most likely, the Centre will need to see ongoing grant (competitive) and public (stable block-) funding to be an essential component of its sustainable financing, with economic activities making up a minority portion (at least in the short to medium term).

To achieve sustainability from non-industry sources it will be important that the research outputs of the Centre are excellent and able to contribute to both local and global healthcare challenges concerning infectious diseases and their control.

Experienced leadership will also provide a better prospect of achieving sustainability. An internationally recognised researcher with experience of establishing sustainable operations in the relevant sector should be sought.

[250] Campbell, A., Cavalade, C., Haunold, C., Karanikic, P. and Piccaluga, A., Knowledge Transfer Metrics - Towards a European-wide set of harmonised indicators, Karlsson Dinnetz, M. editor(s), EUR 30218 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-18885-8 (online), doi:10.2760/907762 (online), JRC120716, https://publications.jrc.ec.europa.eu/repository/bitstream/JRC120716/kjna30218enn.pdf

ROADMAP ON LONG-TERM SUPPORT

The Centre needs to position itself as capable of making meaningful contributions, both locally and globally, in the understanding, prevention, diagnosis and treatment of infectious diseases, indeed its potential role is significantly highlighted by the current COVID-19 pandemic. Once this reputation and standing is established, the nature and extent of sustainable revenues streams should become clearer allowing for better scoping of the preferred legal entity going forwards, its competences as well as the reasons for creating a legal entity in the first place. Until the long-term funding landscape is clear, there is little point working towards a legal structure without any solid evidence it will be viable. In the meantime, the Centre should continue to operate under the existent Partnership Agreement until the end of the six years project duration when an evaluation is to be conducted and the management structure adjusted if needed considering the (new) revenue generation channels. The- current collaborative framework/partnership with regard to IP and management should be updated in view of international best practise (see also general part of report). A working group should be appointed, comprising key stakeholders from the Centre, the national and international public and industrial healthcare community to progress this recommendation with external expert advice (where possible). Targets should subsequently be identified and defined by this Working Group that may provide ongoing support towards their delivery.

Achieving the above will require the concerted effort of all Centre stakeholders, but it is critically important that strong, visionary leadership is secured, and a leader appointed with international experience, networks and standing.

It would be useful to appoint Working Groups (where possible with external experts) looking at:

- IPR arrangements and commercialisation
- Funding streams and strategy

9.10 Centre of Competence "Smart Mechatronics, Eco- and Energy Saving Systems and Technologies"

Summary of Centre

Identification number: BG05M2OP001-1.002-0023

Centre name: Centre of Competence "Smart Mechatronics, Eco- and Energy Saving Systems and Technologies" (SMEEST)

Budget of the project: 23 569 719.17 BGN

Lead Partner: Technical University, Gabrovo

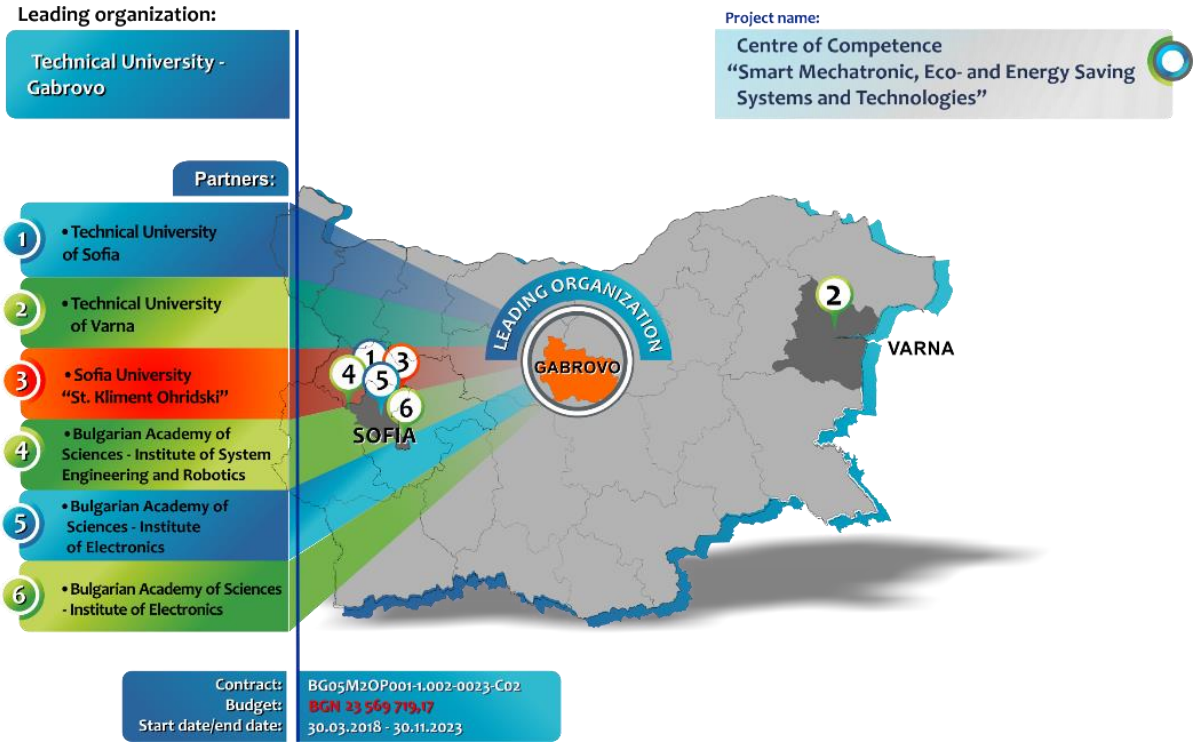
Start date: from 30.03.2018, End date: 30.11.2023

Declared project goals:

The main objective of the project is to build a sustainable functioning National Centre of Competence “Intelligent Mechatronics, Eco-and Energy-saving Systems and Technologies" (SMEEST), in which three sides of the "knowledge triangle" - education, research and business are in effective and dynamic interaction based on shared strategies, strong and concrete commitments and joint research projects and partnership.

The research aims of the Centre of Competence for Smart Mechatronics, Eco, Energy-saving Systems and Technologies (the “Centre”) is to carry out market-orientated research under two themes:

1. Intelligent mechatronic systems and technologies
2. Energy saving and clean technologies



CURRENT STATUS OF CENTRE

Analysis of questionnaire

The standardised questionnaire sent to all 14 Centres included in this study to collect Centre specific data was answered by the Lead Partner, Technical University-Gabrovo of the CoC SMEEST. It is assumed that these answers represent the unanimous position of all partners in the Centre. The outstanding specific issues are:

- The project is largely de-centralised, meaning that each of the partner organisations is responsible for its own actions and each organisation signs the contract. The work is performed by the partner organisations. The Centre would have its own administrative staff. It is noted however, that the project is led by Gabrovo Technical University, which is also part of several other Centres. Administrative staff will be made available by Gabrovo to support multiple Centres. Research staff however will be allocated to the Centre on a non-permanent and per project basis.

- The equipment purchased can be only used for the purposes of the CoC SMEEST. At present, it is not envisaged that equipment and research infrastructures are transferred to a dedicated legal entity.

- The Centre's decision-making at the highest operational level is provided by the Management Team (MT), that consist of top representatives of each partner organisation. Furthermore, each of the partner organisations is represented in an Advisory Board. It is recommended the various governance bodies have sufficient degree of interaction.

- The respondents stated that no new legal entity should be established and the Centre should preferably remain to be organised as a loose consortium of the partner organisations. It should however be managed by a common management at the CoC level with substantial decision-making powers to decide on research programmes and projects (=MT and (Deputy) Manager).

- It is not obvious from the answers what the position of the Manager and Deputy Manager is in relation to the MT. For this, we looked deeper into the Project Justification (page 341) which sets out the envisioned duties/ tasks of the Manager, Deputy Manager and the Leading Coordinator.

- An Advisory Board is also foreseen. The Centre should be largely independent in its management and operations, however, on strategy and budgeting it should agree with the partner organisations.

- No answer was given as to how collaborations with industry and international R&D&I projects will be structured.

- It is indicated by the respondents that the Centre utilizes a financial administrative system that enables separate accounting for economic and non-economic activities, using analytical accounting to the extent that overhead costs can be allocated to each activity. The system also enables depreciation/VAT recovery and specific tax issues. However, to date no information is available yet as to the administration of the use of research infrastructures, equipment and real estate as a percentage of its yearly capacity. This is normal as of Q4 2019 only 22% of the budget had been spent.

- There is a 220 456.00 EUR budget for activity Knowledge and Technology Transfer and an Internal Committee dedicated to technology transfer. However, we understand from the Project Proposal only 1 FTE is available to coordinate the Central Hub wherein these technology transfer activities will be concentrated. There seems to be a mismatch here, but possibly the term is used “sensu lato” and e.g. might include external costs for patenting or other services.

- It is not decided yet in detail how the proceeds of research commercialisation (including technology transfer?) will be shared between the partners, other than a basic arrangement in the Partnership Agreement. The experts recommend reviewing this issue.

- The questionnaire does not provide clear information whether the Centre already has an IP-policy and strategy. The respondents indicated that there is a sufficient number of skilled financial & legal experts for the business planning, controlling, contracting and monitoring of the use of the research infrastructure. We interpreted this as having regard only to the RI’s itself, but not to technology or techno-marketing issues in respect to the RI’s.

- There is a lack of knowledge skills and experience of current staff about the necessary internal ecosystem that would enable and promote TT, formal channels of Technology transfer, TT procedures and sources of translational funding.

- There are not enough skills and resources to deliver solutions to industry within an acceptable timeframe for the industry, for contemporary incremental spin-off development, nor for attracting and closing Early Stage Investments (pitching, valuation, negotiations, etc.).

- There are KPI’s set, but only those that were set by the public call rules. The KPIs are monitored monthly only by the Managing Authority.

- The following issues were **perceived by the respondent as the main barriers to successful technology transfer:**

- **Technical barriers** – "Different orientations exist between the technology provider (R&D Organisation) and its user (business) concerning the aspect of time; Different approaches are taken by the technology provider and recipient towards the desired results. Usually, these approaches include innovation-oriented vs. easily implemented technologies; there are often problems with selecting the most appropriate technology transfer mechanisms".

    - The expert team has interpreted this statement as a lack (as perceived by the Centre) of knowledge and expertise in the interface between the Centre as technology provider and its customers as technology implementers.

- **Organisational-economic barriers** – "There is a lack of developed infrastructures, market and public incentives (for innovation); The absence of a technological development plan is observed at a national level, because the public decision-making power is not able to create conditions of promotion, support, and a coherent target for public and private R&D and innovation".

- **System barriers to technology transfer** – "New technologies need to be tested and demonstrated thoroughly before public agencies will accept them in competition with other, well-established technologies; Technology is too sophisticated, making it difficult or impossible to change in order to make it suitable for the requesting production/market".

    - The expert team does not follow the Centre in this remark as public agencies will probably not become the main market for technology developed at the Centre (although public agencies might have to approve the use - issue the necessary permits- for some new technologies or models, depending on regulatory framework). Moreover, the acceptance of new technology by public agencies as well as by industry is an extensively researched topic (e.g. the Technology Acceptance Model (Davis, F.D. 1989)). Seasoned TT professionals are familiar with this topic.

- The Centre claims (in its powerpoint-presentation) that it may be difficult to recruit researchers. While this may be a genuine concern, even more valid for smaller cities or towns outside Sofia, the expert team recognises that commenting on the Bulgarian job market and labour conditions for researchers is be outside of the remit of this assignment. Nevertheless, some suggestions are contained in general part of this report.

Identified needs and challenges

A challenge cited in discussions with the Centre was the status of one of the buildings undergoing renovation using the Programme funds as a "monument". This was affecting progress on the renovation works due to the need to comply with building preservation regulations in force.

The Centre has identified a desire to see PhD students, that conduct research within the Centre, spin-out new companies to further constitute the ecosystem going forwards. However, a stated challenge is a lack of understanding of this process and the means to support it.

More generally, a challenge is the lack of technology transfer resource and an understanding of the transactions concerning IP that allow companies to take the IP forwards.

The needs and challenges of CoC SMEEST that were identified by the expert panel:

- Business development skills to collaborate with international corporations – top/experienced, seasoned international manager required to enter the international market for R&D;
- Legal form that would allow for an agile and flexible HR commercial decision making and contracting process;
- Technical expertise on different kinds of collaboration with industry and development of accompanying agreements. This includes the structuring of "effective collaboration" agreements. Sustainable collaboration with industry cannot be driven by change, but requires a systematic business development effort and a research agenda that is in tune with the needs of industry;
- Technical expertise in accounting and pricing: A separate accounting system for economic and non-economic activities, analytical costing so that overhead costs can be properly allocated to each activity, is available. However, there may be a need to further improve specific knowledge of value-based pricing of research services and technology transfer;
- To the experts' opinion, the Centre needs to build capacities to facilitate their growth and sustainability. This should start with the creation of a sound innovation ecosystem, e.g. by acquiring skilled business developers and performing market studies. Simultaneously, the contracting skills of legal and financial staff should be improved. Standard operating procedures should be improved by using standardised Terms and Conditions (T&C) and model contracts. Effective technology transfer and/or contract research requires these processes are put in place;
- Training on the formal channels of Technology transfer, TT procedures, sources of translational funding and on contemporary spin-off development;
- Systematic and supported "networking" to approximate potential partners, introduction of technology scouts or brokers, that can bridge the gaps between academia and (international) industry. The existing local networks should not lead to turning a blind eye to external markets;
- There are no KPIs monitoring the performance in terms of IP generation, commercialization and TT and its effectiveness in terms of income. The Centre has provided some target indicators for expected patents, licences and contracts that should have been reached by 2023. The Centre has also provided some indication of how it envisages this process (e.g. on page 321 of the Project Justification). However, KPI's are required to monitor the progress of these processes over time and are required to assess in an early stage whether long term goals, usually based on expectations, can still be pursued or need to be adjusted when more market information becomes available over time.

LONG-TERM VISION

The Centre's long-term vision should be further clarified. The Centre has suggested it sees itself as a sustainable Centre and regional leader strongly collaborating with industry and competence Centres across EU on the execution and commercialisation of applied research. At a high level, the long-term vision is to provide an effective mechanism through which innovative ideas and technologies that align with the needs of industry and Bulgarian society could be progressed through successive technology *readiness* levels to eventually create value via e.g. the *Green Synergy Cluster,* but specific details remain to be developed.

Notwithstanding the lack of detail, this outline vision appears a pragmatic approach that leverages existing relationships and established drivers to work towards making the Centre a success without being mired in the complexities of looking to establish a new legal entity or business for these purposes.

Legal Framework of the Centre

Current legal framework

The SMEEST CoC is currently constituted by the Partnership Agreement between seven partner organisations according to terms and conditions of the public call defined by the MA.

The Centre has developed and adopted some rules for access to the equipment and Intellectual property policy. Annex 3 to the Partnership Agreement governs the basic ownership and usage rights of the SMEEST partners between themselves on project results. The Project Proposal also contains an outline of the envisaged structures and procedures for IP protection and exploitation. However, this is still no more than an outline. The Project Proposal (page 67) states that the Centre will subcontract the development of the IP policy and commercialisation policy to outside experts. This has already been budgeted.

The Centre has also adopted rules for access to equipment by outside organisations. This says that the revenues generated shall belong to the Centre, which is unclear because the Centre is not a legal entity yet. What is possibly meant here is that the "Centre" is actually the partners who own the equipment that is rented in question.

Recommendations and analysis:

- The Centre wishes to focus on applied research in a broad range of research fields comprising, amongst others, nano-materials and intelligent automation systems. Such fields are highly IP-driven and are of interest to industry. These activities require a close collaboration with industry as well as a swift and efficient contracting process. A loose consortium of individual partner organisations, each having to agree with a contract and having to co-sign it, might not be ideally suited to meet these requirements. Therefore, the panel recommends to consider the setting up of a legal entity to coordinate activities and efforts. It is necessary to mandate extensive powers to an executive body that is allowed to act on behalf of the partner organisations. Since the Centre is in its early stages, it might be too early to tell what exactly is the best approach and therefore the panel advises to set up a working group to further explore the requirements, the pros and cons of possible structures and a migration path towards the desired structure.
- A legal entity could initially be set up as an NGO-entity – association (sdrujenie in Bulgarian). We offer two main models/options in Chapters 2 and 3 on Legal and Organisational Framework (a less integrated one and a more integrated one). The Centre should first commence operations and after several years of R&D&I activities re-assess the situations, needs and options with a view to create a legal entity before the end of 2023. This legal entity would help to streamline capacities, continue the joint and coordinated efforts of the partners and build a recognizable brand for the field of mechatronics and green energy in central Bulgaria (Gabrovo and Plovdiv).
- It is important that the executive body/organisational structure/new legal entity gains rights to manage the equipment and infrastructure for joint and coordinated R&D&I activities. Despite the fact that nothing prevents one or several of the partners to apply individually or

jointly, a separate entity could enable the Centre to apply also as one legal entity for EU framework financing and become itself a member of European research networks.[251]

- It is not recommended that the ownership of the equipment and real estate be transferred to the new entity. The depreciation costs are substantial and would most likely cause a negative balance sheet, which consequential closes the access to EU framework financing. Please note that the transfer of equipment and research infrastructures is not per se *required* for the sound operation of the Centre. It is perfectly feasible that the faculties/institutes contribute the use of the equipment to the Centre by means of an agreement.

- The manager of the Centre, should be a single full-time leader with a broad mandate needed to achieve ambitious goals. He or she should also be accountable and responsible for results and periodically be monitored by a supervisory board. At present, it is not clear to the experts how supervision by the partner organisations is organised. The panel advises the Centre and the partner organisations to agree on a clear and unambiguous governance and management model.

ORGANISATIONAL FRAMEWORK

Ownership structure

The partners within CoC SMEEST are: Technical University of Gabrovo – Gabrovo, acting as a lead partner together with three other universities of which TU-Sofia Campus Plovdiv gets the major part of the funding, as well as three institutes of BAS.

Under the Partnership Agreement, the partners appear to:

i. Own with the Centre (which is contrary to the current legal status of the Centre) the intangible assets (IP outputs). Art. 2.3 of Annex 3 to the Partnership Agreement stipulates that the Centre will co-own any IP generated by the partner(s). This seems to be legally incompatible with the current status of the Centre as a partnership without legal identity and provides yet another reason for the formation of a separate dedicated structure.

Governance and decision-making, management of the tangible and intangible assets

The Partnership Agreement falls short of best practice[252] in terms of providing clarity and comprehensive coverage of matters that may arise in respect of the Centre's assets, rights and obligations, particularly concerning intangible assets. For example, the use of background owned by another party for the purposes of the Centre. Or the possibility of granting exclusive licenses by one of the co-owners, etc. The Centre appears to have less detailed arrangements on some aspects of its governance compared with other Centres.

Especially in loose R&D consortia clear *a priori* agreements should be in place on topics like ownership of background and foreground IP as well as access rights thereto. Another topic that should be covered is the limitation of legal liability towards each other and towards future customers.

[251] As of Q1 2020, a final version of the Horizon Europe Model Grant Agreement was not yet available.
[252] See the references to the Lambert Toolkit in Chapter 2 on Legal Framework. Direct link: *Guidance University and business collaboration agreements: Lambert Toolkit,* https://www.gov.uk/guidance/university-and-business-collaboration-agreements-lambert-toolkit

Similar to the other Centres, the Partnership Agreement provides that the rights/benefits to research results/IP shall be shared according to respective contribution of each partner. Then, Annex 3 "Rules for the allocation of IP" assumes that the Centre is already a legal entity (otherwise a consortium may not own itself) and introduces an 80/20 % principle where the Centre bears 20% of the costs and gets 20% of revenues from commercialization while the partner organisation(s) involved - 80%. This could indeed be one possible model especially in the existence of a jointly created association which is engaged with industry liaison and technology transfer office/hub for the Centre.[253]

RESEARCH INFRASTRUCTURE AND STATE AID RULES

Management of the infrastructure, the access process, and the in-house research

The Centre is considered by the Managing Authority to be performing moderately in terms of its profiled expenditure (21.89% of the budget has been utilised to date). Procurement of equipment is therefore not as progressed as it should be leading to research activities remaining uninitiated. In the Project Justification the planned activities are listed, the indicative time period and stages of implementation, scheduled participation of individual partners and applicability/utilisation of both infrastructure and equipment (page 67).

Under State Aid rules technology transfer activities may be regarded as non-economic regarding the capacity used if revenues from these activities is re-invested into non-economic activities. In this case, the capacity used will not count towards the 20% capacity threshold.

Recommendations on the plans for utilisation of research infrastructures, financial plans, access rights and IPR arrangements

- To date, specific research programmes have not been initiated, although they were defined in the Project Justification on a fairly high, abstract level.
- It would be helpful if a template contract (or series of template contracts) could be developed (potentially for use by all Centres) to provide an appropriate framework for collaboration and involvement of commercial associates. These templates would have the objective of streamlining and facilitating negotiations with companies when engaging with partners for the purposes of research. Such templates that can be used in the university-industry interface are widely available. Reference is made to the *Berlin Contracts*[254], the *Lambert Agreements*[255], the AUTM *Sample Policies and Agreements*[256] and the TTO-Circle as set up by the JRC. The Lambert Agreements were developed with ASTP participation (and are openly published on gov.uk website for instance). They offer several models where consortium partner participate (and similarly to the Berlin Contracts, help arrange how IP is shared and used among partners).
- As stated in the section above, access rights and IPR arrangement currently lack clarity and do not adhere to best practice. The Centre should look to update its IPR framework with expert input.

[253] Explore the model of the Joint Innovation Centre of BAS – where the JIC gets a small percentage of the revenues.
[254] The main models covered by the Berlin Contracts are described in the following presentation by Heinz Goddar and Boehmert & Boehmert, *University/Industry Cooperation in Europe*, 2012, available on WIPO website: https://www.wipo.int/export/sites/www/amc/en/docs/vienna51goddar.pdf
[255] https://www.gov.uk/guidance/university-and-business-collaboration-agreements-lambert-toolkit
[256] https://autm.net/surveys-and-tools/agreements

- SMEEST CoC /its partners should carefully study the general part of this report and Chapter 4 on State aid rules to understand how to formulate its price/fee to client undertakings from industry. We should only mention here that as a rule market prices must be charged by the CoC for its services, or in the absence of a market price - the equivalent of it: charge full costs plus a margin (as one of the two alternatives for the price formulation). The experts have not identified any further State Aid issues that are specific for CoC SMEEST. Therefore, for this topic we refer to the generic part of this report.

- As to monitoring mechanisms, we remind the CoC that both the Grant Contract and the EU State Aid rules limit the economic activities of the Centre to 20% of the overall annual capacity. While the experts believe that this is normally not a serious impediment for research organisations, it requires careful application and monitoring. The Centre has stated that it will employ separate (analytical) accounting and that this includes functionality to measure and keep track of the actual operational use of equipment (page 337 of the Project Justification). Although this should be verified with local accountants, the experts believe that the basis for calculation of the 20% threshold should be the actual operational capacity, e.g. the actual available machine time. Product Lifetime Management-type software could be used here if standard administrative software does not provide this functionality.

Technology Transfer and Commercialisation

Centres' TT strategy outline and expectations

To the experts' understanding, the Centre does not yet have a detailed IP-policy or strategy (although the individual partners have their own policies incl. TU Gabrovo which we checked and it provides similar arrangements to other Bulgarian universities such as TU Sofia and Sofia University).

Although the partners themselves have adopted certain IP policies that may apply to their activities for the Centre, the experts consider it of high importance that the Centre creates and adopts such policies so that in can operate in a coordinated way. If only to prevent incompatibilities between partner-specific IP policies that may impede the collaboration. The respondents have stated that currently the Centre has no projects with industrial partners, but envisages to initiate at least five of such projects per year. The expected yearly net income from these activities is 50.000 Lv. While the interface with industry is of course of paramount importance to the Centre, it is essential to note and to remember that the Centre may also perform its own independent research incl. with applied/ innovation focus. SMEEST should not see themselves mainly as an "outsourced business R&D Centre" but also engage in significant independent research or project-based grants and collaborative research. Often, specific government grants are available for research leading to societal impact. A sound innovation ecosystem should not neglect the societal need for research for which there is an effective market failure.

Furthermore, the Centre foresees to derive up to 20% of its yearly income from the private sector. Unfortunately, the answers to the questionnaire do not give any insight into the distribution of this 20% over contract research, collaborative R&D and sponsored independent research. We must note that the 20% threshold for economic activities in state aid rules concerns the overall annual capacity usage and not the revenue share. "Sponsored independent research" qualifies as a non-economic activity and should not be factored in for the calculation of the threshold for "economic use" of both the research organisation and research infrastructures. When applied correctly, it is the opinion of the experts that this threshold should not be regarded as a substantial impediment for

the Centre to perform contract research or other economic activities with and services for industry. State Aid rules do not preclude that a percentage above the 20% of the yearly revenues is received from economic activities as long as the use of capacity for economic activates remains up to maximum 20% (and economic activities remain ancillary in nature). We note that SMEEST is the Centre with highest number of associated partners from industry, and should aim at utilising all opportunities both in terms of economic and non-economic activities in its engagements with industry.

Identified Challenges and Needs

- There is a general lack of knowledge, skills and experience of current staff about the necessary internal ecosystem to enable and promote TT, formal channels of Technology transfer, TT procedures and sources of translational funding. It is not clear whether the partner organisations have agreed to exclusively carry out certain activities within the Centre, or that they have retained the possibility to carry out such activities bypassing the Centre. However, putting in place an overarching Technology Transfer strategy now would mean less work later and higher chance of successful commercialisation activity of the Centre.

- There are not enough skills and resources to deliver solutions to industry in time acceptable for the industry, for contemporary incremental spin-off development, including the capitalisation of such new companies by attracting and closing Early Stage Investments, (relevant activities include IP and market valuations, pitching to investors and negotiating investment agreements, etc.). While many activities of spin off creation can be outsourced, it is in the best interest of the Centre's partners to perform such activities in-house at the early stages of new company development, potentially outsourcing very specific tasks.

- There are KPI's set, but only those that were set by public call rules. The KPIs are monitored monthly but, only by the managing authority.

Recommendations

(a) TT Arrangement for the Centres (Strategy, Policy and Process)

- Build a structure to bring the research agenda of the CoC in tune with the needs of industry and markets. Any mismatch here could lead to unmarketable research results. Generally, academic entities are usually more driven by supply side drivers (research publications) then by demand-side factors (needs of industry or society). However, due to the operation of the EU state aid legislation, industry should not be able to exert decisive influence on the broad research agenda and the Centre itself. If the Centre would allow such *decisive* influence, it no longer qualifies as Research and Knowledge Dissemination Organisation under State Aid rules. To avoid any misunderstandings, this does not preclude that an undertaking may of course specify the scope of fully paid contract research (provided the overall annual capacity used for ancillary economic activities remains up to 20% maximum).

- Create commercial awareness with the Centre's personnel, including the research staff. A good academic researcher does not necessarily qualify as a good industrial researcher. Research in an industrial environment must be offered under clear legal and commercial conditions and executed in a timely manner. The management of customer expectations can sometimes be a challenge.

- Likewise, capacity building on Open Science, Open Data, Fair and Open Innovation principles is required. While these generally do not impair the exploitability of research results, a basic understanding of these principles is required when executing projects under e.g. the Horizon Europe programme.
- Build capacity on how to manage IP-portfolio, necessary internal ecosystem that would enable and promote TT, formal channels of Technology transfer, TT procedures and sources of translational funding.
- Build capacity on how to implement the state aid rules on a practical level, i.e. planning, controlling, contracting and monitoring of the use of the research infrastructure.
- Do not copy others' TT Strategy, Policy and Processes, but instead develop your own custom arrangements based on the local context, considering inhibitors and motivators of local researchers and the drivers for local industry and investors. Where required with the support of international experts.
- We understand that the Technical University of Gabrovo is a partner in several Centres and aims to cluster these TTO activities. However, the 1 FTE dedicated to TTO activities for SMEEST at Centre level do not create "critical mass". We recommend that if TU Gabrovo plans to cluster TT activities of several Centres they should establish a fully functioning and equipped TT Office with skilled personnel to cover the whole TT process value chain.
- There should be a clear description of the role of the TTO.
- No public funds should be used for *continued* support to already spun-off companies.

(b) Collaboration with industry

- Collaboration should be developed based on the industry needs and trust.
- The most reliable way to build trust with industry is to aim at "Low hanging fruits" with existing industry contacts (regardless of potentially being small in value) as this will build traction and the Centres brand.
- Bring the research agenda of services to the Centre in tune with the needs of industry and society. The CoCs can and should perform their own research and not only aim at solving industrial problems, which can be lucrative activity but the CoC scope should be far beyond just contract research and research services.[257]
- It is important to focus on innovation driven industry sectors that are keen to absorb inventions. Especially in these sectors R&I performers are able to create a higher added value, enabling them to extract higher revenues in the TT process.
- Considering the work packages and partners within the Centre the automotive and mechanical engineering sectors could have a demand for technology being developed within SMEEST. Establishing agreements with international agents and technology scouts within these industries could enhance the commercialisation performance;

[257] At least 80% of capacity should be used for non-economic activities. This includes effective collaboration but not research on behalf of undertakings (which is economic).

- Considering the State Aid rules and past experience of the Centre's partners the most favourable form of collaboration should be collaborative research, followed by contract research and consultancy.[258]

- Build capacity on academia – industry interaction, contemporary business development methodologies, contemporary incremental spin-off development and on attracting and closing Early Stage Investments (pitching, valuation, negotiations, etc.).

- To create a funnel of spin-off ideas, focus on campaigns that promote an entrepreneurial mind-set. Identify early adopters, secure individual financial and soft support for their entrepreneurial projects and promote the champions.

- To support spin-off creation, it is highly recommended to develop own incubators or similar support facilities in Plovdiv and/or Gabrovo, but to cluster the specialised activities.

Synergies and Complementary Initiatives

- Sofia Tech Park announced a financing scheme for very early stage high technology start-ups, offering 75.000 EUR of funding and free access to laboratories and innovators community.

- Financial support for Proof of Concept or development of prototypes is also available by the Innovation fund.

- Regionally recognised private venture funds and accelerators stationed in Sofia

- Test possibility for collaboration with regional innovation centres[259], and especially the companies within them.

A more detailed coverage of these topics in included in the chapter describing the Ecosystems/VC and seed funds in Bulgaria in the general part of this report.

KPIs

Straightforward key performance indicators demonstrating the effectiveness of activities for commercialization but also the final financial results should be implemented:

- The Centre's output in terms of protectable IP should be monitored. In this respect, a clear system of Invention Disclosure Forms should be created. This is relevant to the cases where it is clear that the Centre has IP ownership embedded (in the case of contract research it depends on the clauses in the contract). In case where the IP ownership remains fully with the company, such published patent applications could still possibly be considered as scientific publications by the Centre (co)-inventor(s).

- As a rule, the Centre should file for patent protection when it has the resources and motivation to file a PCT application (based on strategic IP analysis).

- Business development efforts should be measured by the number of generated leads and qualified leads as well as by the acquisition costs involved.

[258] We would like to remind once again that based on state aid rules and the Grant Contract economic activities (e.g. contract research & renting out of research infrastructures) are limited to 20% of the overall yearly capacity. An effective collaboration is regarded to be a non-economic activity. For a more in-depth coverage of the State Aid rules see Chapter 4 of this report.

[259] In fact the Green Synergy Cluster made an application for a Regional Innovation Centre in another field – bio and circular economy.

- A periodical knowledge position audit should be conducted by independent expert evaluators against criteria to be formulated by the Centre itself. IP positions should be part of this evaluation.
- Cost benefit indicators of IP: cost of protection vs. income from IPR
- Indicators of market conversion: leads, hot leads, income
- Indicators of effectiveness of marketing channels: income / vs cost of marketing channel
- Start-up funnel: Number of ideas, number of pre-seed stage teams, number of start-ups, investments raised, value of exits

It is worth noting that IP related KPIs such as number of patents or patent applications is not always the best indicator when the Centre does not want to disclose its exclusive knowledge, which is frequently the case in working with defence industry. Furthermore, in certain branches of industry, e.g. process technology, trade secret protection is often favoured over patenting as any patent application will be published ex officio 18 months after first filing. Where the use of a patented technology by either the patent holder or its competitor is not obvious from the products sold or services rendered, trade secret protection. Finally, not all branches of industry are as IP-driven as e.g. pharmaceutical research. Therefore, IP-related KPI's should not be used as the sole determinant of excellence of the Centres.

CENTRE SUSTAINABILITY

Requirements and Expectations

The Centre expects that there will be available national resources within the next operational program.

Recommendations

The expert panel distinguishes between short term and long-term sustainability. For short-term sustainability the experts consider it of paramount importance that the CoC focus on identifying short and middle-term needs with local and regional industry, fine-tunes its R&D agenda to those needs, and exerts targeted business development efforts aimed at local and regional industry to secure contract research assignments[260]. It is recommended that the Centre also try to balance contract research assignments with an independent research agenda. It is very unlikely that the CoC will soon reach self-sustainability therefore it should seek for National, European and International public (research) funding which is also planned in long term financial projections. Such independent or collaborative research projects may be used to initiate subsequent or simultaneous contract research.

On the other hand, after building trust with smaller contract research projects they should run for larger and longer-term collaborative research cooperation. During the meeting in Plovdiv in February 2020 the CoC expressed they want to keep the IP. In this respect, '"collaborative research – effective collaboration" will not only allow the Centre to keep part of the IP generated throughout the collaboration, but also provide constant financial streams back to the Centre, contributing to its sustainability. To extract the maximum advantage from such collaborations the CoC will need to build experience in negotiation and liaison with industry.

[260] SMEEST CoC has firmly claimed that they receive "specific demands from industry", so there is potential for contract research projects which will offer one stream of funding.

Regarding commercial income, the general recommendation is to use contemporary approaches to business modelling as the way to develop an offering of the Centre which is based on the needs of the market. Build trust with industry by focussing first on "low hanging fruit" in a reliable and efficient way. In this manner, the discovery of clear target segments and their needs is the first step, followed by the development of clear value proposition in form of appropriate innovative technology, service or product. Larger industrial resources are only engaged when there is a very high certainty that the end result can be commercialized.

ROADMAP ON LONG TERM SUPPORT

The Centre has the potential to become an effective component of the innovation ecosystem within its regional sphere of influence; a contributor to the wider green engineering community; and to fulfil its stated goals.

The current strengths of the Centre include its extensive regional networks and immediate opportunity to make strategic investments in technical infrastructure and it will be critical to leverage those strengths in the early phases of its mission to establish its reputation and demonstrate the scope to secure funding beyond those made available for its inception.

Moving forward into the longer term the Centre should ensure it is able to effectively target European research funding and align with other funding opportunities. It is recommended the Centre dedicates appropriate resources to maintain strong links with centralised support mechanisms as well as the wider European research community.

9.11 CENTRE OF COMPETENCE "DIGITISATION OF THE ECONOMY IN AN ENVIRONMENT OF BIG DATA"

SUMMARY OF CENTRE

Identification number: BG05M2OP001-1.002

Centre name: Centre of Competence for the Digitisation of the Economy in an Environment of Big Data (DEEBD, also abbreviated as DEBD)

Budget of the project: 13 333 868.86 (6,8 M€)

Beneficiary: University of National and World Economy

Start date: 30.03.2018 **End date:** 31.11.2023

Leading organization:

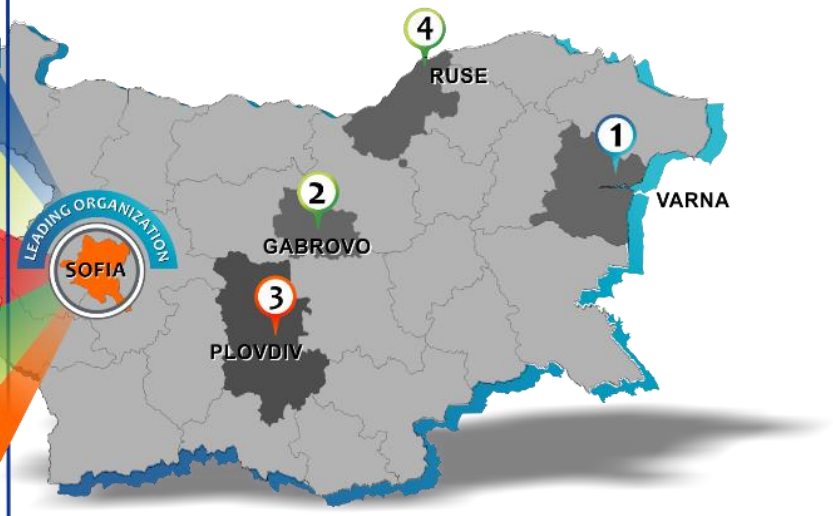
University of National and World Economy

Project name:

Digitization of the economy in an environment of Big data (DEBD)

Partners:

1. University of Economics – Varna
2. Technical University of Gabrovo
3. Plovdiv University "Paisii Hilendarski"
4. "Angel Kanchev" University of Ruse
5. Institute of Information and Communication Technologies (IICT) at the Bulgarian Academy of Sciences



Contract:	BG05M2OP001-1.002-0002-C02
Budget:	BGN 13 333 868,86
Start date/end date:	30.03.2018 - 31.11.2023

Main project goal

The main goal of the project is to establish a Centre of Competence (CoC) for Digital transformation of economy in Big Data environment. This is a complex ICT infrastructure with integrated research and organisational structures and with a special focus on the application of research results in various business areas of Bulgaria.

It is implemented by 6 partners: UNWE, Economic University of Varna, Technical University of Gabrovo, Paisii Hilendarsky University of Plovdiv, Angel Kanchev University of Ruse and the Institute of Information and Communication Technologies - Bulgarian Academy of Sciences (BAS).They have joined efforts to develop a CoC unique in nature and scientific research in Europe. To reach this goal the project will create the necessary critical mass of researchers, the project already involves some of the most prominent national researchers in ICT infrastructure for digitisation of the economy and elite specialists from Europe will also be attracted.

The CoC DEEBD plans to offer 52 research services to the scientific community in the following fields (presentation made by Prof. Kisimov): R&D services (for Digitalization strategies and Digital transformation with Big Data), ICT-DEEBD products, models, algorithms and services development, Cloud based usage of CoC infrastructure, Security in Big Data multi-tenant services, Multi-industry IoT integration with Big Data environment and Networking (comp/human/institut.) of partners and R&D Organisation.

Project activities to achieve the project goal

1. Establishment and equipment for CoC (hardware and software systems, peripheral devices);
2. Performance of independent research activities (market oriented research and development of new technologies at high international levels; involvement of leading researchers and top specialists in the core fields of knowledge of the CoC; implementation of new education methods; specialisation/training researchers and innovators; development as leaders in competitive international and national innovative systems; development of strategic partnerships with leading technological research organisations and companies in Europe and Bulgaria);
3. Wide dissemination of research results;
4. Knowledge transfer activities (protection of intellectual property and establishment of innovative companies).

CURRENT STATUS PROJECT IMPLEMENTATION

Analysis of questionnaire

Two questionnaires have been submitted by one CoC representative (within a 2-month period).

- According to the respondent, the Centre management consists of a Manager, 2 Deputy Managers, Manager of R&D and 6 local coordinators representing the 6 partners. They coordinate the efforts and activities through Skype meetings between all partners (2 times a month). They also organise virtual and face to face training sessions.
- They believe the CoC will work better if it is registered as an NGO and common management is needed for substantive decisions. There is no consistent opinion if the new entity should have its own budget and different opinions appear in time on auditing (once

the respondent thinks it should be implemented by a leading partner, while later he believes any auditing companies could do it).

- Respondent thinks the equipment should be owned by the Centre, not by individual partners; there is confusion what is better – hiring permanent staff of the Centres or not relying on permanent administrative and research staff.
- The respondent considers they have sufficient number of skilled financial and legal experts for the business planning, controlling, contracting and monitoring of the use of the research infrastructure.
- The CoC is focused on applied research only, at the beginning the respondent believes they are fully operational, while later he states they are at the "beginning of the journey".
- Respondent thinks there should be a single leader of the CoC and it should be largely independent in its management, operation, collaborations with industry and international R&D&I projects preferably through a separate legal entity, what does not corresponds to the statements in their project justification papers. The situation shows uncertainty and need for further discussions among partners to clarify how to organise partners' contributions and respective activity as well as the financial and in-kind results on the one hand and, on the other hand, to guarantee the CoC's future and positioning on the map of the well-recognized research organisations.
- The respondent considers the difficulties related to IPR. All individual partners are responsive and they communicate regularly. Currently they do not have (yet) active projects, especially with the industry. They need support in understanding and applying both contract research and collaborative research.
- CoC does not use a separate accounting system and does not make use of analytical costing so that overhead costs can be properly allocated to each activity. CoC has no realistic income forecast.
- This CoC has no budget allocated for the TTO and they have no TTO dedicated personnel.
- They have personnel to provide solutions and for working with SMEs. Another thing related to TTO: teams are good in identifying potential inventions, but need support mostly in funding for proof of concept and marketing activities.
- CoC partner who has provided answers has not gone through patent application on national or international level. The partner does not indicate government grants, venture capital, private sector sponsorship, and other international grants as available for translational funding. Only EU grants have been considered as a source.
- The respondent considers the size/volume of needs and demand of Bulgarian industry (SME oriented) and market as the most significant barrier to successful technology transfer. They believe the EU market is the focus for future implementations and contracts. The CoC has no revenue sharing mechanism developed yet.
- Several strategies targeting technology transfer have been pointed, such as consulting and training, IP licensing, spin-offs and industrial PhD Programs and Knowledge Sharing programmes bringing revenues.
- Respondent considers the role of IP in these strategies important.

- The CoC plans improvement of intermediation support and work in the field of institutional and legal framework incentives to shape the TT conditions. Some of the partners follow specific IP policy, others do not.
- They have no information about support programmes (grants, subsidies, soft support) that could be used to facilitate interaction with industry.
- Respondent's opinion about the establishment of a common back office/administrative services unit, which could serve all Centres changes in time - once he believes it is needed; next he thinks it is not an option. Respondent would support spin-offs establishment with the participation of their researchers. The CoC has some KPIs developed, but there is no monitoring system in place.

Based on the analysed answers several needs have been identified, with the caveat that we consider there was not a sufficient number of completed questionnaires for objective conclusions:

- Recommendation for CoC management and legal entity.
- Recommendation for structuring and planning of TTO activities and resources.
- Advice on strategic planning, clear targets developments, KPIs and their monitoring.
- Support in collaboration with the industry, entering the EU market and marketing.
- Provision of information about funding resources for joint work with the industry.
- Recommendation for clear collaboration and mechanism for fair revenue sharing among CoC partners.

Long-term vision

DEEBD CoC wants to develop unique competence in providing R&D services related to digitisation of the economy in an environment of Big Data; digital transformation and business processes digitisation/extension/re-design in Big Data environment consultancy; ICT system and applied design/re-engineering services and products; revenue accumulation from external use of the CoC's infrastructure, from IPR commercialization and start-ups established. The Centre wants to build partnerships with business organisations for research services and applied projects. The Centre has a 10-year development program and the goals/dreams described above are part of it. However, they need detailed strategic and operational planning of the activities, efforts and the rules to be implemented in the years ahead to turn the optimistic vision into competitive CoC in reality.

Legal Framework of the Centre

The Centre requested support in identifying the right legal structure to guarantee smooth operation of the current partnership. One of the possible options could be the establishment of an NGO/association (sdrujenie), created by all CoC partners – 5 universities and one BAS Institute. There are no legal boundaries for that. Universities and BAS institutes can be part of an NGO with a view to the protection of the interests and the pursuit of the goals of all partners within this CoC. Clearly, UNWE is taking the lead in driving the development and operation of this CoC and also getting 100% of the contracted funding. The creation of an independent entity would lay down in its Statute, in a more structured way than a simple contract-based agreement, the rights and responsibilities of the partners and of the lead partner who drives the project (UNWE). This could be

a working model as it formalises the joint efforts of the partners also beyond 2023, and guarantees a degree of internal recognition of the CoC activities within the UNWE structure.

Another option could be the establishment of a *university institute* under Article 26 (6) of the Law on Higher Education, which would grant a degree of organisational independence and own identity of the Centre project.[261]

Concerning the application for public funding (EU or other type of grants), incorporating a separate legal entity may not necessarily increase *per se* the eligibility of the founding partners to apply for programs designed for public research organisations. However, it may provide advantages from organisational perspective and thus effectively increase the chances (e.g. in the Horizon Europe Proposal parallel legal entities can also be specifically entrusted with "coordination and support actions"). If the Centre is given the right to manage the infrastructure, then it might be able to also apply on its own behalf in various projects. Further advantages can be expected when the Centre is looking for partners and wants to position as reliable organizational structure, not just a partnership guaranteed with an agreement.

Another argument for a legal entity is the possibility of maximising the financial results, better control/responsibility for utilisation of resources, and commitment and reinvestment for future development. This may also allow the CoC to implement more flexible activities/research that would not be possible or would require too many hierarchical approvals for operations in an environment of complete dependency of the CoC on a university or BAS institutes (i.e. because of potential limitations in the organisations' rules, lack of effective coordination between partners, policies, hierarchy, complex legal arrangement).

What is important in case a legal entity is created is to avoid duplication of the CoC NGO's activities/focus with those of the individual partners, especially the UNWE. This means that the NGO/association should have very specific competences and mandate for all its operations (whether a less integrated model is chosen mostly having coordination and representative functions or a more integrated option is chosen – see Chapters 2 and 3 of the report). There should be policy on that topic and all efforts should be concentrated on the benefits from working together and implementing projects that could not be done by the individual organisations. If this is not regulated, that could cause unhealthy competition and divert funds from the universities and BAS structures instead of building strong and productive cooperation.

A Council of Ministers' decree[262] from Q1 2020 allows universities to establish companies, under certain conditions. Decisions on the establishment of companies or on the participation of higher education institutions in the capital of such companies are taken by the Academic Councils of the universities. It is emphasised that educational institutions can create companies only for the economic realization of the results of the research and the created objects of intellectual property. The HEI can participate in the capital of the companies with cash and with in-kind contributions.

[261] This does not appear to necessarily depend on the existence of a separate legal entity. Also consider that there is one non-university partner, which can particulate in a legal entity but probably not as such in a university institute.

[262] During the meeting and visit of the UNWE the Centre representatives expressed the intention to explore possibilities to make the Centre itself a spin-off company. However, shortly after the meeting in February 2020 the Council of Ministers enacted the implementing rules for spin-off companies which regulates situations where universities create commercial companies exclusively for the "*purpose of the commercial realisation of their research results and created IP*". This means that the university can create companies but only for the purpose of realisation of research results and not for all activities of the Centre project. Therefore, the CoE itself being formed as a company under the Decree by Council of Ministers does not seem to be a possible option.

There are 5 partners in this CoC that are universities. Such entity is a good option when there should be a professional team for sales persons, B2B collaboration and development of products for end clients. It should be related to a specific project/product that is being commercialized. The experts are not in consensus whether the entity could and/or should be owned by the CoC NGO/association but in any case a company can be formed by several universities together (and a BAS-institute). Some experts in the panel expressed the opinion that the option of NGO owning the company, although identified as a complicated structure, could at the same time canalize different type of possibilities for different type of activities; it implies professional management for closer to market products and could better protect/manage the IP challenges.

Other important point that needs to be commented, since the CoC needs practices and advice, is the IP management and the legal framework for that. It is important not only for the protection of the CoC results, but also for fair and healthy collaboration among partners. IP of universities is included as part of the topics in High Education Law after its amendments in 2016. Universities started developing their IP policies. They and BAS institutions have specific regulations (Council of Ministers act) that have to be followed when it comes to IP management and commercialization of products through companies.

Think box: legal structure and need for a legal entity

Part of the experts working on the recommendation for this specific CoC are inclined to recommend the creation of an NGO, which possibly then to own a commercial company. While there is no consensus among experts that this model is the best solution, we should remind that:

- The need for legal entity in the words of the CoC is based upon the need to "have the right to use the scientific capability of all the partners and to put together and unite the researchers".

It will be relatively easy to create an NGO/association for certain specific activities but it will be more complex to create a commercial company owned by this NGO.

The CoC can already start its operations under the present partnership arrangement and under the strong lead of the UNWE (since it also gets 100% of funding). The CoC should have the full commitment of the rectors to make their capabilities and resources fully available to the needs of the Centre and recognise a degree of organisational autonomy for the operational activities of the CoC. Whatever the type of the legal entity to be created and used, more detailed arrangements would have to be implemented in an updated Partnership Agreement between the partners, led by UNWE, and/or the Statute of the new legal entity.

Last but not least, UNWE should evaluate if the establishment of a university institute under Art. 26 (6) of the Law on Higher Education could facilitate the development of the DEEBD Centre of Competence.

Organisational Framework

Ownership structure

This CoC involves 6 partners. The leading partner is the University of National and World Economy, Sofia. Other 5 organisations included in the partnership are: University of Economics – Varna; Technical University of Gabrovo; Plovdiv University "Paisii Hilendarski"; "Angel Kanchev" University of Ruse; Institute of Information and Communication Technologies (IICT) at the Bulgarian Academy of Sciences.

Ownership is stated in the Partnership agreement and it is currently with the independent partners, thus Centre has no legal rights of ownership at this time.

Research[263] from 6 countries shows that in most cases CoCs seem to be free to choose the form and ownership of organisation, but ensuring transparent decision-making structures, diversity, and effective formal communication. It is recommended to have an advisory and governing board and some sort of formal connection between CoCs leadership and host. See for instance the organisational structure of CITIUS[264], hosted by the University of Santiago, which includes a Governing Committee and an external Scientific Advisory Board and also Business Committee on top of the Scientific Director[265].

Additionally, in some countries, the Government financing the Centres or Centres themselves promote the establishment of Centres networks looking for synergies in fields of common interest and to win positioning and visibility as a scientific system. They could be Associations of CoEs and CoCs, aiming at capacity improvement, working for quality improvement of services and products, promotion, support for international relations, administrative and legal advice and support for initiatives improving the Centres' environment. Some examples are: SOMMA[266], the alliance of Severo Ochoa Centres and María de Maeztu Units to promote Spanish Excellence in research and to enhance its social impact at national and international levels; BIST[267], a Catalonian CoEs partnership to build new scientific collaborations among these Centres or CRCA[268] in Australia. Although the CoC and CoEs Program is in an initial phase in Bulgaria, to promote this kind of networks can help the Centres to learn from others experience and to accelerate their establishment. Institutional conditions could differ in most respects from typical project funding, cooperation among CoEs and CoCs will have a positive impact on institutional capacity building.

Governance and decision-making. Management of the tangible and intangible assets

The analytical comparison, in the opinion of some of the experts, indicates that the potential benefit of structuring the Centre as an NGO is the expanded opportunities to apply for public grants (including for funding that is not specifically designed for public research organisations).

Thus, one possible recommendation is to use a mixed instrument - an NGO that establishes its for-profit entity. Within this model, all research results, patents and revenues are owned by the commercial entity, owned by the NGO. Then, the NGO after covering its expenses, reinvests the remaining "profit" for further R&D&I of the CoC or respectively returns (part of) it to the partners.

IP regulations should be developed internally, but in full compliance with the national and EU legislation.

Benefits of forming an NGO can be: formalising the partnership, optimising managerial structure, empowerment of confidential agreements, real implementation of results measurement and control mechanisms, ensuring responsibility and commitment, positioning in the research organisations' world, expanding the funding opportunities, etc.

In case partners do not want to directly establish a new entity, they could make their partnership agreement more detailed. There should be risk assessment done for this option. There are such practices in other countries, but building competitive and sustainable CoC could not be guaranteed

[263] Held by Tomas Hellström in 2018 (Centres of Excellence and Capacity Building: from Strategy to Impact).
[264] https://citius.usc.es/centro/historia-e-organizacion
[265] This is a common governing structure at Centers of Research Excellence, for more examples see SOMMa, the alliance of Severo Ochoa Centres and María de Maeztu Units to promote Spanish Excellence in research and to enhance its social impact at national and international levels.
[266] https://www.somma.es/
[267] https://bist.eu/about-us/
[268] https://crca.asn.au/

in the long term without a permanent legal and organisational structure dedicated to developing the Centre.

The partners' contribution strengths, experience (human capital, financial resources, infrastructure, equipment, corporate culture, public recognition, etc.) has to be carefully assessed for the purposes of strategic planning, positioning and evaluation of CoC's responsiveness of market needs and last but not least for better measurement of and management of tangible and intangible assets.

There are many well recognised research organisations and Centres of Competences worldwide. It is not easy to build real competitive advantage in the century of innovations, data-driven economy and rarely limited markets. To be among the first, it always comes to improving organisation's financial performance, which based on internal tangible and intangible resources. Tangible assets usually are not unique and could be easily mimicked. They can ensure temporary competitive advantage or a good start. Intangible assets such as human capital, brand reputation, knowledge, know-what and know-how, culture, relationships, etc. are difficult to measure, but play important role for long-term organisational development. Tangible assets are easy to value, trackable, controllable through good accounting, measuring and reporting systems. Set of KPIs, effective utilisation of resources, professional managerial practices and goals, good planning and organisational policies could ensure tangible assets working for better organisational results.

Intangible assets are difficult to value and measure. There are several known methods of measuring them. If the CoC forms an NGO, these methods would be Direct Intellectual Capital methods (DIC - estimate the monetary value of intangible assets by identifying its various components. Once these components are identified, they can be directly evaluated, either individually or as an aggregated coefficient) or Scorecard Methods (SC - various components of intangible assets are identified, indicators are generated and reported in scorecards or as graphs). Since they do not need to measure in financial terms, they are very useful for non-profit organisations, internal departments and public sector organisations.

What is most important is the objective assessment of tangible and intangible resources every partner steps in the CoC and then ensure professional management, transparency and common rules for utilisation of the assets considering CoC is not (only) a project to be implemented, but also an organisation/a partnership that should have future.

Management of the CoC

Currently DEEBD CoC management consists of a Manager, 2 Deputy Managers, Manager of R&D and 6 local coordinators representing the 6 partners. They coordinate the efforts and activities through virtual meetings between all partners (twice a month) and also organise virtual and face to face training sessions.

This management structure can serve for the project but not for the functioning Centre. The management structure should be aligned with the Centre goals at both strategic and operational levels and to evolve as the Centre grows. The structure should differentiate[269] the governing bodies

[269] It is common practice at a global level today that research or technological centers have a Governing Body, which makes strategic decisions, as different from the management unit, which makes day-to-day decisions. According to the maturity of the system, there are different models, but it is clear that the Governing Body is different from Scientific Direction and Management. In young systems, normally without funding to hire a professional manager, they start by appointing a Scientific Director and creating a management unit.
See some examples here: Advanced model McDiarmid Centre in NewZealand
https://www.macdiarmid.ac.nz/our-people/management-strategic-and-professional-staff/;
Intermediate model: https://citius.usc.es/centro/historia-e-organizacion,

from the scientific direction and management units and establish clear leadership. Considering that financial sustainability is critical at the management structure, key positions shall be given to a fundraising manager and an "industrial liaison" experienced officer. In general, at new centers this position is occupied by a "project officer" or by the "manager of the projects unit". We suggest using a fundraising approach to look for funding opportunities not only at competitive calls and public funds and to explore other sources, strategic alliances with commercial firms, or philanthropy, etc. Thus, a specific person shall be entrusted with the responsibility for liaison with industry who could be based at the TTO of the UNWE or in close proximity.

Currently, the Rector is engaged as "Project Manager". The role of the Rector of UNWE, who is normally engaged with a host of tasks across the university management, is not suitable for being also manager of the Centre, in particular after the Centre has been fully established. The Rector shall not be involved operationally in the daily tasks and activities of the Centre, but rather on strategic and direction level: in making the necessary resources and capabilities of the university available for the effective functioning and operations of the Centre.

RESEARCH INFRASTRUCTURE

This CoC infrastructure is very sensitive to "time-pressure". ICT, IOT, Big Data, Artificial intelligence practices and solutions develop faster than ever. Slowing down in innovating, scaling and upgrading of infrastructure decreases chances for success, good market positioning and revenue accumulation.

There are three typical infrastructure challenges to be considered by the CoC:

- *Scalability and Agility:* Volumes of data traffic and new infrastructure requirements make the infrastructure management issue most pressing. CoC leadership needs to permanently think about increasing the number of devices that need connectivity, infrastructure capacity and upgrades, increasing need for real-time processing and analysis, short shelf life of IoT data, storage and space needed for research information, etc.

- *Security:* a significant challenge that needs on-going attention. This topic is also related to the compliance with national rules and EU regulations on data securing.

Designing and maintaining a scalable system for analysing, processing and mining huge real-world datasets is challenging and needs smart investment and future re-investment. This CoC should plan for optimal big data processing, which includes non-blocking, multi-tier, scale-out IP Clos[270] fabric design; a high-bandwidth infrastructure for rapid processing of large data so that when collected data increases, network infrastructure can grow with it; decreasing possibilities for bottlenecking; etc.

At the same time, equipment/infrastructure could be used for external needs, research organisations, enterprises etc.

To ensure proper utilisation and sustainability, the Centre has to follow several basic rules:

New center: https://igfae.usc.es/igfae/the-institute/organisation/.

[270] IP-CLOS provides scalable option for large scale Data Center for hosting providers or Infrastructure as a Service (Iaas) model. IP-CLOS model consists of spine and leaf layer switches, where leaf layer switches provides direct connectivity to Bare Metal Servers (BMS), hypervisor based servers or other network devices (e.g Firewall, Load balancer) for services layer.

- Research Infrastructure (RI) Access Charter has to be developed and formalized. DEEBD CoC should include in it access rules ensuring transparency, predictability and traceability of RI's usage. It is recommended that the access rules be complemented by software system tracing type of users, time, scientific and data diaries/bases, etc.

- Implement data policy that supports European Open Science Data, but also enhance the return on investment by reuse of the data.

- Online information and promotion of DEEBD CoC's RI, that is user friendly, user attracting, findable, always current and complete, clear and detailed enough when it comes to capacity, scope, responsible organisation(s) and persons, access policies, services and automation.

- The DEEBD CoC's partners must negotiate in a specific and detailed MoU how they will provide the RI to the DEEBD CoC future organisation in a way that can be held accountable financially as well as operationally, with a guaranteed time horizon for its operations.

- All DEEBD CoC RI has to meet the needed ISO standards and to be accredited to prove operational and scientific quality. Annual internal performance assessment should be also implemented, based on preliminary developed KPIs. It includes security and quality standards, GDPR compliance, etc.

- DEEBD CoC has to maintain electronic diaries to follow the state aid requirements on 20% limitation in RI capacity usage for economic activities.

Link with State Aid rules

As stated in the project documentation, the Centre plans to charge 10 BGN per device for external users of the infrastructure for cloud and hosting services. It is further stated that for ICT products (final prototypes), research contracts and consulting services to large enterprises, the Centre states that it will charge market prices (stated is 200 000 to 250 000 BGN per project) as described in the project documentation. In principle, in the field of operation of this Centre (ICT, digitalisation) it should be relatively easy to establish a clear market price for services provided to industry/private clients.

DEEBD CoC will meet the definition of "research infrastructure" of the Framework for State aid for research, development and innovation, and thus the project will contribute to achieving the objectives of the Operational Programme. The partners understand they have to balance the utilisation of the Centre's capacity and consider the 20% "limitation" for economic activities, but need some specifics and recommendations on how to be compliant and financially sustainable at the same time. Most of this Centre's constraints and/or challenges do not differ from the challenges recognised by the other CoEs and CoCs. Therefore, for better understanding of this topic please refer to the generic part of the report (Chapter 4 on State Aid).

Nevertheless, there are several particular issues that were identified from studying the project documentation or the expert visits and that need to be addressed here. The first and rather unusual statement and setting that we note from the Project Justification is that no economic/business activity is foreseen to take place during the 6-year implementation period of the project 2017-2023. This is surprising considering that the Centre's activity and business plan are clearly oriented towards providing services and products to company clients and not only reserved for independent research and university users. If the Centre offers digitisation products or services on a market this constitutes economic activity. Even if only one service contract is concluded and performed using the research infrastructure of the CoC then the universities (the research organisations, institutes)

involved should implement all systems for effective separate accounting for economic and non-economic activities and when/where necessary monitor capacity usage to prove that the economic use does not exceed 20% of the overall annual capacity. In addition, in all transactions, contracts and relations with industry the CoC/its partners will have to make sure these do not pass on state aid to users and clients of these business services (e.g. by way of charging lower prices/fees).

If offering products and services on the market, the Centre (respectively each of the individual partner organisations that are involved in the particular activity) needs to charge market prices or the equivalent of market prices (see Chapter 4 on State aid in this report for the conditions on price setting).

Furthermore, there seems to be a confusion about revenues from IPRs and utility models and the Centre plans to only start registering these in 5/6 year as expressed by the Centre "*to avoid state aid problems*" due to the expected revenues (as apparent from Project Justification document). Important to explain here is that if the revenues from knowledge transfer activities are re-invested into the main non-economic activities of the Centre, then the activity will not count towards the 20% capacity threshold. Moreover, passing on non-IPR protected research results selectively to one or more undertakings may result in indirect state aid being provided to these undertakings.

The Centre states that companies will be engaged to work as "researchers" and only after the 6 years project period has passed, they will be involved as industrial customers for a fee. It is not entirely clear what is meant here and what would be the particular consequences if researchers from companies create IP within this period. The Centre is advised to carefully explore the possibilities and conditions for forming "effective collaboration" arrangements for the purposes of engaging these researchers (see Chapter 4 of the general part of this report).

Note that the same State Aid rules will continue to be valid after the 6 years project period ends. This means that from an operational R&D&I perspective there will be no difference for the CoC whether it collaborates with industry before or after 2023.

If the Centre/UNWE creates a spin-off company in which the Centre/university holds shares and if this company is given usage of the research infrastructure for free or under more favourable terms, then, as a rule, it must be arranged that the spin-off does not receive an advantage that is disproportionate to the Centre/university's respective share (participation) in this spin-off, and the value of such shares. Furthermore, the advantage given to companies may fall under De-Minimis Regulation.[271]

Monitoring Mechanisms, capacity usage of the research infrastructure

From the questionnaire responses, we understand that the Centre has not implemented separate accounting and analytical costing yet. If the Centre conducts any economic activity it needs to follow these rules as also imposed from the standard Grant Agreement concluded by the MA Agency with all beneficiary organisations.

The 20% limitation for economic activities of the annual utilisation of research infrastructures capacity requires ongoing and strict monitoring, in order to be able to prove, when necessary, that the capacity for economic use is maximum 20% of the overall annual capacity. This CoC consists of a comparatively small number of partners and most of the resources are concentrated in the leading partner, which facilitates the monitoring for implementation. At the same time, from the

[271] Bear in mind that the spin-off must still pay for the use of the RI. This can be by means of shares, under conditions that would pass the "MEO" test i.e. when an independent privately held company would also have entered into a similar deal.

limited number of answers provided it appears that partners have different understandings and capabilities to measure and monitor, they use accounting systems with different features and not everyone is able to keep CoC accounting separately. There should be a software solution/access and reporting automation implemented to ensure regulated access and reporting on the utilisation of the capacity of the infrastructure, to track the time, results, to assign responsible users and to help for revenue distribution afterwards. This could also help in counting the work hours of the researchers involved in different projects and help the CoC to plan the attraction/recruitment of additional competent researchers, since the limited number of hours *per month* (up to 32-33) allowed per researcher was considered as a constraint in project implementation.

TECHNOLOGY TRANSFER AND COMMERCIALISATION

Issues noted from reviewing project documentation and visits in UNWE:

- In the Project Proposal document, spin-offs are listed as preferred/main methods for Technology Transfer. The Project Justification also mentions licensing to larger corporates.
- The Centre identified the presence of stable interest from industry and it intends to start offering research services (strategy, optimization, restructuring and introduction of new digital processed) to companies in identified fields (finance, supply chain, property etc) in the 5th and 6th year of operation. It is not clear why the Centre does not become open to offering its planned services and products (in 3 consecutive labs) already now so that it builds experience and a customer base as soon as possible.
- The Centre plans to allocate the IP rights generated equally to all partner organisations. We understand from the project documentation it seems that the IP rules and policies of the UNWE shall apply for the activities of the Centre.
- The TTO office is perceived by the Centre to require stronger marketing skills to secure deals with companies. The UNWE seems to rely exclusively on the employees of the IP institute to be engaged as TT experts, possibly part time for the activities of the Centre (according to Project Justification). The Centre should consider hiring dedicated experienced "Industrial Liaison" officers to be closely connected to the IP policy institute.
- Centre believes there are not enough researchers, only 32 hours per researchers per month all of them engaged part time on a second contract and only a few full time researchers are hired. Please note that effective technology transfer is based upon a strong research base and critical mass of independent research produced.
- There is a need to formalise contracts, collaborations with and services provided for industry. This is important not only to remain compliant with state aid rules (see general part of the report on state aid), but also to guarantee that any intellectual property rights arising from relations with industry are allocated in an appropriate way, so that the Centre (respectively, the universities and BAS partners) extract the maximum possible economic benefit from every project and activity.

Lack of market-oriented approach

The project definition is mainly based on the scientific and technological capabilities of the partners and on the opportunities linked to the digitisation of the economy (which is a big trend that opens research and innovation opportunities for the CoC). The document "Analysis of Market Potential" identifies the market niche for four systems: a web-based scientific conferences management

system, business intelligence systems for SMEs, information systems audit, and business intelligence systems in the public sector. However, this potential is established in a general way, it does not provide a precise description of the market addressed by the CoC (number of firms, sectors, location, profile, needs, etc.). The role played by the public sector in developing programmes and services for digitisation is another field to be explored, since it can be the channel to get to the market.

We note that approximately eight sectors are listed across project documentation (Finance, Supply Chain, Real Estate etc.), however in our opinion this is still a very generic approach. Digitisation is a broad field and needs are different from sector to sector; therefore they have to be identified in a precise way in order to establish an effective TT strategy. Thus, we believe that the CoC shall focus in two directions: technology and sectors (one Centre cannot cover everything in this field). Thus, the CoC has to start small, make the processes manageable, and build reputation on specific products and solutions.

For instance, in Galicia (Spain), the digitisation strategy is based on a complete analysis of different sector needs that has established technological fields sector by sector (automation, big data, HMI, etc.).[272] [273]

Recommendations

- Innovation and technology transfer action plan

Before starting to commercialise the CoC DEEBD services, it is recommended to develop an action plan in innovation and technology transfer focusing on commercialisation, for which some actions in this direction are recommended:

- **Market analysis:** To constantly carry out a quantitative and qualitative analysis of the Bulgarian market of digitisation services in terms of number of firms, sectors, needs, ways in which firms are satisfying those needs, factors to select a service provider, etc. This analysis should be based on quantitative data but also on interviews[274] to a sample of firms, representative of the targeted market. These interviews can be taken as an opportunity to test the market and the interest in the services provided by the CoC DEEBD. The study will provide useful information, not only in market potential but also on how to approach the market. As the foreign market is targeted it should be analysed where and who the potential clients of the Centre. The suitable mechanisms to approach these clients should also be explored.

- **Competitors analysis:** identification of digitisation services providers in Bulgaria both at the private sector[275] and in the innovation ecosystem of Sofia Tech Park and the Big Data for Smart Society (GATE) project. Complementarities and opportunities for joint projects can arise from this study.

- **Public opportunities analysis:** SMEs normally look for public support for innovation, mechanisms can involve funding or services. An analysis of the public scenario should be

[272] http://www.igape.es/es/ser-mas-competitivo/galiciaindustria4-0/estudos-e-informes/item/1529-oportunidades-industria-4-0-en-galicia
[273] For sectoral focus see: https://www.gradiant.org/en/about/
[274] We note that the CoC claims, in the project documentation, to have done such interviews already, where the Centre tried to identify potential and actual needs of the companies for specific services.
[275] See participants at IOT Bulgaria Summit

carried out since it can be a channel to access the firms market for the CoC knowledge and services.

- **TT mechanisms portfolio definition:** based on the demand and competitor analysis, as well as on the CoC capabilities, select the portfolio of services and TT mechanisms (consultancy, joint R&D projects, R&D services, licensing, spin-off) and services to be launched in the initial phase. This analysis can involve a pre-screening of R&D results in terms of commercial potential and to establish roadmaps to the market.
- **Procedures development:** the different TT selected mechanisms (joint projects, consultancy, spin-off creation) should be based on clear procedures and rules (both internal and towards the market), in this way rules about commercialization (economic rewards, IPR, confidentiality…) will be clear from the beginning avoiding future bottlenecks.

- **Define marketing actions**: based on the qualitative information gathered during the market analysis, define marketing actions starting by naming and branding, such as visits to firms, demonstration session, participation at fairs, forums. For this purpose, one option to consider is to use the term Industrial Liaison Office instead of Technology Transfer. A communication plan with specific actions addressed to the different audiences (business, public sector, clusters and firms associations among others) will be a key tool for attracting "clients" to the Centre and to win visibility in the country and abroad.

In this sense, the CoC project envisages the organisation of meetings and the participation in events but again in a general way. Several events concerning digitisation are organised in Bulgaria (IOT Summit, Industry 4.0 Conference[276]), however these activities should be carefully selected for marketing purposes.

- **Upgrade marketing skills** of the CoC DEEBD team: although the Centre will have a marketing professional on board, it is recommended to upgrade the marketing skills of most team members that will be in contact with firms in projects, services.

CENTRE SUSTAINABILITY

When talking about sustainability there are several aspects to be considered by CoC DEEBD:

Financial

It refers to organisation of the business/research activities in a profitable way and building a safe and positive "corporate" environment for the staff/partners involved.

Securing funding for research and operation is challenging. Funding can come from several sources:

- Operational budget: a relatively secure way of ensuring continual funding. However, this funding can be relatively small. This requires careful assessments of the research programmes/projects the Centre is able to implement. Centre's management has to be somewhat selective in the studies they conduct, avoiding those with high operating costs.
- Industry-sponsored research projects: generally, have a higher compensation, but may also have higher operating costs to consider and it is important to ensure that the costs of

[276] http://www.iotsummit.tech/, https://industry-4.eu/summer/

running the programme/research project are lower than the revenue generated from accruing cases.

- As this Centre is focused on applied activities and possesses the capability to produce final prototypes, products and provide services, an important share of the revenues shall come from economic activities including preparation of on-demand ICT products (final prototypes), research contracts and consulting services as well as cloud and hosting services and renting of the Centres' equipment and infrastructure to external users. Conditions apply to comply with state aid requirements – see chapters and section on state aid in this report.

- Collaborative research in particular can be fully or partially funded by the industrial partner and as a non-economic activity there is no limitation in the capacity usage. Conditions apply.

- Grant funding: Grants may be obtained to cover the costs of performing relatively small studies or to fund major long-term research groups or infrastructure. An example of grants and R&D supporting EU programs/organisations are: Horizon 2020 (and future Horizon Europe), LIFE, EUREKA; CEF Telecom, European Research Council; European Data Incubator[277], European Cooperation in Science and Technology etc.

- Donated funds: Some organisations provide resources/funds as an unrestricted grant for research/educational purposes, others may donate to start a specific program. Private donors may donate money to research.

- "In-kind" funding: another institution provides non-monetary support for research activities, such as equipment, space or human resources.

- Others. This includes the National Roadmap for scientific infrastructure[278] 2017/2023 adopted by the Council of Ministers in 2017. The roadmap serves the implementation of the National Science strategy and allows for funding of key and priority R&D infrastructure in the country.

The financial management of research activities is complex, because funds come from multiple sources and have to be disbursed to the multiple partners of the Centre, based on their contribution in a specific research activity/project. Sound financial management and accounting is required to ensure that: research activities are budgeted correctly; financial resources are sufficient to fund both the short- and long-term costs of the CoC and they are spent appropriately; there are measures in place to ensure accountability; skilled financial and accounting specialists are recruited to ensure the financial activities and management. Research activities have to be subject to auditing – internal, from the body providing the funding and, if necessary, from independent auditing company. Transparency is also important to build trust among Centre's partners. Accurate and standardized reports have to be provided to all the partners annually. They have to be mandatory for each partner using common infrastructure and resources. It is recommended that a research service coordinator be engaged and manage the contracts, infrastructure utilisation, partners input in a specific research activity and as a whole.

[277] http://www.bdva.eu/node/1022
[278] https://www.mon.bg/bg/53

Societal

This focuses on relationships between Centre and customers/suppliers and other research institutions.

Societal sustainability means the Centre is able to position itself well on the market and builds trust among its customers/suppliers. To achieve this, DEEBD CoC has to:

- cooperate and become recognizable by well positioned, competitive international Centres of excellence and competence, such as Insight Centre for Data Analytics, Ireland; IMEC; RISE; Berlin Big Data Center; Know Center, Austria; BIG DATA LAB - the LUISS Business School Competence Centre & Lab, Italy; Big Data CoE Barcelona; IBM Big Data & Business Analytics Center of Competence, Greece; Competence Centre for Scalable Data Services and Solutions (ScaDS) Dresden/Leipzig; etc.
- participate in strategic alliances and associations, such as: Big Data Value Association[279]
- attract front-line international research talents and researchers from Bulgarian diaspora abroad for its activities and continually develop capacity to train future generations of researchers and involve young scientists in research activities;
- strengthen the relationships with business, public organisations, municipal and government authorities (through organising industry specific and Centre promoting events; market research and proactive contact development with businesses potentially interested in Centre's services and products; organising of open days in Centre's facilities for businesses and journalists; organising hackathons and competitions for young researchers, implement customer relation management practices to ensure adequate communication with customers and provision of quality services);
- accredit its laboratories to guarantee certain quality level, control and legitimacy of results;
- Become a valuable partner for the other universities across the country and support them in their needs for services on big-data in education and research, as stated in the Centre's program;
- Ensure added value creation through projects in synergy with the partners in BAS who possess a supercomputer (connect big data, IoT and supercomputer power).

Organisational

This refers to implementing best practices and systems that improve management and work methods and delivery of services/products.

It is recommended to develop processes for: access and utilisation of the Centres infrastructure; control; reporting; KPIs, internal communication, marketing and business development; strategic, operational and project planning; cooperation and attraction of external experts, distribution of results; recognition for participation in research projects and activities, etc. to be designed, standardized and agreed and the have to become obligatory for all partners, possibly laid down in the Partnership Agreement and endorsed by the rectors.

[279] http://www.bdva.eu/about

Institutional

DEEBD CoC internal operation and corporate policy/culture has to be conceptualized as a set of capabilities for strategy, governance, structure, funding, and people leading to transparent and profitable operation of the Centre. The Centre needs access to high-level business development skills and knowledge, well set internal (among partners) and external (with other ICT research institutions) collaboration, research support services (business analyst, sociologist, database experts, etc.), technical infrastructure, experimentation/demonstration platforms, IP and data protection (and cybersecurity) knowledge, on-going training and information about cutting-edge technologies and solutions, Technology Transfer capabilities, performance and impact of the research monitoring and assessment methods and tools.

ROADMAP ON LONG-TERM SUPPORT – IDEAS

Lack of strategic approach

The Centre shows a good performance with respect to the project's progress and the Centre has the potential to achieve its objectives. However, the main gap is between the proposed objective and the actions proposed to achieve it. In the medium term, an ambitious objective is set to become a Centre of reference at both national and international levels, but the planned actions are of a generalist nature and do not seem to be based on a process of strategic reflection (for example, there is no mention of the existence of a research and innovation agenda, reference is made to participation in networks but it is not identified which ones, etc.) but rather on the eligibility of expenditure.

The Centre is based on an aggregation of capacities among the members of the partnership, it has been a good basis for achieving funding but, again, if the medium- to long-term ambition is to become a centre of reference, the starting point must be a strategic reflection.

Recommendations

- Strategic Planning

To undertake a strategic planning exercise, which concretizes the mission and vision of the CoC DEEBD and defines the lines of action to advance in that direction. Considering that the Centre is in a structuring phase, the priority challenges will focus on:

- Research and Innovation: Establishing the Research and Innovation project, with which the CoC DEEBD can position itself as a reference entity, at a national and international level, in its fields of research.

- Knowledge and technology transfer: To configure a model of transfer of knowledge and technology from a demand-based approach. This means that, based on scientific capacity, the CoC DEEBD will be oriented towards meeting the needs of its target market in order to generate economic returns and contribute to economic development through innovation, primarily in Bulgaria (based on the TT plan recommended in the TT chapter).

- Talent: To form a cohesive research community and an attractive working environment for the retention and attraction of research talent.

- Governance and management: To complete the model of government, organisation and agile and efficient management for the achievement of the challenges of research, transfer and talent posed for the period.

- Priority actions in the framework of the strategic planning process

In relation to the above challenges, some particular actions are recommended to be considered during the planning process:

- To carry out a **benchmarking exercise** that will allow the CoC DEEBD to fix their goals in terms of strategic positioning. A qualitative analysis will be also of interest in order to identify best practices in other fields (organisation, marketing, prices, firms involvement...). This exercise will also make it possible to identify partners for future international projects. Since the Centre envisages to perform both research and services, the benchmarking exercise should cover different models: research oriented Centres (i.e Barcelona Supercomputing Centre[280]) and service oriented Centres (i.e The Centre of Excellence of Big Data in Barcelona -based on services and oriented towards SMEs[281]- or Catapult Digital -based on research and innovation[282]).

- To **define a scientific and innovation agenda** aligned with the priorities of the European Union In this sense it may be of interest to consult the innovation agendas of the initiatives that will arise after the completion of the Artificial Intelligence PPP[283] or the new Strategic Research Agenda of the European Technology Platform for High Performance Computing[284], as well as the White Paper on Artificial Intelligence "A European approach to excellence and trust"[285].

- To **appoint a scientific director** of the Centre who will lead the definition of the research and development strategy.

- To create advisory committees: an international **Scientific Advisory Board** that will provide advice on the research strategy definition and an **Innovation Advisory Board** that will focus on providing advice knowledge and technology transfer strategy.

- **The TT unit should be staffed with two complementary profiles and functions: management and commercialization**. "Project Manager" in charge of fundraising, supporting researchers with project definition, contract management, "The Industrial Liaison Officer" with a focus on commercialization, that is following groups activity to identify results of commercial interests, prospecting the market needs and trends, visiting firms, attending info days and networking events, acting as one stop shop when firms "call to the Centre door" to identify their needs.

- To **join the main international initiatives in the field** and to participate at their networking activities in order to establish contacts for future projects. Some initiatives to explore are: EIT Digital[286], the European Technology Platform for High Performance Computing[287], EU Robotics[288], the Alliance for Internet of Things Innovation[289], European Factories of the Future Research Association[290].

[280] https://www.bsc.es/
[281] https://www.bigdatabcn.com/en/
[282] https://www.digicatapult.org.uk/
[283] http://www.bdva.eu/AIPPP-Vision-paper-PressRelease
[284] https://www.etp4hpc.eu/sra.html
[285] https://ec.europa.eu/info/publications/white-paper-artificial-intelligence-european-approach-excellence-and-trust_en
[286] https://www.eitdigital.eu/
[287] https://www.etp4hpc.eu/
[288] https://www.eu-robotics.net/

- In order to attract foreign researchers and be recognized as a European class research institution, it is suggested that the leading partner apply for the Human Resources Excellence in Research award[291] (Sofia University got it 2019 and could advise on the procedures, although it is not in the partnership).

- Define a Technology Transfer action plan based on a market/demand approach and involving the definition of tailored mechanisms according to your research and innovation profile and client needs. For instance, proof of concept programs in case you detect that there is a need to scale research results (both technologically and in terms of business model and development), industrial challenge programs to attract firms to the Centre or living labs to stimulate co-creation among the Centre and the SMEs.

[289] https://aioti.eu/
[290] https://www.effra.eu/
[291] https://euraxess.ec.europa.eu/jobs/hrs4r

9.12 Centre of Competence "Mechatronics, Innovation, Robotics, Automation, Clean Tech" (MIRACLe)

Summary of Centre

Identification number: 1.002-0011 MIRACLe (BAS)

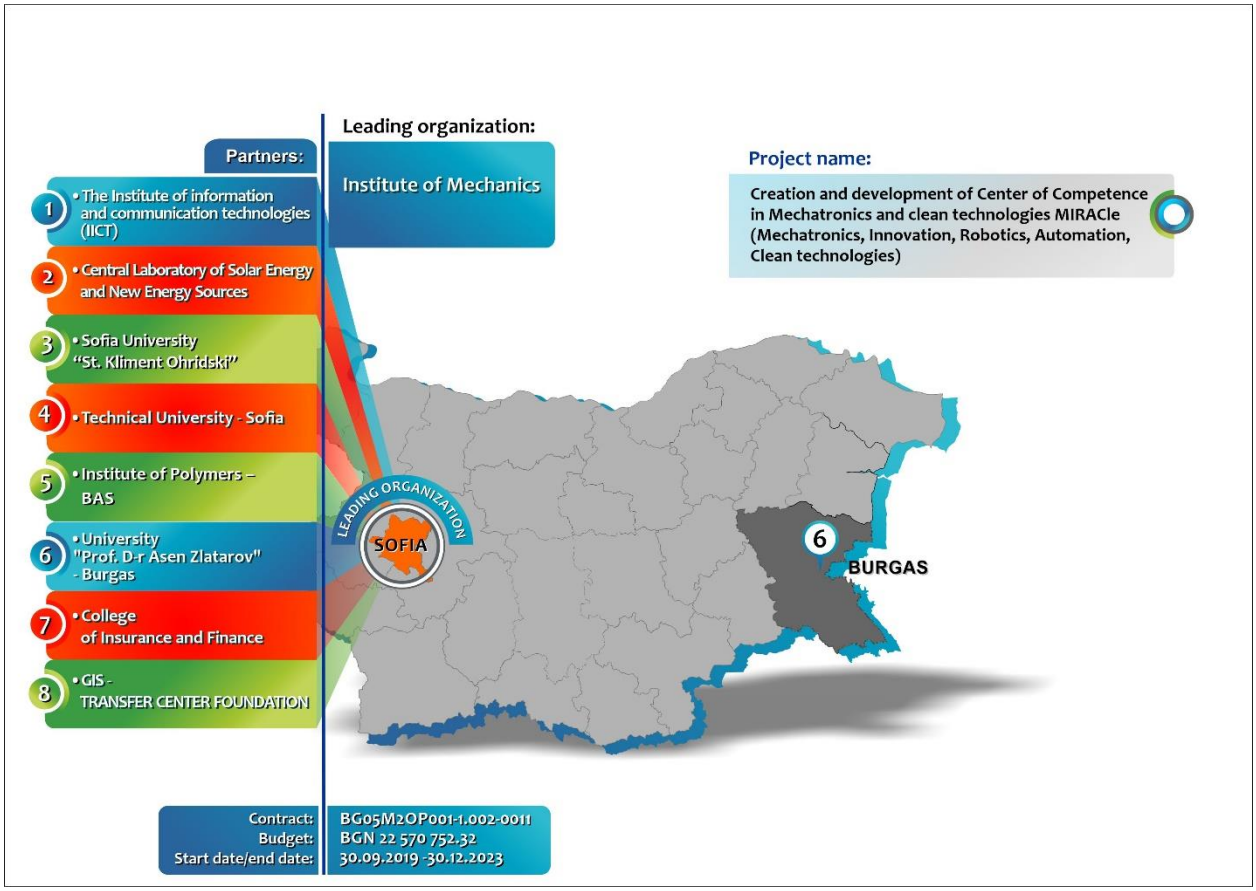
Centre name: Centre of Competence Mechatronics, Innovation, Robotics, Automation, Clean Tech (MIRACLe)

Budget of the project: 23 514 000 Bulgarian Lev (contracted amount as of 31.12.2019: 22.5 million BGN)

Lead Partner: Institute of Mechanics-BAS

Start date: 30.09 2019

Consortium (8 partners): 3 BAS institutes, 3 state universities, 1 private university (VUZF), GIS + Associated partners: 5 foreign universities and 5 companies/clusters


Leading organization:
Institute of Mechanics
Partners:
1 • The Institute of information and communication technologies (IICT)
2 • Central Laboratory of Solar Energy and New Energy Sources
3 • Sofia University "St. Kliment Ohridski"
4 • Technical University - Sofia
5 • Institute of Polymers – BAS
6 • University "Prof. D-r Asen Zlatarov" - Burgas
7 • College of Insurance and Finance
8 • GIS - TRANSFER CENTER FOUNDATION
Project name:
Creation and development of Center of Competence in Mechatronics and clean technologies MIRACle (Mechatronics, Innovation, Robotics, Automation, Clean technologies)
LEADING ORGANIZATION
SOFIA
6
BURGAS
Contract: BG05M2OP001-1.002-0011
Budget: BGN 22 570 752.32
Start date/end date: 30.09.2019 -30.12.2023

CURRENT STATUS OF CENTRE

MIRACLe is a distributed research infrastructure consisting of several partners with the Institute of Mechanics – BAS (IM – BAS) as the main partner responsible for the project execution. The main partner is also a main beneficiary, as the large part of the budget (48%) is allocated to the IM – BAS, while the other seven partners receive between 1% and 21% of the budget. Budget distribution leads to concentration of infrastructure in the IM – BAS and TU Sofia premises.

This Centre has been very recently set up (30.09.2019), which explains its relatively limited progress to date compared to the Centres established much earlier. Public procurement and construction work are planned to be completed by the end of 2020. We shall therefore base our assessment largely on the proposed plans and an assessment of how realistic they appear to be and make some specific recommendations on how to improve chances of a successful implementation.

Analysis of questionnaire and primary research

Several partners believe that no additional legal entity should be incorporated, and the Centre should remain a loose Consortium of partners, each responsible for their own equipment, activities, contracts and budgets. Substantive decision-making powers to decide on research programmes and projects could be delegated to a common management, provided that the partners agree in advance on budgets and strategy. One partner indicated a preference for a non-profit organisation/association with its own budget. The majority indicate that in this scenario an external auditor should be appointed. Based on this vision of the majority, the Centre should have only a few core administrative staff and no researchers. However, a large number of personnel, well over a hundred researchers and dozens of technicians, are employed by the partners and so the necessary teams, could be deployed in the activities of the Centre by the participating partners.

Not all partners have strong legal and financial teams, though some declare that they have all they need. It is important that these competences are placed at the disposal of the Centre for use by the whole partnership and not involved solely in activities of the individual partners who employ them.

The consensus seems to be that most partners operate in the TRL 3-4 range in terms of the applicability of their research activities. This bodes well for the activities of the Centre.

All partners recognise that the CoC is at the start of the process and is only at level 1 in terms of operational capacity. All respondents to the survey believe the Centre should be managed by a single leader, supervised by a board and the majority favour close supervision. All partners who responded to the questionnaire agree that the Centre should be independent in its management and execution of operations but should agree its strategy and budget with the Individual Partners and report on outputs annually/quarterly.

At present partners indicate they are able to clearly differentiate between the activities and projects of the Centre on the one hand and of the individual Institutes/Partners on the other hand and have already defined relationships between founding partners and the Centre regarding IPR and sharing industry contacts and leads. Some of the partners have strong experience in these areas but it is important that this experience be made available to the whole partnership. There are regular scheduled meetings and updates between partners and communication seems to be effective.

From the questionnaire, it is clear that the partners will appreciate support in understanding how to differentiate between economic and non-economic activities. On the subject of separate accounting systems there again seems to be some variance between partners. While at least one partner has

already implemented separate accounting systems for revenues from economic and non-economic activities, only one indicates the presence of analytical costing so that overhead costs can be properly allocated to each activity and one has no separate accounting capability. Not all partners seem to monitor the overall annual capacity in a manner that clearly distinguishes the capacity usage devoted to economic activities from the capacity used for non-economic activities.

One partner has already set prices for external users, but this practice is not shared across the Centre. While all respondents claim they can clearly distinguish between contract research and collaborative research their responses do not substantiate this claim. In one case the percentages indicated are "80% contract research and 20% research sponsored by the private sector" which would indicate 100% economic activity. Whilst this may be a simple clerical error, the doubt remains whether there is a sufficiently clear understanding of the difference between these two forms of financing of research activities and how they should be accounted for.

Estimates for expected income from the private sector vary tremendously from 0 to 20%. This suggests that each subject is assessing their own institute's activity and not the activity of the Centre as a whole. Similarly, the estimates of private sector revenue range from zero to 205,000 EUR.

The budget allocation for the Technology Transfer Office function of the Centre is not clear and once again the variance between responses (zero - €700 000) suggests different interpretations among the partners. There may have been some misunderstanding of the questionnaire, but it may also be that the partners still do not see the Centre as an organisation in its own right and merely as a collaboration between distinct entities that have no need to share common Technology Transfer services/activities.

When asked specifically about dedicated personnel to deal with specific areas of activity one partner (the project leader) responded with confidence that they have everything they need. This suggests that other partners are either less well equipped or are not aware of some of the competences which could and should be made available by the lead partner to the Centre.

There is some discrepancy in the responses regarding the focus of the Centre with one partner placing more emphasis on technology transfer capabilities and others much less convinced of this focus. Again, this may simply be a result of one partner having key strengths in these fields that other partners are less aware of, but it will be imperative that these capabilities are at the disposal of the whole Centre in all its activities.

As the Centre was only constituted in September of 2019, there is little data on activities already accomplished or underway, though all project partners are able to demonstrate a track record in the key tasks assigned to them.

Private sector investment availability seems to be weak in the estimation of all respondents and the general consensus seems to be that the Centre will rely more heavily on funding from the public sector (EU or national government).

Revenue sharing is foreseen on the basis of each partner's contribution though how this will be measured is not clear.

Clear institutional IP policies are identified as in place at the lead partner's institute and they indicate that these policies will be applied to the Centre. There was no access to an incubator for spin-offs indicated by the respondents.

According to the respondents to the survey there are very few restrictions on publication and dissemination or research results, which raises questions about the awareness of technology

transfer approaches and policies to guarantee the valorisation of research results for example though patenting.

While some partners indicate awareness of support programmes to facilitate interaction with industry not all do, so once again it is important that these competences are shared between partners across the Centre to optimise its performance.

Some partners agree with the option of a common back office/administrative services unit to serve all Centres, others do not. This resembles the attitude overall among the 14 CoCs/CoEs.

While the lead partner cites KPIs defined in the project proposal other respondents did not seem to be aware of this and respond that no KPIs or monitoring system are in place.

Conclusions from the questionnaire answers

Analysis of the responses to the questionnaire in the context of the project proposal leads to a general conclusion, that there is serious doubt to what extend project consortium members understand and accept the overall concept of the Centre and work to create a common vision. This serous doubt comes mainly from differences between answers of different project partners. Topics, where differences are the most evident are: obligations to the Centre, expected income from the private sector, budget allocation for the TT, focus of the Centre, and KPIs and monitoring system.

The sense of identity of the Centre as opposed to a mere aggregation of project partner organisations working together is under question also because of some other elements. The majority of project partners responded, that the Centre should remain a loose Consortium of partners, each responsible for their own equipment, activities and budgets but that substantive decision-making powers to decide on research programmes and projects should be delegated to a common management. On top of that, project partners independently employ research and technical staff, while only small number of administrative personnel is employed by the lead partner to work exclusively in the Centre. This strengthens doubts as to what commitment would be given to the activities of the Centre compared to the activities of the partners who remain the direct employer of the majority of the staff. This is a potential concern and needs to be addressed with proper division of tasks, incentives and reporting structures to prevent any conflict of interest.

The vision presented above, is to some extent contradictory to expectations of partners who responded to the questionnaire with agreement that the Centre should be independent in its management and execution of operations but should agree its strategy and budget with the individual partners and report on outputs annually/quarterly.

It is highly recommended to strengthen communication between project partners, and agree a common understanding of the most critical elements of the project implementation, starting from a common vision and identity, via prioritisation of different activities (e.g. technology transfer), to operational issues related to budget management, KPIs and relationships / obligations between partners. Some discussion and decisions have to be taken at the management level of the Centre and partner organisations to secure common understanding of the vision and goals. In more operational aspects (e.g. account practices and systems, contract research and collaborative research, application of State Aid rules, TT) good progress could be achieved through joint training for all partners or experience sharing between partners. It will guarantee the effective performance and management of the Centre and helps as a way of transferring and standardising best practices between partners.

Long-term vision

It is of the utmost importance going forward that the partnership decides not only on what it wants to achieve but what the partners want the Centre of Competence to become. At the moment, it seems that the majority of the partner organisations would be happy to continue as a loose collaboration. If that is the case and if no measures are taken to ensure the coordinated performance of R&D projects and actions as well as the effective (joint) engagements with industry, the real "added value" of the Centre concept is not going to be produced/achieved.

The Centre aims to be a strong provider to the business sector and to focus heavily on applied research. They provide accreditation of labs, to serve local business and to issue the necessary certificates. This mission statement resembles in our opinion to a large extent the SMEEST Centre of Competence in Plovdiv/Gabrovo. The Centre should operate (as all other 13 CoEs and CoCs) under the EU State Aid rules and the Grant Contract from the MA and can use up to 20% of its capacity for economic activities. We need to be clear that this does not necessarily mean 20% of income – income is an incorrect indicator of capacity utilisation (research organisations can have more than 20% of their income from 20% of capacity).

Legal Framework of the Centre

As stated in the previous section, the current situation is that the CoC, which is still in the early process of establishment, represents a loose collaboration and the majority of the partners would like to keep it that way expressing that no additional legal entity should be incorporated and the Centre should remain a loose Consortium of partners. Whilst this may sound attractive in terms of flexibility it is not clear how this strategy will permit the evolution of a brand identity for the Centre which would allow it to be a recognisable and attractive potential partner for industry, not just locally but nationally and internationally. In order to achieve this objective, a concerted effort will be necessary to bring in new business in the form of projects with industry partners. A loose consortium may lack the focus to achieve this unless specific business development tasks are assigned to experienced individuals with clear priorities and no conflict of interest. They would need to be incentivised to bring in projects for the Centre and not just for one of the partners, irrespective of which institution pays their salary. While not impossible, this approach is challenging and having a single legal entity which coincides with the brand identity is almost certainly more straightforward.

As the partnership is dominated to a certain degree by the Institute of Mechanics of the BAS, it is likely that in the medium to longer term this institution could absorb major part of the brand identity of the CoC and could effectively manage the back-office activities on behalf of the entire consortium so as to optimise resources. This would permit the development of the CoC with the active collaboration of the various partners, hosting specific research infrastructure and performing specific research activities on projects managed (or at least closely coordinated) more centrally, having with certain central functions autonomous from the partners. This approach seems more plausible and efficient than an indefinite collaboration as a loose consortium with no specific identity. Some form of central management function is likely to prove necessary to guarantee efficient and effective running of the Centre in the long term. There must be a "driver" of the project also after 2023 when direct funding from current OP will come to an end. If the central management structure does not have some degree of "leverage" in the Centre, the CoC will become dysfunctional and the partners will just utilise their own infrastructure and conduct their own activities; intense collaborative work will not take place.

There are also other options and there is no one-size-fits all solution.[292] As far as specific considerations for this Centre are concerned, we remain convinced that the nature of this CoC's activities places it further along the spectrum towards industry and away from pure academic research. As such, a legal framework that facilitates the performance of applied research projects with industry is to be preferred. This could be in the form of a non-for-profit association (an NGO) which resembles one of the two options described Chapter 3 of the report (less integrated or more integrated).

The choice of legal entity and structure should be based on needs and on the route that optimizes the visibility of the Centre as a specific identity that can be built up over time. This can also be started with a simple association with a strong coordination, promotion and possibly industry liaison functions (see the "less integrated" option/model). Safeguards must be put in place to guarantee the coordinated and effective realization of the Centre's goals, activities and projects. Otherwise, it will continuously risk being in conflict with its founding institutions which will in turn not be able to scale up their R&D&I activities.

Organisational Framework

Whilst from the questionnaires it appears that most partners acknowledge that the CoC should be managed by a single leader closely supervised by the board, the organisational structure chosen is somewhat more complex than this and reflects the need, in a loose consortium, to have many parties involved in the decision-making processes.

The questionnaires also revealed as prevalent the opinion that the Centre should have only a few people as core administrative staff (no researchers). This is more consistent with the vision of a lean central organisation with research activities devolved to the single host institution partner or several partner organisations in the execution of joint R&D projects. It is not clear how the process of business acquisition will be driven to ensure the entire Centre and all of the partners involved get the sufficient support where necessary and relevant and for access to new projects.

The management of the Centre is described in the project documentation Annex I, Section 6.8. There is a General Assembly and a Coordinator under whom a number of managers work coordinating the different activities. The Institute of Mechanics, being a leading organisation, is responsible for the project execution (2019-2023). The project management comprises of four structures with different responsibilities:

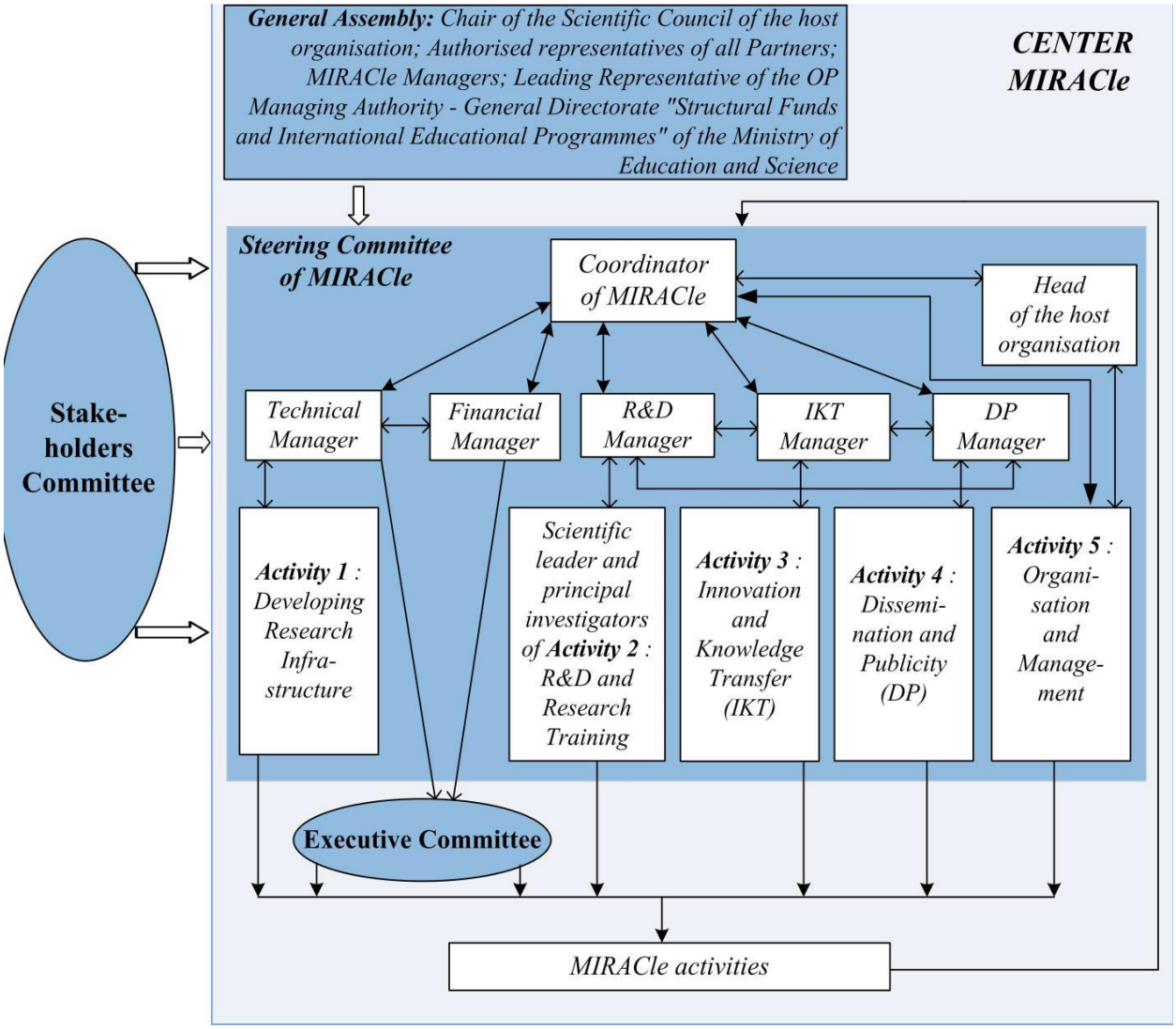
• MIRACle Partners General Meeting: a collective governing body for strategic planning of the Centre. It meets once every 6 months, accepts a report of tasks completed and plans activities for the next six months with appropriate forms of internal monitoring;

• Board of Directors: monitors on a monthly basis the normal course of project activities, plans ongoing tasks and ensures coordination between partners;

• Executive Committee: Ensures the day-to-day operation of the Centre in accordance with decisions of the Management Board;

• Committee of Interests: advisory and monitoring body, including representatives of the Centre, associated partners and other interested organisations. The committee will have a meeting at the end of month 9 and month 18 (at the end of the first stage) and then annually. The figure below shows the graphical representation of the organisational Framework.

[292] For an overview of the possibilities and considerations on the merits of these see Chapters 2 and 3 of this report (Legal Framework and Organisational Framework respectively).



These bodies and functions are described in great detail in the project proposal (Annex 1 page 110-116).

In the opinion of the Expert Panel, this organisational framework could be reduced to fewer layers. A Board representing the interests of the partners and stakeholders and a lean management structure, dedicated exclusively to the activities (after procurements are done, only R&D&I activities and promotion of these activities and capacities) of the CoC with a small number of full-time operational staff. This staff could be employees of the partner organisations if the desire is to avoid having a separate legal entity. However, the best way to guarantee the success of the CoC is for them to be assigned exclusively (100%) to the work and joint activities of the CoC (ideally independently employed by the legal entity/association) and not to have their time and their loyalties divided.

State Aid rules

In the Project Justification, p.108, and in relation to the operation of the Intelligent Urbanized Environment (IUE) Laboratory, the following is stated:

> *"Two basic ways of functioning of the laboratory can be defined. The first one is granting a part of the capacity of the IUE Laboratory to companies for implementing specific projects for a fee, and the second is carrying out of certain tasks or projects by the IUE Laboratory on behalf of a client (a legal entity or an individual). In either way,* ***the goal will be to set lower tariffs that would cover only the costs of operation of the IUE Laboratory without generating profit****."*

The two described modalities resemble 1) renting of equipment/infrastructure and 2) performing research on behalf of undertakings.

- Firstly, we need to make clear that both of these are economic activities. We remind that under EU State Aid rules the capacity that the CoC (its partners) allocate to ancillary economic activities must be equal to or less than 20% of the overall annual capacity at the level of each relevant entity that actually carries out the economic activity in question. Usually research organisations have several departments, sections, so it should be at the level of the relevant department or section.

- Secondly, the above-described model for setting the fees/tariffs may not be compliant with EU State Aid rules if it resembles the full costing possibility. The full costing method should include in addition to the full costs a mandatory profit margin commonly applied in the sector for similar services.

  Regarding the costs formulation for research on behalf of undertakings we need to explain the sequence and steps of establishing the price/fees. As a first resort, market prices should be charged. **In the absence of an established market price the research organisations have two options that are, in principle, alternative. The first one is to charge full costs plus a margin** (as explained just above). In other words, this is one of the two alternative possibilities for setting the price in the absence of a clear market price. The other possibility is to formulate a price following the principle of arm's length negotiation. This alternative, however, carries an inherent higher burden of proof. To find out about the conditions refer to Chapter 4 on State aid rules in the general part of this report and also check the recently published Guidance in the form of a Decision Tree[293].

From the answers to the questionnaire, we also note the following:

1. Some partners do not monitor the capacity usage in a way to effectively distinguish between capacity used for economic and for non-economic activities (this is an obligation under the Grant Contract; under EU state aid rules monitoring may be necessary to prove that the capacity allocated to economic activities does not exceed 20%);

2. Some partners don't conduct analytical costing and therefore can't properly allocate overhead costs;

3. There is a misunderstanding in some partners that contract research is a non-economic activity. We need to clarify that research on behalf of undertakings (incl. contract research) is an economic activity.

[293] Kebapci, H., Von Wendland, B. and Kaymaktchiyski, S., State Aid Rules in Research, Development and Innovation, Kaiser, L., Neu, M., Teernstra, F. and Nicolaides, P. editor(s), EUR 30436 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-25081-4 (online), doi:10.2760/675525 (online), JRC122304. https://ec.europa.eu/jrc/en/publication/state-aid-rules-research-development-innovation

Research Infrastructure

Ownership of infrastructure is in the individual partners. The research infrastructure of the Competence Centre MIRACle will be **concentrated in four locations** (bases). Base 1 will be built on the site of the Bulgarian Academy of Sciences (from laboratories of IMech, IICT, CL SENES), Base 2 - on the site of TU-Sofia, Base 3 will be developed on the site of Sofia University, and Base 4 (which is the smallest) will be on the site of the University "Prof. Dr. Assen Zlatarov" – Burgas.

The application states that members of the consortium represent 90% of capacity in the research fields of the CoC.

The description of the research infrastructure to be acquired is detailed extensively in the project proposal and it is evident that partners have significant expertise in their respective fields.

What is less evident is the way in which the whole CoC, as an organisational entity, will come together to offer its services in an integrated way. The loose consortium has put together a series of impressive work packages in a variety of fields, each of which are interesting and have merit; however, the sum of the parts does not make a clear and coherent offering as a CoC. More attention will need to be paid to developing this aspect if the Centre is to evolve into something worth maintaining which will attract the attention of industrial partners nationally and internationally.

Technology Transfer and Commercialisation

The budget for IP protection and technology transfer is 566.000 BGN over the project period, while for “dissemination of results and publicity” it is another 569.000 BGN (updated data from Financial Justification, May 2020), to be distributed among the partner organisations. In July 2020, the expert team was informed that the budget has been revised due to the insufficient remaining time to implement the project. GIS-TC and VUZF (a private HEI) will receive part of this funding for TT and dissemination activates.

The Institute for Mechanics at BAS operates its own “Patent Activity Fund” which gets 10% of the revenues of commercialised IP (the remaining 40% goes to the institute and 50% for the inventor/author).

The project documentation makes numerous (over 70) references to TT and to specific actions that will be put in place.

In addition, reference is made to collaborations with the Technology Transfer Network of Steinbeis in Germany and with the Enterprise Europe Network, both positive signs.

The theoretical models described across documentation appear sound and the partners, in particular GIS Transfer Centre seem to have all the necessary expertise to support/perform TT activities at a high level. There are only two areas of concern that the experts feel it is appropriate to highlight at this point.

Firstly, as elsewhere in this document, it must be stressed that there is a great difference between carrying out technology transfer activities on behalf of a specific institution or with regard to the results of a single research project, and performing systematic technology and knowledge transfer activities for a Centre of Competence. The latter requires that the professionals involved be incentivised to perform the technology and knowledge transfer activities in the interests of the CoC and not just of any single partner institute. This means a balanced approach that minimises conflicts of interest.

The second concern is that, despite the presence among the partnership of strong international networks, the approach to TT in the early stages of the project seems to be limited to the Bulgarian national market. This is a potentially serious limitation and needs to be addressed early so that the activity is re-focussed on the international opportunities.

Regarding the long-term GIS participation as a partner in the CoC also after the funding period (post-2023) the public research organisation partners should find a suitable arrangement for utilising the knowledge and experience in commercialisation built by GIS.

Each partner should place its international connections at the disposal of the TT team so that they can present the capabilities of the whole CoC to these contacts. For instance, BAS is a member of a consortium of innovative activities within the project Robotics Ecosystem to INnovate for SMEs - RE-IN4SME of FOF-12- 2017: ICT Innovation for Manufacturing SMEs (I4MS) - Robotics, in which members are leaders in the field of robotics as follows - six existing Competence Centres of France, Germany, Britain, Spain, Greece and Slovenia and 5 newly established Centres in the new EU member countries - Poland, Hungary, Slovakia, Czech Republic and Bulgaria, as well in Serbia. This would be a great platform to showcase the CoC.

Centre Sustainability

Income streams are described as originating from external use of the infrastructure/equipment, from private sector investments, from commercialisation activities, from technology and knowledge transfer activities and from work on projects. Specific areas of specialisation are indicated and for each an estimate of projected revenues over a six-year period is provided. This is very helpful and if the targets will be reached the CoC should have some very good revenue streams on which to base its longer-term sustainability.

The economic impact of the research activities of the CoC is also described in some detail in the project documentation, but what is missing is a more pragmatic, down to earth business plan outlining exactly what measures will be taken by whom in order to guarantee that these various revenue streams materialise. The excellence of the research capability is in no doubt and the enhanced research infrastructure will make it possible to propose attractive research projects to the industrial and business community. However, it is not enough to have an interesting offering. In the competitive business world, the offering needs to be presented to the right target market or interested stakeholder at the right time in a compelling way. This requires a constant and proactive approach, driven by market research and utilising the full array of skills available to the experienced TT professional.

It is not clear that the CoC has fully addressed how much energy, time, and resources will be invested in proactive business development and how this activity will be managed to benefit the CoC as a whole, rather than on an ad hoc basis to push the results of a single research activity.

The TT team should be created sooner rather than later and should develop a comprehensive business development plan that can be validated at the board level before implementation. This plan must clearly identify targets, strategies, and measurable objectives.

Roadmap on long-term support

It is the opinion of the expert panel that this Centre of Competence has an excellent chance of success provided attention is paid to the key issues raised in this report.

It is not essential that the CoC has a separate legal entity, but it is paramount that it builds its own identity and that the activities of its founding member institutions be consolidated to guarantee the fulfilment of common goals and value adding joint R&D&I activities and avoid even the perception of conflict of interest, either internally or externally.

This can be done by the partnership clearly and transparently agreeing to consolidate their institutional activities guaranteeing that all necessary resources and competences will be made available to the CoC. Personnel, if not actually contracted by the CoC as a separate legal entity, should at the very least be clearly assigned to the CoC, preferably 100% of the time at least for the core team. They should be incentivised in line with the objectives of the CoC and not those of their host institution.

There should be a clear business plan for the CoC which clarifies what the expected results are and how the staff assigned to the CoC is expected to achieve those results. Clear lines of responsibility and accountability must be defined. The management structure should be as lean as possible, allowing for rapid operational decisions to be made while maintaining a level of accountability to the main executive/manager selected to coordinate and "drive" the project, complemented by Board which fully represents the interests of the stakeholders.

Identified risks, needs and challenges

- Fragmentation, breaking up of partnerships after the end of the project due to a loose consortium plus institutional and geographical dispersion and/or lack of funding
- Availability of insufficient operational funding to achieve full potential use of facilities, lack of commitment and obligation for partners to cover CoC operational cost.
- Serious mismatch between declared and expected profile (pure research vs commercial cooperation)
- Complex management structure, which might be suitable for procurements but not for operational R&D&I-focused activities
- Lack of structured international advisory Committee and quality control for research access.

Clear expressed choices and vision

- Not all partners recognise the benefits of creating a separate legal entity
- CoC as the "face" of a consortium – entry point to research infrastructure and staff
- Focus on services/projects for SMEs

Recommendations

- Operational model – separate unit (legal entity – dedicated organisational structure) to manage business process (scouting for projects and clients, contract management, IP management, etc.) and represent CoC as a one entry point for commercial cooperation.
- Simplification of management structure – light management of research activity (coordination model) of CoC (as probably it will be managed on a partner institution level) and separate strong business management for unit/legal entity mentioned in first recommendation.

- Integration with other CoC/CoE (on the level of unit/legal entity for commercialization of activity – see first recommendation) in similar fields to create critical mass, strengthen position on the market and streamline communication with business
- Define an "IP management, Industrial liaison and information" strategy allowing more structured collaborations and interaction with users and industry.

If, as it would appear, the long-term sustainability will depend on strong links with industry and a constant stream of industry-funded research projects, then the CoC needs to make a real commitment to consolidate its offerings in order to utilise the full potential of the commercial demand, within the allowed capacity usage percentages. The loose consortium model does not lend itself well to a thriving service-oriented business model and so the CoC should move towards /initiate creating a legal entity with a lean management structure with clear objectives and incentives to perform, including competitive salaries with a significant performance-based component.

The CoC has several overlaps with other CoC's and CoE's (such as SMEEST, Mechatronics and Clean Technologies, Pleven MU-led Centre on personalised medicine, which is also involved in the design of orthotic devises for instance; Centres doing research on in-vitro), as well as with other entities such as the industry cluster. These overlaps should be eliminated through a serious analysis of the roles of each institution to eliminate duplication, identify synergies and propose areas of collaboration to optimise performance and productivity of the whole system. Already during the only very short meeting we have had with representatives of the Centre it became clear that there is a need for national coordination of all Centres and activities in the field of mechatronics and clean tech. Only though a systemic approach can the public funding invested in these initiatives add real value.

In order to achieve this ambitious objective all stakeholders must be actively engaged, must agree to undergo a serious analysis on the basis of which changes can be made. This analysis should identify overlaps and gaps and include a comprehensive capabilities analysis. In addition, it should indicate which of the stakeholders have the strongest capabilities in each of the core activities necessary for the system to function optimally. Resources should be reallocated so that each activity is performed by the partners who are strongest in that field gradually eliminating duplication and enhancing performance and excellence. The key to this process is for all stakeholders to be committed to the change and to accept that change may also require sacrifice, each giving up something to get the whole system to perform better. This is always politically challenging, but we feel very strongly that it is what the Bulgarian ecosystem needs to create a brighter future.

All members of the consortium need to agree on the basic principles that will guide their collaboration and establish a Business Plan covering not just the short-term period of implementation of the project – mostly for the acquisition of the infrastructure - but also the medium to longer term running of the CoC. This business plan must address in a serious, realistic and quantitative way:

a. Specifics on what each member of the Consortium will contribute to the Centre and what they will get in return for their contributions and input
b. A realistic determination of fixed vs variable costs and a plan to minimise the former and to render the latter a function of the expected revenues
c. A comprehensive business development plan with adequate staffing and realistic achievable targets for business acquisition locally, nationally and internationally

d. Specifics on the planned sources of income including:

    - Technology fields of major interest
    - Sectors in which these technologies are applied
    - Examples of target companies by sector, size and geographical location
    - Estimate of resources needed to effectively target these companies
    - List of priorities for action

e. Specifics on the staff who will work in the CoC, their competences, activities, training needs:

    - This should include not just research staff but also commercialisation staff such as technology scouts and brokers, key account managers etc.

f. A plan for the internationalisation of the activities to include:

    - International collaboration on fundamental research which could receive independent funding
    - International education and training opportunities
    - International expertise that could be attracted to the CoC to enhance its offering
    - International clients that could be interested in accessing the services of the CoC at market rates

We specifically recommend that the CoC should have a strong focus on cultivating a multitude of revenue streams to enhance its sustainability. Some examples include:

- Grant schemes that could finance fundamental research to be carried out on the research infrastructure and which could contribute to covering a portion of the fixed costs as well as a contribution to overhead
- Collaborative research projects with co-financing at the local, national or international level
- Commissioned research projects for other public or private sector organisations
- Development of proprietary IP for future commercialisation
- Valorisation of research results through three distinct channels
    - further collaborative research with industry with shared IP
    - license IP to industrial partner or partners
    - spin-off or start-up companies with ring-fenced risk and genuine scalability and growth potential

9.13 Centre of Competence "Sustainable Utilisation of Bioresources and Waste of Medicinal and Aromatic Plants for Innovative Bioactive products"

Summary of Centre

Identification number: BG05M2OP001-1.002-0012

Centre name: "Sustainable utilization of bio-resources and waste of medicinal and aromatic plants for innovative bioactive products"

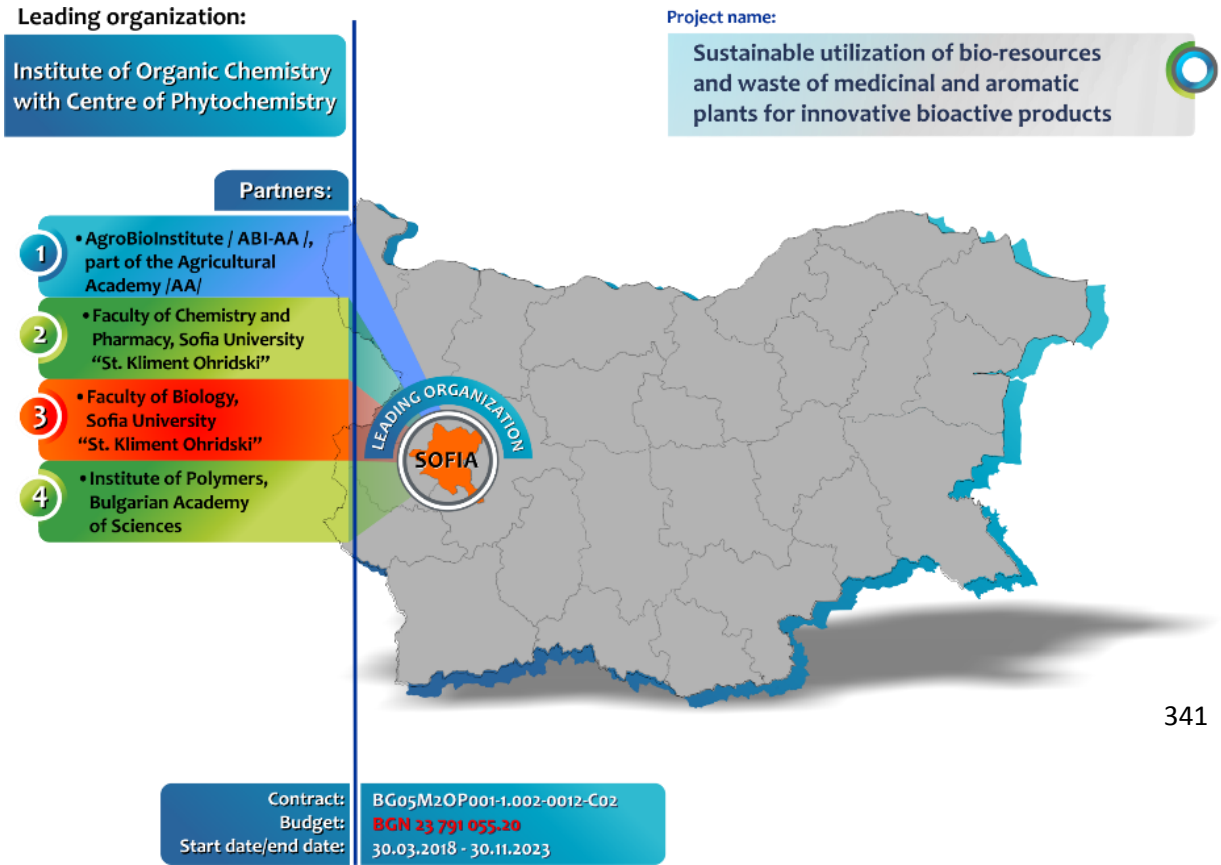
Budget of the project: 23 791055.20 (12 M€), verified expenditure (Q4 2019): 10,28%

Beneficiary: Institute of Organic Chemistry with Centre of Phytochemistry, BAS (Lead Partner)

Other beneficiaries/partners: AgroBioInstitute, Agricultural Academy, Faculty of Chemistry and Pharmacy, Sofia University, Faculty of Biology, Sofia University, Institute of Polymers, BAS

Start date: 30.03.2018 **End date:** 31.11.2023

Associated partners: Wageningen University and Unilever (NL)



MAIN PROJECT GOAL

The main goal of the project is to concentrate expertise, competencies and infrastructure of the lead partner institute of BAS (Institute of Organic Chemistry) together with the Faculty of Chemistry and Pharmacy and Faculty of Biology in Sofia University, AgroBio Institute and Institute for Polymers of Bulgarian Academy of Science, to specialise in innovative utilisation of aromatic and medicinal plants to create bioactive products with high added value and become a name in establishing the scientific fundament to industry oriented R&D for utilisation of the local generous natural flora; the motto is "from plant to product".

The CoC is to add value to currently exported resources and products and work with local industries to produce higher value-added final products whilst capturing the economic benefits for the industry and the country.

CURRENT STATUS OF CENTRE AND INSIGHT INTO THE QUESTIONNAIRE

The investments are distributed among all five partners, as follows:

- Equipment is planned to allow synergies and support to activities in the field of "green technology" and "bio-technology".

The Centre declares the will to construct an integrated research infrastructure where the partners will engage in R&D aiming at utilisation of Bulgarian biodiversity for development of green technologies and approaches for innovative phytoproducts based on natural substances for medical, cosmetics and food industries.

Their respective roles on particular R&D activities throughout the whole process, from plant to final product, include a seemingly **complementary approach** uniting the competences and experiences of the partners.

The leading partner has experience in executing projects from the National Science Fund and international programmes as well as in regards to its initiation of regional networks in South-East Europe, while the Agricultural Academy institute represents Bulgaria in the International Centre for Genetic Engineering and Biotechnology (ICGEB, Trieste). Large international corporates are associated partners with track record of collaborations, while Sofia University also works on projects with world-leading universities.

The project describes an ambitious programme aiming at upgrading the existing laboratories and equipment for each team-member. No common buildings, laboratories, equipment or common teams are created within the project. The contractual agreement between the partners is focused on the management and spending of funds within the six years project. All narratives and technical information, however, point at the lack of common strategy for the long-term and the life of the CoC as one synchronised body; this is nowhere to be found in the project. The main drivers for unification appear to be the **need for business-oriented marketing and sales approach, as well as the need for financial and legal support for entering into balanced relationships with industry**. Therefore, the first step will be filling the gaps of missing skills and capacities that would create grounds for optimisation of the already mastered scientific and professional skills.

Parties to the partnership agreement have empowered the leading organisation to represent them before the Managing Authority but they refrained to empower a representative of the CoC in case of relationship with any third party be it university, institute, NGO or commercial entity (as expressed in the questionnaire responses). The leading organisation is entitled to coordinate but not

to fully manage the project, let alone the future activity of the Centre after the implementation of the project and closing of its financial support.

Looking further in the two (partly) different responses to the questionnaire, it is clear that at the moment, the individual partners of the Centre own the equipment, and only a few core staff are with the leading partner organisation. An estimated 100 researchers, 20 technicians, and 10 administrative employees are involved in the project. These are employees of the Centre partners dedicated to the current activities of the Centre. There is an identified lack of skilled financial and legal experts for planning, controlling, and other operational tasks. The structure does not envisage any personnel assigned specifically and mainly to the mutual work on the Centre, (we note that in numerous Centres the management is involved only part time on a half-day /50% FTE basis). The leading partner expressed agreement to have a single leader in the Centre that is to be closely supervised by a governing body.

Some partners cannot differentiate between their present activities and the future activities of the CoC. The project description and strategy focuses on the individual capacities of the partners and their track record of successfully completed projects in the their respective field of expertise. However, there is no dedicated TT staff or an agreement with internal to the Centre office or external experts specialised in the field.

Currently, the number of projects per year with industrial partners is 10. This number reflects the projects of the individual partners.

The data show that there is a strong ongoing relationship with industry. The partner representatives have highlighted that there are over 20 stable relationships with business. These are established mainly by the principal partner with a clear vision of possible products It is not clear whether some of these industrial connections will be transferred within the CoC. As a result, Government and EU grants are expected to be major potential source of income for the CoC.

There is also a lack of good understanding of state aid rules and the application of the 80/20 split between non-economic and economic activities.

There are identified challenges regarding attraction and retention of specialised personnel, specifically in legal and TT aspects. The lack of a separate/dedicated legal entity may make long-term contractual or labour relations between the Centre and skilful employees more complex, in particular as to the joint TT efforts of the partners. As we will explain below, the creation of a legal entity in the form of an association (in Bulgarian sdrujenie) would help consolidate these capacities especially post-2023. This legal entity would also be capable of independently hiring professionals.

During the meetings, the representatives of the CoC expressed that although there is a stable interest from industry, Bulgarian SMEs do not have sufficient dedicated resources to work with the Centre and often there is a lack of meeting points where CoC and the SMEs could exchange information and hear about each other on a regular basis.

Long-term vision

The vision is that of operating on a collaborative basis, with a leader under the supervision of the board representing each partner. The Centre's partners seek to concentrate expertise and to specialise in innovative utilisation of aromatic and medicinal plants to create bioactive products with high added value. They wish for the CoC to become the scientific source of knowledge for industry-oriented R&D around the use and conservation of national flora and its bio-resources.

Legal Framework of the Centre

The legal base is a contractual agreement based on civil law principles (not formally registered). The agreement does not indicate any intention for formation of a not-for profit association or any other type of a separate legal entity. Therefore, the budget is envisaged only as far as the present project is concerned, which brings the question about long-term sustainability of the Centre. Moreover, according to the administrative agreement between the Managing Authority and the beneficiaries, irrespectively of the legal form of the agreement between the partners, the CoC should continue its activity for at least five years after the final payment under the project. The partnership agreement signed between the partners is standard for all other 13 Centres and is focused on (i) the project drafting and application and (ii) project implementation. Distribution of rights and obligations between the partners refer only to the rights and obligations under the project and does not contain rules for management or distribution of activities outside the scope of the project. Although the partnership agreement explicitly confirms the obligation for existence of the CoC for five years after end of the project there are no rules for the existence and management of the CoC post-2023. Provisions regulating main activities of any structure as management bodies, their election and structure, specific functions of the management bodies, majorities, etc., do not exist in the partnership agreement.

A loosely integrated legal entity and related organisational structure requires an established level of maturity and longer-term perspective of the relationship between parties that may not have been reached by the Centre yet. A discussion, and subsequent agreement, on this topic is a very important first step for the members of the CoC. To achieve this, the existing partnership agreement can be developed further to form a set of internal rules and regulations (that are more comprehensive and focused than the current arrangement), or a legal entity of the "less integrated model" can be initially created and with time more competences are conferred to it (in particular after 2023).

A legal structure serves best its function when it supports and lays proper grounds for already existing or developing relationships. Formation of an additional legal entity would bring benefits such as improved coordination, management and decision-making, employment of personnel, IP Rights distribution, technology transfer and, overall, the liaison with industry on projects that concern several partners.

The relationship between partners must be clearly defined with regards to: future cooperation and how to integrate the resources, especially after the termination of the project period; future funding and joint initiatives towards industry, intellectual property rights; usage of equipment; utilisation of expert time; distribution of costs for utilities, personnel, marketing, legal and financial services. These rules and arrangements should follow the experience and anticipate the future needs and issues arising during the life and functioning of the Centre and should contain sanctions and enforcement mechanisms agreed between parties. These rules will be the contractual basis and could, in time, be the grounds for the establishment of a legal entity – an association/NGO.

We have described two options in Chapters 2 and 3 on Legal and Organisation Framework of this report - one less integrated and one more integrated. The less integrated option could easily be established even before the end of the project period (prior to 2023) to help converge the capacities of the partners in particular in TT and to help with promotion vis-à-vis third parties. This model entails that the legal entity be entrusted with only specific limited competences to support the partners.

The CoC in this particular case expressed a belief that the rationale for forming an association is rather limited to the improved visibility and the coordinated application for joint projects. This

resembles largely the "less integrated model" for a separate legal entity. In this respect the CoC also explicitly said that the partners would prefer a "looser, less integrated form".

A separate, albeit 'less integrated' legal entity, will help the Centre in connecting and managing all phases of the research and development process (from the research on plants to the eventual commercialisation of the research results and final products – a process involving a number of teams from different partner organisations). It will need a more integrated structural and governance model than simply a 'partnership agreement'.

This analysis is based on the model proposed for some other Centres with a strong governance with several semi-independent **"components" with component leaders** (broadly corresponding to the five main activity Departments and/or the six Scientific Projects in the case of this specific CoC). For more information on this possibility - see Chapter 3 of the report as well as the example of CoE Mechatronics and Clean Technology. A **strategy for the management of existing infrastructure** together with its maintenance could be adopted, and at least partial ownership of newly created intangible assets by the Centre's legal entity itself could be possible as part of the mandate/competence of the new legal entity. This proposal for a separate legal entity might be justified due to the need to **better integrate, manage and synchronise the activities of the partner organisations, which** are at the moment rather divided into various stages and roles from fundamental research on plants, through proof of concept, to the development and production of final products.

In any case, the common legal entity (association) would also help converge/concentrate and build the specific necessary internal TT skills and capacities (recognised as lacking) that can serve all partners of the Centre. Possible collaboration with the TT staff of the lead partner institute, the JIC-BAS and Sofia Uni TTO could also prove beneficial. The specific focus of the CoC can actually justify the creation of focused TT unit (2 people) to cover all aspects of commercialisation and appoint people who can also understand the science.

To conclude, it suffices to say that in 2023 the partner organisations should make an evaluation of their joint activities and achieved results and decide on the most appropriate way forward including the degree of integration.

Organisational Framework

Referring to the obligation of the partners in Art.2 (7) in their partnership agreement to implement mechanisms for coordination and management indicates the lack of such mechanism for the longer term (post-2023); the partners indeed recognise the need for such mechanisms. The partners have already set some principles for management and indicated the structure of management bodies in points 6.8.1 and 10.1 of their Project Justification (respectively pages 213 and 267 of the document).

Whatever the legal form, the CoC should elaborate more concrete legal provisions, which should contain clear rules, possibly developed and tested during the project period (which runs until 2023) for:

- Management bodies, their election rules, structure, functions and competencies;
- Rules for acquisition and distribution of assets

- Financial and accounting principles; including separate accounting for economic and non-economic activities if the respective partner performs economic activities; this will allow them to monitor the capacity usage.
- Employment of staff including the rules for utilisation of specialists;
- Distribution of funds, revenues and expenses;
- Distribution of IPR;
- Use of equipment of one partner by another partner organisation
- Methodology to develop joint contractual obligations with industries

At present, the main principle in the organisation and implementation of tasks within the CoC appears limited to a declared and rather informal synergy between the partners, based on the existing complementarity of competences. Post-2023, either a more detailed partnership agreement will have to be continued, or preferably - the rights and obligations of the partners could respectively be embedded into the founding statute/act of a new legal entity: association (sdrujenie in Bulgarian).

The Rules on IP and the Policy for Commercialisation of the Institute of Polymers – BAS have been adopted for the whole activity of the CoC.

The project is also supported by two Boards/Councils:

- A scientific Council of 25 members (mainly connected to the operation of the project and including the leading scientists from the partner Institutions and of the work-packages) and
- An Advisory Board of 15 members that includes members from the external scientific and industrial partners, as well from the State Administration.

This arrangement seems to ensure outreach to most of the relevant stakeholders, but may miss the need to have some independent advice.

The project has an external project team, with a Project Leader supported by 1 Financier, 1 Chief Lawyer, 1 Architect, and expert in EU projects, who convenes meetings of the Scientific Council and, if necessary, joint meetings of Scientific Council and Advisory Board. The expert in EU projects is consulted by the partner directors in the decision-making process.

A specific feature of the Justification management organigram described in the Project is the presence of two complementary internal and external management teams (the external team is planned only for the duration of the project – six years, and its description appears more that of a consultancy than a management team). It would be important to identify the proper tasks and clear arrangement for engaging the external management team so that tasks, rights and responsibilities are not duplicated but competences are clearly complemented.

On a separate note, the identified internal experts that engaged to work for the Centre part time are already employed by one of the partners[294]. Their involvement could be structured either as a secondary employment agreement or as a civil agreement which brings the question of priority between their main employment agreement and the additional one related to CoC.

[294] The key experts are listed in point 10.1 of the Project Justification.

Six Scientific Projects (SPs) have been envisaged (while the "Work Packages" in this particular CoC are more connected with the organisation of the project, page 213 of the Project Justification). Each of the SPs is **interdisciplinary and inter-sectoral in its nature** and is led mainly by one of the partners with the support or collaboration of usually one or two other partners. The six SPs roughly correspond to five thematic "departments" each consisting of several labs and having main reference to one of the partners.

Each partner is said to have clearly defined functions consistent with its area of competence, all partners are **expected to operate in synergy** – a synergetic approach for project management with active interaction and cooperation, exchange of HR and equipment to achieve common objectives.

The following describes the five "Departments":

Department 1 "Agrobiotechnology"

Department 2 "Bioactive natural and synthetic compounds"

Department 3 "Bioactivity of products"

Department 4 "Polymeric nutraceutical and cosmetic formulations"

Department 5 "Formulation, characterization and safety assessment of plant based products"

In principle this organisational structure, which makes good sense from the scientific/technical point of view, should be the longer-term structure of the CoC, and should be reflected in the overall organisational approach, with (as proposed) a **central support team allowing the management of the joint activities and resources.**

Lacking the setting-up of a structure having a single legal identity, the question remains which partner is entrusted and responsible for industry relations, and under what conditions the agreements between third parties and the Centre/its partners are going to be signed. A simple answer could be that all partners should sign such agreements only in case of common involvement and after common approval. The same could be needed for all other management decisions be it agreements for joint research, hiring experts or buying consumables/amenities of the existing expensive equipment. This approach seems workable only in case there are very few common decisions to be discussed and decided between the parties. In case of regular and even intensive activities, which are actually the goal of the project and even the entire programme, unanimous decisions could be time-consuming and sometimes impossible to all parties/ projects/ agreements/ decisions. Moreover, in case the partners need to assume obligations or obtain rights in relation to a contract with any third party (including the Managing Authority) the representatives of each partner should be validly empowered by the respective management bodies of their entities – partners and should expect that such empowerments will be checked by the counterparty, i.e. they would need to be formalised in writing.

The Centre is not sure about the ownership arrangement as well as the division/sharing of revenues between the partners. During the meeting in November 2019 the Centre mentioned three scenarios which we list below with a short comment from our side:

- **If a project is generating revenues:** the revenues would, in the opinion of the CoC be easily shared between the partners (no need for comment here)
- **In contracts with companies where one partner uses equipment of another partner: what should be the arrangement?** In this situation we can say first that there is **no**

difference as to the conditions for involvement of the company. For the latter, it does not matter what the internal arrangements are between the partners. For instance, the company would pay exactly the same price for the service or negotiate the same conditions in any collaboration agreement. Be it in a contract with all participating partners or one partner organisation which already has an arrangement with another one for use of its resources, or be it with the Centre as one legal entity if such exists and has the mandate to conclude agreements with third parties. Clearly, for matters of legal certainly and transparency it is recommended that all partner research organisations, which are to be involved in the said activities, participate in the contract with the company (in case no legal entity exists with the relevant mandate). For this, there can be an internal arrangement (possibly a framework agreement) between the five partner public research organisations (or four if we consider Sofia university one legal entity). **If a legal entity is formed, its statute will stipulate its mandate and how it is to be involved in industry liaison activities.** In any way, the industrial partner/client should be treated by the CoC in a coordinated manner (CoC/its partners speaking in as much as possible in "one voice").

- **In cases of joint project application?** Here, if the partners apply together they would have their separate rights and obligations, but it can be expected that for the application process a coordinated approach is taken (e.g. through the support of a common legal entity for instance). Once again, this depends on 1) whether there is a new legal entity and if yes 2) how much power/competence does this new entity have. We explained in the general part of the report (Chapter 2 Legal Framework), that in Horizon Europe projects there can be a legal entity dedicated only or mostly for coordination in which case the separate research organisations apply themselves. This could be the case if the CoC opts for a *less integrated legal entity* with coordinator functions. If, however, the CoC integrates into a *more integrated legal entity* (which is mandated to set research programmes and lease/manage the infrastructure) then the application for a project would come directly from this joint legal entity.

Taking into account the strong synergies reported below with the Biopharmaceutical laboratory at Sofia Tech Park, the COC should include a structured approach of the activities reflecting the major longer term activities and allowing the explicit leadership of a fixed structure (departments) supporting (e.g. in a matrix approach) a plurality of projects allowing to develop leadership by selected research staff.

The CoC could develop during the project's lifetime, and based on the effective success in attracting funding as a COC, an effective operational structure, with an additional **strong horizontal function dealing with IP protection and use,** staffed by technical people with industrial background. This could be one of the functions of the new association, depending on the willingness of the partners to "transfer" (understanding by "transfer" to converge, concentrate, dedicate, commit and make available resources and not necessarily formally and physically to transfer) within the perimeter of the Centre a number of successful activities already developed in the partners.

Synergies and Complementarities

The Centre states that its conception is consistent with the Biopharmaceutical laboratory complex (BioPharma) constructed within Sofia Tech-Park, so that both infrastructures complement each other and operate in synergy, without duplication of scientific equipment and activities. The Project Justification states that "the STP BioPharma complex is to support the transfer of research, development and innovations to companies and will provide the infrastructure for R&D activities of companies". In our opinion there should be no strict division as is expressed here, but based on

individual projects and closely coordinated strategy and actions especially related to Industry Liaison and Tech Transfer, which will bring added value.

STATE AID RULES

Looking in more detail in the documentation we note that part of the management activities will be outsourced to an external contractor (External Management Team). The external team's role as described in the Justification document resembles mostly assistance with and control of procurements with suppliers, but surprisingly also includes "*Application of the state aid rules and the relevant accounting*". It is not clear if this is meant to be the aid concerning the procurements only or also the operational R&D activities of the research organisations, but in any case the partners in the Centre should **build internal capacities** to interpret and apply EU state aid rules in all their R&D&I actions and activities.

We need to remind that the partners are obliged by the Grant Contract and under EU State Aid law (in case they conduct economic activities) to conduct separate accounting for economic and non-economic activities which will allow the monitoring of capacity usage. We note from the responses to the questionnaire that not all partners have implemented these requirements. See general part of report for more information.

On page 24 of Project Proposal there appears to be a misunderstanding of economic vs. non-economic activities, similar to at least one other Centre. We should make clear that

1) wide dissemination of results through e.g. teaching and publication with open access is not an economic activities;

2) independent R&D and R&D in the context of effective collaboration are also economic activities;

3) public education of large number of specialists (under certain conditions[295]) is also a non-economic activity.

These three categories have been listed as **"economic activities" which should be corrected**. Contract research is a type of research on behalf of undertakings and therefore an economic activity. Please refer to Chapter 4 of the report.

Once again and possibly due to inaccurate translation, as in other Centres, non-economic activity is misunderstood to be the same as "non-for-profit" activity.

TECHNOLOGY TRANSFER AND COMMERCIALISATION

The following is planned under the project documentation at present:

- There will be one TT expert and one IP experts engaged directly for the CoC project; they may receive further support from the TTO of Sofia University or from the JIC at BAS.
- The budget for IP protections is approx. 50.000 BGN, while for dissemination through seminars and conferences approx. 214.000 BGN; for market analysis conducted by external contractor 30.000 BGN are envisaged; for publications of research papers approx. 95.000 BGN. It is not clear, however, how the category "Dissemination of results, IP protection, TT" is listed with 860.000 BGN budgeted eligible costs (page 238 of Justification) since the

[295] See Commission Notice on the notion of State aid as referred to in Article 107(1) of the Treaty on the Functioning of the European Union C/2016/2946.

sum of the above is overall smaller. This amount is split between the partners. The 860.000 could possibly include the costs for business trips – around 300.000 BGN. According to original project documentation, the 30.000 BGN will be spent for a subcontractor for making market analysis/investigation to explore the attitudes of potential consumers.

    - In the opinion of the experts, the seminars should be cheaper (not many resources dedicated as there is other funding support the Centres can rely on) while the patent budget should be at least 100k EUR to begin with and market analysis can be 50k EUR dedicated for **specialised market** reports not general market research that can be performed internally.

- The Project Justification states that Unilever has capacity for, among others, IP management. It is not clear what is meant by this but as a rule the CoC should **build internal capacity** to manage its IP and then it can license IP to third parties including undertakings.

- Page 165 of the Project Justification states that "*for the commercialisation of inventions, utility models and industrial designs trademarks will be used*". We can say here that in order to reach the level where a trademark is successfully licensed to a company, firstly the trademark has to be developed with product portfolio and its own recognizable brand value, normally via spin off companies the research organisations create.

- One of the options for commercialisation of the IP portfolio is listed as "*receiving single payment for the sale of IPR on patents, utility models and trademarks*". We should say here that receiving single payments means actually selling IPR in a one-off transaction and this is not a good practice. IPR should provide a stable source of income if commercialised, not one-off, also because in earlier stages the calculation of the value of the IP cannot be estimated.

The CoC expressed it needs advice how to manage the IPR and whether a dedicated TTO should be created. The CoC plans to develop the TTO only at the last year of the six-year project. We believe that **capacities for TT should be developed from the very beginning of starting the R&D activities.**

As stated above, the Centre lacks qualified personnel in TT. With this in mind, and to minimise additional costs and complexities, the technology and knowledge transfer activities could be carried out by existing offices and capacities of the partners, in the transitional period, but, in perspective, the Centre should evolve an independent capability, to ensure full protection and utilization of its own IP.

At the moment, the Centre has several possibilities and can rely, to an extent on the TTO players involved in the activities of the Centre. These include the Academy of Sciences Joint Innovation Centre (complemented by the two individual institutes of BAS which have their own technology transfer staff and/or office), the TTO of Sofia University responsible for the two faculties involved in the Centre, and the Sofia Tech Park's Biotech Complex which is said to have complementary activities and for the transfer of results to companies.

These organisations (TTOs) can, at least in the beginning of the project development phase, provide the correct skills and knowledge necessary to effectively carry out technology and knowledge transfer activities where necessary. They can also serve to begin training dedicated Centre staff in TT skills.

Last but not least, the CoC, in conducting more "effective collaboration" joint projects with undertakings should plan a strategic approach whereby part (e.g. the open availability) of the IP created is kept within the assets, thus building an own formal IPR portfolio, as opposed to the current focus on performing research on behalf of undertakings (as identified during the field trip and interviews with them in November 2019).

CENTRE SUSTAINABILITY

As to the financial situation we note the following:

- The envisaged costs to implement the research programme for 10 years period are approx. 9.7 million BGN of which approx. 2.2 million for 1) external services and 2) external contractor/project manager (only for the first six years and for the amount of approx. 288.000 BGN).
- The projected total revenues over a period of 15 years from commercialisation are expected to be approx. 800.000 BGN (incl. revenues from patents, licenses, "sale of cultivation resources", while the revenues from knowledge and technology transfer (which only includes provision of trainings) would be 370.000 BGN.
- During the meeting in November 2019, representatives of the CoC, if understood correctly, expressed that about 1 Million per year is the expected income from contract research usually from foreign companies. Companies seem to be ready to pay (more) but to keep the full IPR.

The experts believe that, unless part of the present interactions with industries are made available to and concentrated at the CoC and a specific IPR strategy is implemented to generate income by appropriate protection and management of the IP, the Centre is unlikely to produce sufficient commercial revenue, at least during some time, and there will be the need to ensure the largest part of the sustainability also through recurrent public funding. On the other hand the Centre cannot use more than 20% of its capacity for economic activities[296] and this limits the capability to implement effectively the plan to have 1 Million income per year from contract research, unless this is within a collaborative (non-economic) approach/domain for which there are no capacity limitations.

We made a further reference into the Project Justification and found a discrepancy with the above statement concerning the income from contract research for foreign companies. On page 234 it is states that:

> *"Within the 10-year period it is envisaged that the CoC will generate own revenue which amounts to BGN 8 295 450. They will be assured by project work (81.5%), external use of infrastructure / equipment (11.5%), commercialisation of results of the research (5.3%) and transfer of knowledge and technology (1.7%)."*

It could be that contract research is included in the category of "project work" but even in this case the revenues would be much less than the stated 1 Million. Another possibility is that the representatives meant the total overall revenues from contract research of the lead partners (so not within the framework of the CoC). We tend to consider this option since across the project documentation, the financial plans are separated in groups: one for activities using the equipment within the CoC project and one for activities not using this equipment. Identified risks, needs and challenges.

[296] Research on behalf of undertakings includes contract research and research services (both are economic).

The main risk, lacking effective coordination and longer-term integrations mechanisms, is that of different evolution of the five partners in function of independent interactions, strengths and successes in industrial relationship, all in all resulting in missed opportunities to create added value through joint R&D&I activities.

A risk shared with most other Centres included in this evaluation is the loss of trained personnel, due to limits in salaries as compared with offers from Industries and from abroad, and the difficulty to have specialised industry liaison staff for relations with SMEs.

The CoC expressed there are difficulties in collaborating with local and national SMEs, and in protecting local plant biodiversity. On the latter issue, the participants underline that there may be a risk of not being able to fully develop the possible international market. This is due to possibility that local plants and biological products are (excessively) exploited abroad, which itself is connected to the fact that the *Nagoya Protocol on Fair and Equitable Sharing of Benefits Arising from the Utilisation of genetic resources of plants*[297] within the Convention on Biological Diversity, is claimed to not be effectively applied/enforced in Bulgaria. This issue should be taken over at Government level and aim at more effective enforcement in the international arena.

A specific challenge seems to be that of finding a strong single technical / scientific leadership being able to build on the vision of an integrated Centre while not too subjected to legal constraints.

The main challenge is that of effectively supporting a better positioning of Bulgaria in the value chain of the specific products (producing final products not just exporting row material). A possible important step in this direction is the better implementation and enforcement of the Nagoya protocol (addendum to the United Nations Convention on Biological Diversity).

The longer-term sustainability may be difficult to reach even with a large interaction with industries (as always, even when there are large contracts, the effective margins, which can be dedicated to keeping and building the competences and instruments will be small).

Based on the analysis of (i) internal rules for management of the institutes and faculties – partners and (ii) the provided partnership agreement, becomes visible that the partners do not envisage, on paper, any future development of their relationship after the project. Nevertheless, it was mentioned during meetings that the partners are thinking of creating an association, which is indeed one option as we have discussed above.

As discussed earlier, there is no clear vision for allocation of trained and qualified personnel to a potential common structure of the CoC. It would be necessary to create a clear vision for the common management structure/ principles that could survive the term of the project and its funding (meaning a feasible and effective structure for post-2023 where funding for management costs might have to come from the partners if not from EU funds).

Recommendations

- Define the shared vision: is an integrated capability acceptable and useful for the longer-term?
- Create a legal entity in 'less integrated' model. Setting-up an independent legal entity does not appear as a priority from the available information. It could become an asset if there is

[297] Also known as the Nagoya Protocol on Access and Benefit Sharing (ABS). A quick reference shows that Bulgaria is a full party to the Protocol while some countries in Eastern and Southern Europe have signed it but not ratified it (yet).

success within the project time-frame. Subject to the results of the relationship and interactions between the partners in CoC, the initial legal - contractual structure could be a not-for-profit association/NGO which can help with the promotion and coordination of TT and industry liaison activities, and which could in the long run become a more integrated legal entity with more competences. Partners should develop clear common vision for the future and based on that vision such separate legal entity could be structured/further developed. An NGO/association would enable more coordinated and effective relationship with industry and other partners.

- The involved scientists and specialists (that seem to be difficult to find and keep on permanent basis) must have clear and real opportunities for their longer-term development within the Centre thus allowing them to join and be hired with a clear career perspective in a more permanent (and resource-concentrated) structure. The Centre shall thus build an effective team capable to attract next investments, specialists and to develop the CoC.

- Having in mind that the focus of the CoC is one of the main pillars of development of the leading organisation – the Institute of Organic Chemistry (IOCCP), the need for a common strategy for long-term future development needs to be agreed between the partners. Uncertainty on future developments and especially the lack of perception that CoC is the building brick for **streamlining part of the activities of all partners into a particular direction on the R&D chain "from plant to product"** within a separate new organisational structure, could, in certain scenarios mean that potential IPR or business relationships common to all partners be recognized as sole ownership of the leading organisation. It is highly recommended that partners form a common strategy and structure ideas about their cooperation in more detail for a longer term and outside the scope of the project (i.e. post-2023), so that results from such enormous efforts and capacity brought together could have sustainable result.

- Plan for a strong international advisory for the science and industrial development.

- Focus towards a more structured and strategic connection with relevant industries, helping the SMEs act within a network.

- Invest as soon as possible some available funding to hire a TT staff with real industrial/marketing training, but with technical background.

- Strengthen the attractiveness and retention of critical staff (e.g. setting a legal entity for the purpose of allowing a more flexible hiring and implementation of competitive salaries, but only resort to this type of hiring if generated income makes it sustainable).

ROADMAP ON LONG-TERM SUSTAINABILITY

The Centre builds rather upon existing longer term "contract research-type" of collaborations between individual academic institutions supporting industry-requested activities, than on an effective vision of finding the way as an integrated Centre of Competence to enter more directly into market related activities. The CoC and its partners should aim to further develop the direct (and independent) income channels to support the continuous evolution of both the non-economic and the economic activities. The longer-term collaboration should also be devoted to "effective collaboration" type of joint research with undertakings, in which the research organisation keeps part of the IP/research results created. This also means that the CoC and its partners need to improve their skills for negotiation with industry and for structuring collaboration agreements.

The special situation of Bulgaria as a producer of interesting phyto-products could be, however, the basis for setting-up a Research Centre of international visibility and level, provided a more enterprising longer-term approach is taken. From this point of view, the experts suggest to set-up (also taking advantage of the connection with external partners in other EU countries) an international advisory body which could help to design a step-by step evolution towards a longer-term institutional arrangement allowing for a longer-term sustainability.

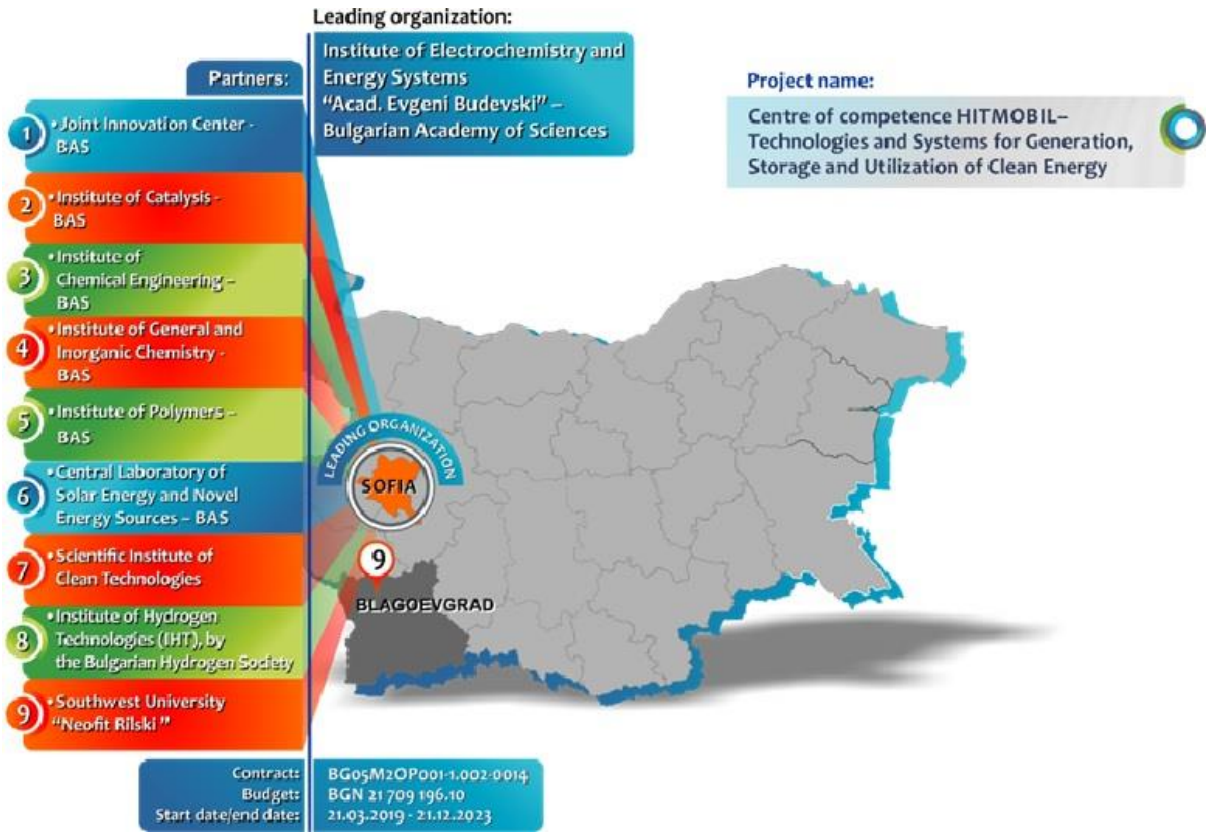
9.14 Centre of Competence "HITMOBIL – Technologies and Systems for Generation, Storage and Utilisation of Clean Energy"

Summary of Centre

Contract: BG05M2OP001-1.002-014 C01

Budget: 21,709,196.10 BGN

Start / end date: 21.03.2019 – 21.12.2023



The project is coordinated by the Institute of Electrochemistry and Energy Systems Generation of BAS, with the participation of the following partners: Joint Innovation Centre of BAS, five other BAS research institutes/units (SW University Neofit Rilski and two not-for-profit organisations /NGOs: Scientific Institute of Clean Technologies (SICT) and Institute for Hydrogen technologies (IHT, of the BG Hydrogen Society). Its focus is on Clean Technologies and on Hydrogen Technologies; its aim is to build an infrastructure for applied research and technology development in Energy storage, Renewables, and Mobility.

In principle, the CoC brings together a combination of energy and chemical scientific disciplines, towards electric mobility and other advanced uses of energy.

The project has a large component towards building infrastructure and equipment. To be noted is that more than 40% of infrastructure and equipment investment is assigned to the private NGO partner Scientific Institute of Clean Technologies (SICT) whilst the rest of the laboratory equipment is planned to be distributed among the other, mostly public research partners.

CURRENT STATUS OF CENTRE

Analysis of questionnaire and interview

After analysing the questionnaire (three responses), the following elements are highlighted:

- The coordinator/leading organisation is the central element and in charge of main tasks and operates with an Executive Board with three members.
- The CoC is not set-up as a legal entity and the plan expressed by the respondents is to keep the present arrangement as the final set-up. One of the respondents expressed the opinion that there may not be a transition to a legal entity, but if this should be set-up, it should have control of the budget, while property and staff should still be distributed in the partners).
- Number of staff (in the leading organisation): 40 research, 15 technical, 7 admin. Annual budget for research 63K€. The leading organisation has (before the Centre is operating) an average 4-5 projects with industry per year.
- One specific request by the respondents is to be provided with templates for research projects with/for industry.
    - Here, the Sample agreements for research and development cooperation from Germany could be useful.[298] Clearly, these templates have to be adjusted and adapted to the Bulgarian context.
- The potential income estimated from commercial activities is equal to 10-15% of the overall operational costs. TT is carried out by one of the BAS partners (which has one dedicated FTE staff).
- Indicate the current very low availability of translational funding as a challenge.

From the in-person meetings (especially the one in February 2020) with the CoC partners, we observed/concluded the following:

[298] https://www.bmwi.de/Redaktion/EN/Publikationen/sample-agreements-for-research-and-development-cooperation.html

- There is a well thought-out and defined structure of activities in modules with management at different levels. The six Work Packages (WPs) resemble the six laboratories. The first four WPs/Labs will work on lower TRLs and the 5th and the 6th WPs/Labs are to further develop the initial research results with demonstration projects (especially the lab complex constructed by the SICT at the outskirts of Sofia).

- Somewhat uncommon, as compared to other CoCs and CoEs, is the full partnership of one of the two private NGOs, the SICT, set-up by a group of six individuals and one private entity, with a major part of the overall project's budget allocated to implementation of its infrastructure. The declared scope of this infrastructure is that this will allow tests at larger power requirements, outside town.

- The perspective of the sustainability of this private partner NGO/not-for-profit after the end of the funding phase (post-2023) and how its management and financial viability will be related to the public partners is somewhat unclear. The equipment and infrastructure incl. the new building is to remain ownership of the SICT private association after 2023 with the BAS institute partners having access for another few years until 2027. During the meeting, some of the experts suggested/asked whether BAS could become owner of all infrastructure funded under the CoC project. The MA Agency also expressly pointed out risks that the SICT could start conducting own activities with the funded infrastructure/equipment after 2027 which are not part of the CoC project. There are also questions of possible insolvency of the NGO/not-for-profit organisation and the consequences for its assets thereafter (we look into this in more detail below).

- Representatives expressed that a possible "conflict of interests" arises in the future operations of the BAS institute(s) within the framework of the CoC. This was said to arise out of the different contracts, projects and activities of the independent institutes (or at least one of the BAS institute) vis-à-vis the respective interests/contracts/projects/activities within the framework of the CoC project. Question is where and to what extent these should "overlap" or alternatively where there should be a clear demarcation. The possible creation of a legal entity is also believed to have an impact.

- The role of the other private association (but with a somewhat stronger public scope) is also unclear, adding up to the reasons for which there has been reference to possible conflicting interests. The IHT/BG H2 Society that is an entity with a long-standing presence in the European and Bulgarian Hydrogen Technologies scene gets a much smaller amount of funding compared to SICT.

- The project shows a significant delay in implementation according to the progress report presented by the Managing Authority in Q1 2020 (<1% expenditure absorption).

Summary of expressed choices and vision

The technical and scientific vision of the centre is well founded and clear on previous experience of the leading organisation, however a commitment towards setting-up a new legal entity with all partners in the project is still lacking.

Another clear decision made is to focus a sizeable amount of the total available budget to build the testing facility, allowing higher power tests by a dedicated private entity outside town, whilst strengthening the instrumental capabilities for less-market-oriented activities within the BAS research institutes.

The way the project is organised is quite distinct along three lines, in terms of technology and TRL focus, i.e:

a) M1 lab for Industrial Research in Batteries, Photovoltaic Generators, Hydrogen & Fuel Cells with TRL level 3-6, with 4 laboratories in existing buildings of university and BAS partners,

b) M2 experimental development for TRL > 4 for chemical power sources for energy storage and integral energy systems in 2 laboratories of University and BAS and,

c) the detached new laboratories at SICT new building (L6) for integral energy systems and demonstration of combinations, of Solar / wind and storage for TRL 6 – 8;

Identified risks, needs, and challenges

The choice to have a distinction between institutional activities and private activities could lead to two diverse scenarios of evolution, of which one would tend to fragmentation if appropriate measures are not taken in advance. We have outlined the scenarios and their challenges below:

1. One scenario, which may be desirable but challenging, is that the three groups of activities are really integrated and coherent along the TRL climax and lead the Bulgarian advanced renewables sector from R&D to Commercial Innovations.

2. The other, less desirable scenario is that the three groups of activities evolve in a rather independent way along the three lines of TRL focus without a direct and continuous exchange. They would have fragmented external users and funding opportunities. If only a few external paying users or applied projects are available, this may lead to issues with centre sustainability at the end of the project implementation and financial support period, when the need for sustainability of operation costs will become critical. There may also be the question of the sustainability of the costs of the large installations outside the BAS with the risk of insolvency of the main private partner (SICT).

Other more generic risks and needs

The main risk currently for the centre is not being able to develop genuine innovation and technological results by being involved and dispersed in many parallel technological sectors (several RES technologies, storage technologies), which have rather been the primary focus of big private national and multinational institutes in developed countries. There is a further negative impact on the creation of a critical mass of coherent teams and infrastructures needed in order to become a recognisable player in the international scene.

In addition, we have identified the following:

- Risk of future tensions between private and public ownership: especially when funding the operational costs and the relationship between the two sides may become more like a customer/provider, than an integrated centre.

- Risk of a lack of budget security and integration of the staff from different institutes if longer-term relationships within the 7 participating BAS institutes are not better defined internally.

- Difficulty and need to attract and retain high quality staff if the salaries are within the public administration salary-grid and remain low.

- Need to relate effectively as a single entity with appropriate critical mass to large joint actions in energy aspects at EU level.

- Risk to need to sustain the operation costs of the private partner entity from public funding (in particular SICT - in case of failure to develop a sustainable R&D operation at the SICT building, equipment and site).
- Risk that the EU-funded acquired assets (infrastructure, equipment) may be lost to creditors in case of insolvency of any of the participating NGOs if they are the owners as legal entities.

LONG-TERM VISION AND RECOMMENDATIONS FOR ITS FULFILMENT

The Vision

The CoC proposes to be active on the current emerging sectors in energy: batteries for energy storage for electric vehicles, applications of hydrogen technologies, catalysis in biofuels, chemical power-based energy storage.

Recommendations, synergies with European and national initiatives

In order to be successful and sustainable, this long-term vision requires that the CoC have the capability to become a main player in the European landscape and to attract enough resources to allow the dynamic response which this field will require. The project partners, if acting together with a recognisable longer-term identity, may achieve this goal. However, this requires a stronger motivation to integrate in formal terms and evolve in the direction of an integrated entity, both in organisational and in legal frame, as we outlined below.

The CoC HITMOBIL would benefit from following and complying with EU level initiatives on storage and hydrogen, as well as electromobility, when it enters international platforms.

Battery 2030+[299] is the EU long-term roadmap for development of batteries for the future. The battery market is projected to develop into a 250 billion Euro market on yearly basis from 2025 and onwards. The European Battery Alliance (business and R&D stakeholders in this sector) was launched by the European Commission and issued the 10-year visionary research programme that invites European stakeholders to participate in the various components of the initiative. These include new chemical technologies in storage, disruptive technologies in the storage value chain, leveraging on advances of enabling technologies such as AI, Big data, sensors, IOT, robotics, among others. It is evident from this multi-disciplinarity in storage that HITMOBIL should not only join the European partnership, but should also enhance its relationship and cooperation with other CoCs and CoEs that serve the respective enabling technologies to overcome the critical mass issue outlined above.

Hydrogen Europe and the Consortium for Hydrogen Fuel cells technology promotion in Europe is a PPP of 160 of Europe's top hydrogen technology related industrial partners with the research community. It takes the form of a Joint Undertaking (JU) under the auspices of the European Commission. The FCH JU[300] drives a funding of 1.3 billion euro to accelerate the introduction to the market of clean technologies in energy and transport. In contrast to Battery 2030+, where a critical mass of R&D and business resources are needed for development, the CoC is in a perfect position to become the Bulgarian partner of the JU. In this case, technology transfer and dissemination is more important.

[299] www.battery2030.eu
[300] www.fch.europa.eu

A similar European partnership where HITMOBIL could have a rather swift entry into the European technology, electromobility platforms, Hubject[301], that unites 600 international partners involved in development and promotion of electric vehicles charging technologies.

The vision of the centre should be adapted towards a more specific one related to the position it aims to win within the value chain of the clean energy research scene within Bulgaria and the EU. It could be, for example, a European level test bed and demonstration facility. Just being active in a wide range of technologies without specifying what is the expected added value of the CoC, and given the huge R&D resources invested in these sectors worldwide, is weakening the centre's message to stakeholders and to the rest of the relevant EU community.

Legal Framework of the Centre

Current situation and Recommendations

The current legal framework is based and oriented mainly on supporting the implementation phase of the funded project, but this does not ensure the visibility and longer term strategic outlook needed in the operation phase and capable to fulfil the continuity needed to achieve the long-term vision.

Taking into account how this long-term vision should be implemented and the specific potential for applied research, as well as the previously mentioned risks induced by dispersion in very heavily resource based emerging sectors, the Centre should aim for a legal framework allowing as much as possible its integration into a unique entity able to perform both public and commercial activities (eventually considering the future possibility of a single site, to achieve possible infrastructural synergies). Ideally, this entity shall also be able to attract and operate on the basis of own income, investments, and contributions.

The Centre should be formed as a not for profit legal entity - **foundation in public interest** - with its founding members being the initial project partners. The legal framework should allow (within the acceptable limits) commercial activities alongside the main research and development activities.

One issue that has to be taken into account while finalising the legal form and the founding act/statute and rules of the new legal entity is in particular the part that refers to ownership and use of tangible assets (buildings and equipment), developed by SICT.

Attention should be dedicated to the scenario in the unfortunate case that SICT ceases to operate for any reason (e.g. financial distress, disagreement of partnership etc.), and that this leads to its closure/liquidation. In contrast to public research entities, where the State guarantees continuity, an NGO is subject to a specific legal regime under the national Law for Not-For-Profit Legal Entities and for certain aspects also to commercial law. Below an overview and insight into the situation of SICT on the one hand compared to the national Law/Act on the other (both for entities in private vs. entities in public interest) is presented and commented.

The SICT Association beneficiary within the CoC and its Statute	**National Law/Act on Not-For-Profit legal entities in the cases of public and of private interest**
• Form: Association in private interest.	The law (act) provides mandatory minimal requirements that have to be observed by all not-

[301] www.hubject.com

• Contracted amount to receive under the CoC project: either 7.4 or 9.4 million BGN (depending on the source) • Statute: according to its Statute the association cannot be transformed into one in public interest. • Main activity: Independent fundamental and applied research, experimental development in the thematic fields clean technologies, renewable energy sources. • Properties/Assets after dissolution/liquidation of the association: The Statute provides that the property/assets of the association cannot in any way be transferred to the list of persons prohibited to receive the properties/assets under the Law (actually resembling the section of the national Law/Act for not-for-profits registered in public interest, see column on the right). The Statute further provides that the properties/assets are to be transferred to another non-for-profit entity with the same or similar activity by a court order. If this does not happen, the properties/assets are transferred to the local municipality which is to make them available to serve an activity in public interest that is as close as possible to the goals/activity of the liquidated entity.	for-profit legal entities. As a rule, there are less requirements for entities in private interest than for the ones in public interest. <u>Liquidation and distribution of assets for entities in private interest/benefit</u>: the assets remaining after the satisfaction/compensation of the creditors are distributed according to the statute/act/highest organ in the structure of the legal entity. If no persons exist to take over the remaining assets or these persons are not defined, then the assets go to the municipality to serve an activity as close as possible. <u>Liquidation and distribution of assets for entities in public interest/benefit:</u> The law stipulates that at dissolution/liquidation of the association the monetary, moveable and immovable assets it possesses should first be used to satisfy the creditors of the legal entity. The list of persons who are strictly prohibited to receive the assets includes: ▪ the founders and the members (also former) of the not-for-profit entity, ▪ its current and former management and employees, ▪ the liquidators, ▪ spouses and relatives of the persons listed previously. ▪ legal entities/persons in which the above listed persons participate in the management or can exercise decisive influence If the statute of the legal entity in public interest does not provide specific arrangement [that are compliant with the previous requirement], the assets are transferred by court order to a not-for-profit in public interest with the same or similar activity. If the assets are however not allocated in the above-prescribed way, they are transferred to the local municipality, which makes them available/utilizes them for an activity as close as possible to the one of the liquidated entity. Note: this final provision in the Law on the transfer to the municipality is the same as the one included in the Statute (see left column).
Comment: The SICT Association is registered in private interest/benefit. Although *its statute* forbids the persons involved from receiving its assets after its liquidation (referring to the full list of	

involved/connected physical and legal persons in the specific section of the Law for not-for-profit entities in public interest), *this does not guarantee* that the statute of SICT will not be changed[302] at any time in the future by the respective organs of the SICT legal entity to stipulate that in the very unfortunate case of liquidation the assets be distributed to specific (including connected) persons or founders/members of the association.

Furthermore, all NGO entities (regardless of whether in public or private interest) have to fulfil the needs of all their creditors, if necessary with their own assets, creating risks for losing the EU-funded infrastructure and equipment.

The potential risks and complex situation makes it even more pressing for this Centre to transform into a clearly defined single legal entity and not remain as a loose consortium partnership with a large private partner beneficiary. This means that, to avoid the risk that the assets acquired by SICT under the CoC project be lost from the public domain in the unfortunate scenario of a liquidation, appropriate restructuring actions should be taken, as compared to the present approach. The ownership of the research infrastructure and equipment by public partners will in any case be kept by the original public partner (BAS Institutes, University), while it is recommended that SICT **transfers the assets & receivables including the full research infrastructure and new building to a foundation in public interest which SICT and the other partners will establish jointly.**

Examples of foundations that operate in the R&D&I sector include:

- ✓ Istituto Italiano di Tecnologia.[303] It is a foundation financed by the State to conduct scientific research in the public interest, for the purpose of technological development.
    - *In 2018, State financing received through the Ministry of Economy and Finance of Italy amounted to approximately EUR 91 million (deducted spending review amount), of which 80% was allocated to scientific and technological activities. External resources directly acquired by the Foundation, from 2006 to 30/04/2020, amounted to approximately EUR 317 million of which EUR 233 million were obtained from competitive projects, EUR 65 million from commercial projects and EUR 19 million as in-kind contributions.*
- ✓ Edmund Mach Foundation[304], Italy. It promotes and carries out research, scientific experiments, education and training activities as well as provides technical assistance and services to companies.
- ✓ Foundation for Research and Technology - Hellas (FORTH), Greece.[305] It conducts specialized scientific research in strategic high-added value sectors, focusing on interdisciplinary research and development (R&D) activities in various areas.
- ✓ CERCA Centres Foundations, Spain. See more information in Chapter 7 on Sustainability.

[302] It is virtually impossible to limit the amendment of the statute of an NGO - association in private benefit as it would be an infringement of the applicable freedom provided in the legislation and would not be more enforceable than a simple contractual provision, i.e. is the management of SICT decides to amend its statute nobody could oppose it from a corporate point of view (the court will not declare the amendment void), but could rather seek proving damages for breach of contractual provisions. Furthermore, after 2027/2028 the partner beneficiaries are not obliged anymore by the Grant Contracts to continue their activities within the framework of the Centre project.

[303] https://www.iit.it

[304] https://www.fmach.it/eng

[305] https://www.forth.gr

Until now, we have mainly discussed associations as a relevant form for the legal entity of most other Centres, but there is another legal structure designed specifically for assigning funds and assets for dedicated purpose in concrete field, and this is the **foundation**. A foundation seems to be the more appropriate option for this particular Centre HITMOBIL due to the existence of a private partner beneficiary of significant public funds for research infrastructure. Foundation is one option that can serve as a "trust" for holding the assets and as opposed to associations; it does not have members while it can receive contributions from its founders as well as from State resources. Public funding is attributable to NGOs, including foundations in public interest. Foundations can be created for a certain period and they are usually trusted structures, because they have neither shareholders nor members *per se*, but only management that is appointed and acts under the rules approved by the foundation. A foundation in public benefit could also be subject to liquidation (same rules apply as for association), but the founding act of a foundation can provide mandatory provisions that the assets may not be transferred by its management but instead should remain with the public domain and/or be used for particular purposes. Having said that, a foundation in public interest/benefit could be used both for public funding and for preservation in the public domain of the valuable immovable property (research infrastructure) acquired by the private partner within the CoC HITMOBIL project. Rules for using and managing the foundation could be detailed and set by the founder CoC members based on their intentions and practise during the implementation of the project (before 2023). The main difference between the foundation and the association is that the association is arranged around its members, their intentions and uniting their joint efforts as well as regulating their interests, while a **foundation is based on its assets and funds** and there is lower risk for its liquidation in line with personal interest and long-term private ambitions. Suggestion therefore could be that all valuable **assets acquired by SICT under the CoC project shall be contributed to a foundation managed by CoC members, under a founding act/statute and rules matching the target of the CoC and possibly formulated with the support of the Managing Authority.**

Although a foundation can have commercial activities connected to its main activities, if having only the foundation is considered insufficient and/or insufficiently flexible for one reason or another by the partners, then the partner organisations may decide to create one additional legal entity in the form of an association or for particular activities – also a commercial company (such as for TT activities or a spin-off).

- Note: We have recommended an association for most Centres that wish to establish a joint legal entity. Then, in principle, we recognise that a more flexible and commercially oriented structure able to accommodate a broader range of business initiatives and even public – private partnerships is the simple limited liability company structure which could generate profits, attract investments and private funding, enter agreements and hire its own business-oriented personnel. A limited liability company allows for the full spectrum of commercial activities and in case of its liquidation or insolvency none of its shareholders will be held liable.

The foundation on the one hand and the other legal entity if such is created (be it a limited liability company or alternatively an association) on the other, shall conclude an agreement for cooperation in a suitable contractual form. The assets of the foundations shall be used by the CoC members in line with the intended R&D&I purposes. Depending on the competences and role of the addition legal entity (next to the foundation), it can contribute to the funds of the foundation in cases of successful results in any of its multiple activities.

Then, a suitable arrangement should be constructed from a legal and financial perspective:

- For the use of the research infrastructure of the foundation (which had already been contributed by partner SICT to the foundation), as well as
- For the availability and use of the private land upon which this research infrastructure has been built and installed (respectively the particular land pieces occupied by the buildings and by equipment purchased within the CoC project; which is probably smaller than the approx. 7000 sq. meters total private land area of SICT), so that SICT would utilise the rest of this land as it wishes. This could include for instance a long-term lease (e.g. 20-25 years) at a symbolic[306] rent value to be paid by the CoC to the land owners (partner SICT). The implication and possibilities of the different property rights and options in the Bulgarian system should be further explored, in particular the right to hold buildings on another person's land, easements and/or special pledges.

Liquidation/Dissolving of the Foundation: In case of liquidation of the future HITMOBIL foundation the main principle to be followed is that all assets in its possession should go in the public domain. Additional to this aspect and as mentioned in the table, the possibility should be taken into account, that creditors will have access to the assets of the not-for-profit CoC legal entity in case business goes wrong (the creditors normally have a priority, subject to particular/applicable legislation). Thus, the founding act of the foundation should stipulate in a clear and non-modifiable way that in case of liquidation/dissolving its assets go in the public domain.

Another option, which was raised during the meetings with the CoC representatives, is a direct transfer of the SICT's assets to the Academy of Sciences. This could be the case if the creation of a more integrated new legal entity for the CoC is not found desirable and it is decided to keep the present contractual approach based on a partnership agreement – i.e. if the founding partners prefer a lower level of integration of the activities of the CoC. A more detailed partnership agreement will be necessary to govern the relationships and the corresponding financial implications. However, in relation to this "direct transfer" scenario, the experts are of the opinion that 1) it may not serve to create the desired value-added out of the CoC partnership and 2) that it may not be (easily) enforceable to oblige the private partner beneficiary to transfer the publically-funded assets under the CoC project in such way, considering that the funding has already been contracted.

Finally yet importantly, it must also be noted that the national Science Fund beneficiaries are "*legal entities which perform research in accordance with national legislation*".

ORGANISATIONAL FRAMEWORK

Suggestions based on best practices

We carried out a review of some key European renewable energy institutes, including:

i. European Institute for Energy Research in Karlsruhe (a partnership of KIT University and EDF Energy Company);[307]

[306] Even if based on market rates (e.g. land plots in the area of Vladaya). The experts believe this is within the capacity of CoC to take care of in the sustainability period.
Another formula could be that CoC pays an overhead to SICT for all projects implemented in SICT facilities (again during the sustainability period), and which corresponds both to rent as well as to any maintenance costs of SICT facilities used by the new projects of the CoC.

[307] www.eifer.kit.edu

ii. The Spanish National Renewable Energy Centre CENER[308] partnership of Ministry of Technology Science & Universities, Regional Government of Navarra and National research Institute CIEMAT;

iii. EURAC Research[309], a private research centre in Bolzano Italy;

iv. The Greek Non-profit Research and Applications Institute on Renewable and Energy Use and Optimization CRES[310];

v. The Center for Energy Storage of Fraunhofer[311]; and the American Joint Center for Energy Storage Research[312].

We found that, regardless of the exact details of the ownership structure, all the above centres share several common characteristics, listed below:

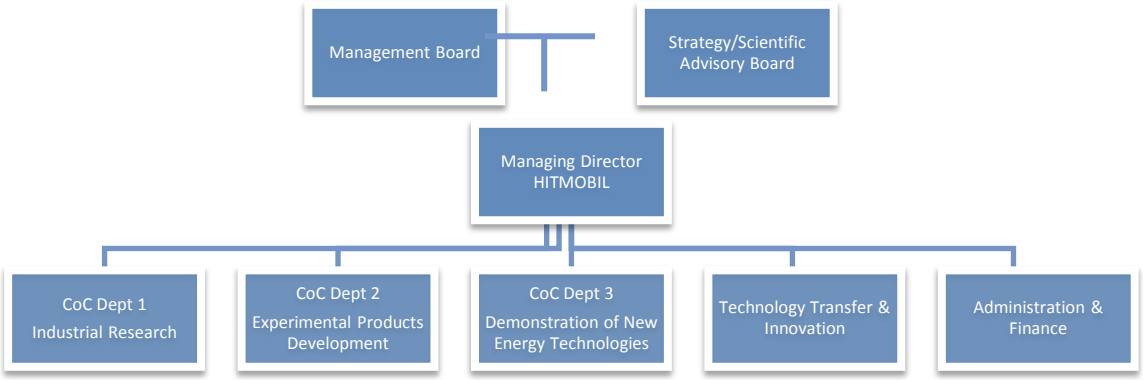
- Interdisciplinarity between all means of renewable (PV, Wind, Biomass), storage, hydrogen and distributed generation management.
- They have activities along the whole spectrum of the knowledge chain (i.e. research, technology development, technology proof and demonstration, technical evaluations of industrial products, technology transfer, training).
- They target multiple sources of income with varied focus, based on strategy and specific competence:
    - EU programmes (HORIZON, Interreg, Erasmus+, Intelligent Energy Europe)
    - National Programmes
    - National Government Advise and Technical Assistance programmes in developing renewable / energy optimisation projects and frameworks
    - Testing of Industrial products and simulation
    - Consulting, technology transfer and technology advice
    - Formal education and VET.
- All of them aim towards self-sustainability and independence from government (annual block) funding.

As per the original plans of the CoC, HITMOBIL planned to apply a "federal" type management of the research activities, including the plan to build the Centre, which is believed to be suitable for the distributed infrastructure, including several partner institutions. According to project documentation, the general science management is to be carried out by a Science Management Team (SMT), comprised of two executive bodies: Executive Board (EB) and Board of Managers (BM), supported by the Advisory Board.

Organisationally, the CoC could have 3 divisions organized around the three well- identified and functional activities (industrial research, experimental products development, new energy

[308] www.cener.com
[309] www.eurac.edu
[310] www.cres.gr
[311] www.umsicht-sure.fraunhofer.de
[312] www.jcesr.org

technologies demonstration) with interdisciplinary approach, along with a technology transfer unit and an administration and finance unit, as shown.



The premises and equipment of the three groups of laboratories could be made available for use to the new entity of the CoC HITMOBIL.

Comparison with another CoC in Bulgaria in the environment domain

The model proposed is analogous to that of the CoC Clean & Circle which, as in the case of HITMOBIL CoC, is also attending a sector with growing opportunities and being the Centre of European Green Deal.

The legal entity, in this case, could be closer to a private sector Research and Applications Institute than that of public nature, as the one proposed for Clean & Circle. The mandate of Clean & Circle on environment might be more of public interest than the target of HITMOBIL which is active in a sector (energy) that is totally under liberalization and privatization in EU.

The reason for proposing the establishment of a non-profit (or not-for-profit) private organization (in contrast to Clean & Circle) is that the Energy sector is totally liberalized in Europe and there are many more chances in working with private markets. This is different in the sector of environment and sustainable economy, where the state and public interests are still guiding regulatory framework and technology solutions more than the private one, and potential for working with public budgets as a final beneficiary or working as a contractor are equal.

Research Infrastructure

The research infrastructure, as detailed in the proposal with existing capabilities and staff, as well as established collaborations with industry, seems well fit for the purpose to develop the vision of the Centre once the appropriate legal and organisational aspects are implemented.

It must be noted that for Lab 5 and Lab 6 no ready-made commercial products were found to be available, so the design and installation are described as “an innovation in itself” that will ensure the uniqueness of the laboratories. Thus, much of the equipment is custom made and designed by HITMOBIL.

Overview of Lab No 6 and new building to be constructed at the outskirts of Sofia (Vladaya), by partner SICT

- Source of information: Financial Analysis and Financial Justification documents.
- The site that will accommodate Laboratory 6 "Integrated Energy Systems" will have a total land area of 6991 sq.m.
- Ground works and construction budget is approx. 2 million BGN. Of this, the total value of the preparatory works on the land area/terrain is approx. 1.4 million BGN (of which approx. 1 million for "reinforcement of the foundation under the equipment".
- The equipment costs are approx. 4.5 million BGN of which major parts are wind generator systems and storage systems.
- The building itself is not large and will have 400sq. meters built area the construction of which will costs approx. 600k BGN.

Monitoring mechanisms of the performance and recommendations

Monitoring of a centre of this kind, which includes applied research and transfer to industry, needs to be based on different instruments helping management (and stakeholders) assess the effectiveness of the use of the available resources and how the "market" and possible commercial value is developed. The Key Performance Indicators (e.g. the number of external users per year, level of own income generated towards break even and sustainability vs overall annual expenditure budget, number of new applied research contracts/tech demonstration contracts etc.) which are a good instrument for the management should be integrated with impact indicators (e.g. the number of new SMEs which have been generated in Bulgaria thanks to the innovations and training introduced by the CoC, high level researchers jobs created, value of technology related exports based on technologies developed within CoC) which are good also for the policy makers. The use of indicators is not, however, self-fulfilling. The real driver of quality and for monitoring success, we believe, can only be ensured by having to report to one or more Independent Advisory Committees, possibly of international level, capable of evaluating and giving advice on both the research and industrial aspects. The appropriate advice can also help to implement an effective **market-oriented approach** and avoid the evolution of a purely formal and ineffective strategy (e.g. by investing too much in the protection of IPR instead of realizing its economic potential).

Other monitoring mechanisms (e.g. independent audit or a Financial and administrative Committee) which are normally implemented when dealing with a mix of public and private contributions and income, should help management to develop the most transparent and appropriate methodologies of accounting and reporting.

Accounting and reporting, if transparent and developed in compliance with international standards, can help avoid possible issues in the misuse of EU funding, as well as any excessively bureaucratical interpretation of issues connected to procurement and/or State aid rules.

STATE AID RULES

As partners in the CoC project, all parties agreed with the standard requirements for the operation of the infrastructure (applied to all Centres and referring to the Framework for State Aid in R&D&I) and committed to have the status of "an organization for scientific research and dissemination of knowledge".

In parts of the project documentation including Project Proposal and Partnership Agreement, the CoC partners commit that within 5 years from receiving the final payment (i.e. 2023 plus 5 = year

2028) they will not change the ownership of the assets received and infrastructure built. However, in other documents, in particular the Grant Contract, the partner beneficiary organisations are obliged not to transfer the assets until the end of the amortisation period of the infrastructure, which is calculated to be 15 years.[313] Below we give an overview of this apparent discrepancy.

Table: Commitments, requirements and conditions related to ownerships

References to amortisation period	**References to +5 year sustainability period**
Template/model Grant Contract with beneficiries: Art. 6.1 of the template Grant Contract refers to the **amortisation period** of the infrastructure as the relevant period in which the ownership (and/or the main purpose of the RI) should not be changed: *"…the Beneficiary shall not initiate any change of ownership of the infrastructure […] and / or of its purpose for the period until its amortisation which shall result in non-compliance with the provisions of item 20 of the Framework and item 13.1 of the Guidelines for Applicants."*	The Project Proposal, page 32, provides that: *"The CC guarantees that **within 5 years** from receiving the final payment will not change the ownership of the infrastructure built."* The Partnership Agreement states in Article 1 the following: *"The Parties to the agreement agree as follows:* *The Parties […] agree with the submitted Project Proposal and the budget, in compliance with which they shall observe the principles of good partnership."* The template Grant Contract states in Art. 1.6. that: *The Beneficiary shall implement the project under Annex II in accordance with the approved project proposal […].* Finally, it was understood that "Annex 1" to Article 5 of the Partnership Agreement contains a commitment that the Centre will not change/transfer the ownership of the infrastructure within five years of the final payment possibly giving rise to an undue benefit to a company or a public organisation.[314]

[313] The life cycle of the HITMOBIL project is calculated to be 15 years in total (6 + 9). The Financial Analysis Report states the following:
The projected investments in fixed assets should be amortized upon completion of the project. Over the forecast period - 15 years. When calculating the residual value of the project, a linear method of accruing amortization is used, with the amortization rate calculated based on the economic depreciation of the assets. The accepted norm for economic depreciation is 11% for the equipment and other services directly related to the implementation of the project. The basis for accepting this amortization rate is the fact that the economic life of the investment is within 15 years, with only maintenance costs being charged on it.
During the last year of the reporting period, earnings from the residual value of the assets are projected. Their amount is determined by the value of the investment multiplied by the historical cost after deduction of the corresponding depreciation charges. As at the date of preparation of the analysis, the residual value amounts to approximately BGN 239,982.
[314] Note: This Annex was not part of the document package submitted to the experts. The Managing Authority explained that it is an additional agreement and does not form part of the mandatory provisions of the model partnership contract.

Annex I (General Conditions) of the Grant Contract states in Art. 1.8 (seemingly repeating Art. 71 of Regulation 1303/2013) that:

> *"In the case of projects involving investment, including infrastructure investment, within five years from the final payment to the Beneficiary or within the time period specified in the State aid rules (where applicable), it shall not be subject to:*
>
> *[…] b) change in ownership of an item of infrastructure which gives to a firm or a public body an undue advantage; […]"*

Considering the above discrepancy between the different project documents, it is strongly recommended that the **Managing Authority ensure legal certainty** both:

1. in the relations MA – beneficiaries, as well as
2. in the relations between the partner beneficiaries, to the extent possible

Overall, the Managing Authority, after a consultation with the national competition authorities, should support and closely monitor the situation and development of HITMOBIL CoC and its partners until the full depreciation/amortisation of the assets and infrastructure. Actions forward could include options for restructuring and/or amendments of contracts and agreements as appropriate (see the previous sections). This should be done to prevent the undesirable scenario that after 2028 publicly funded assets that have not depreciated (research infrastructure, buildings and equipment) are operated not in compliance with State aid rules (and possibly also not for the purposes of the HITMOBIL CoC project, although this is not a requirement under the Grant Contract as the latter covers only the +5 years sustainability period).

In terms of EU State Aid law and also from sustainability perspective, this seems to be a rather unique situation for the private partner beneficiaries. The funding regime does not fall under the GBER Regulation and instead the CoC /its founding partners have committed to operate in compliance with the rules and principles laid down in the Framework for State Aid in R&D&I. In particular they have committed to limit their economic activities to be ancillary and take maximum 20% of the capacity. This means that all partners including the private association SICT will have to observe state aid rules in full (see Chapter 4 on State Aid in the general part of this report). The rules, including the limitation of 20% maximum usage of the capacity for economic activities together with the requirement that the economic activities be "ancillary", will continue to apply also after the +5 years sustainability period.

The following case, concerning the legitimate expectation of beneficiaries of aid as well as the role of national authorities, could be useful as a reference: *Eesti Pagar AS v. Ettevõtluse Arendamise Sihtasutus* (2019)[315], also fully available in Bulgarian language.

Monitoring of usage and access to external organisations

Each partner committed to introduce unified tracing system for the utilisation of the infrastructure under specific conditions. The system developed within the project is claimed to ensure that associated partners or non-profit organizations partners in CoC HITMOBIL, do not receive preferential access to research infrastructure and research results at more advantageous conditions.

[315] Case C-349/17, Eesti Pagar AS v. Ettevõtluse Arendamise Sihtasutus (2019), C: 2019:17, Judgment of the Court (Grand Chamber) of 5 March 2019.

We looked into the Policy for Access of External Organisations to equipment "for the period of realisation of the CoC project". We must remind that even after the six years project funding time, the same requirements will remain valid in relation to the operation of the infrastructure until its full amortization/depreciation. Also, the Policy for Access currently contains references to "for profit" and "not-for-profit" activities but it does not differentiate between economic and non-economic activities within the meaning of EU State Aid rules in R&D&I.

Technology Transfer and Commercialisation

We should start by saying that the budget envisaged under the CoC project for IP protection is approx. 110.000 BGN. The activities TT and IP protection are to be taken care of by the Joint Innovation Centre (JIC-BAS) which is even included as a formal partner in the consortium partnership (this is not normally the case for most other centres with BAS participation). The knowledge and technology transfer are not going to be assigned to an external contractor, but are planned to be executed by the association "Office of Technology Transfer – PROINO", created by JIC.

Clearly, there is a need of a formal unit with staff clearly tasked to explore and develop a TT strategy connecting market development and innovation capabilities. This requires the capability of hiring people with the right expertise and whose performance and rewards are directly connected to acquired market share. In addition, it is essential that a strategy for optimising investment in TT and commercialisation is developed, especially when considering the emerging and commercial nature of this Centre which is competing with global private and public groups.

A viable option, given the investment of the project in state of the art research and technological platforms for RES and Storage, could be that HITMOBIL acts as a high level test bed / demonstration facility and TT centre itself for the respective technologies. It could work (and especially the facility under development by SICT) as a testing and demonstration facility for the cleantech market not only for technologies developed within CoC HITMOBIL, but also by other CoCs and CoEs in the same or complementary sectors, as well as other Clean Energy Research Centers from other EU Countries.

As per the project documentation, a "spin" (off) enterprise is planned to be created with activity directed towards demonstrations and implementation of new technologies in the field of accumulation and conversion of energy. One possible aspect which deserves attention and specific funding are Proof of Concept (PoC) demonstrators developed in the CoC. Thus, the CoC could develop specific PoC projects in the framework of the new programme period 2021-2027, including from structural funds, instead of making proposals for budget for continuation of same type of operations.

Centre Sustainability and Roadmap to achieve it

As per the project documentation, the life cycle of the project is 15 years. The subject of the preparatory analysis is a forecast investment period of six years (funded activities) and a projected nine-year project lifetime.

The yearly costs for operation of the CoC is calculated at about 1 million BGN, mostly for salaries and maintenance of the labs, while the revenues are envisaged to be approx. 600k BGN from non-public sources (commercialisation, licensing, contract research etc.) and another 600k BGN from budget block funding and competitively won projects.

The long-term sustainability of the Centre beyond the present funding period connected to its implementation, depends strongly on its transition into an effectively integrated and organised entity.

The **recommendations below address organisation and planning** aspects that should be addressed during the current implementation period.

Recommendations

- Implement the outlined organisational planning which should lead to a scenario where the project is transformed into an integrated CoC on alternative energy and new energy optimisation technologies, with emphasis in demonstration and proof of concept (PoC).

- Define clearly and as soon as possible the longer-term relationship with the test facility in Vladaya and consider and evaluate the various option to set up the centre as a legal entity with public-private stakeholders. The Centre could make use of building and equipment infrastructure on long-term, possibly with a grace period, and a rent later (based on viability Business plan as proposed) paying also overheads to original owners.

- Regarding the management of the laboratories at the research Institutes of BAS, a suitable arrangement should be found, based on consent, as to how much competence, influence or "voice" should the CoC management have over their activities and whether it should act as a strong coordinator, or should also undertake the operation and maintenance of equipment of these laboratories.

- Thoroughly detail (as part of the legal structure) the use and ownership of the tangible assets developed / acquired, including identifying and mitigating any future risks related to any future failure related either to non-public partners of the CoC or the CoC legal entity itself.

- As the sector has high future prospects, increase efforts on training and attracting young researchers and scientists.

- Define long-term relationships with international partners and with EU programmes. These will define the technology position of the Centre in the EU value chain, as well as prepare the ground for future partnerships for competitive R&D programmes and for contracted research and demonstration projects.

- Depending on the structure chosen, there will be a need to develop an MoU or another suitable agreement laying down some additional relations between the founding partners and the Centre's management, regarding the future main issues of operation, future risks prevention as well as sustainability path agreement with indicative contents.

- Update of "use of equipment agreement" already in place within project documentation to extend to third parties with a detailed charging fee model based on actual costs of equipment bought / depreciation and operation expenses.

- **The Development of a Business Plan** for the implementation period (until 2023), the 3/5 year post implementation period and a vision and strategy for the 10 years after implementation. The business plan should analyse the opportunities of the market, working with national and international business partners, national and international R&D support programmes; identify international collaborators for R&D and technology development; detail the organisational and governance and reporting structures; analyse the mix of

income sources and their evolution whilst the centre matures and attracts; and present a detailed roadmap towards institutional, scientific, and financial sustainability. The business plan should specifically analyse the market and the feasibility of the Centre in becoming a European level test bed and demonstration facility for selected clean energy technologies and create an important revenue line from dissemination / test bed / demo work packages of other EU Research and Technology development institutions and programmes (e.g. HORIZON) or activities. Keep track of European initiatives and discussions on Technology Infrastructures.[316]

- Explore with other centres in complementary sectors (such as environmental / circular economy) the option to partner in the same TTO mechanism with the aim of becoming stronger due to critical mass of activities.
- The CoC team and the experts explained that similar purpose-made state-of-the-art testing facilities exist in Italy and in Germany and other EU countries. The Centre should then visit them and explore how these are managed and what models are being used for the involvement of private partners in those projects.

[316] Technology Infrastructures – Commission Staff Working Document, 2019, https://ec.europa.eu/info/publications/technology-infrastructures_en

ANNEXES

ANNEX I: REFERENCE TO CHAPTERS ON ORGANISATIONAL FRAMEWORK, RESEARCH INFRASTRUCTURE, STATE AID RULES

GUIDELINES FOR THE GOVERNANCE AND THE METHODS OF ACCESS TO THE FACILITY OF THE RESEARCH INFRASTRUCTURE (IR)

System governance and Facility organisational model

The aim of **Bio Open Lab** project is to expand the CERIC-ERIC research infrastructure with facilities for analyses in the fields of biological and biomedical research. The aim is to expand the CERIC-ERIC Research Infrastructure with facilities to be installed at the Hosting Locations of the proponent (Area Science Park) and the co-proposers (University of Salerno-UNISA and University of Salento-UNISALENTO).

In particular, the system of facilities and tools to be developed will support clinical research, ideally covering the path of knowledge of the single molecular actor (protein and /or metabolite), starting from its structural analysis through structural biology experiments with CryoEM and holographic electronic microscopy, passing through its histological mapping with mass spectrometry imaging (MSI) techniques, up to genomic and epigenomic investigation methodologies, which focus on the "control system" of the whole mechanism of protein expression.

1. **Governance**

The management structure is decided in a **Hub & Spoke model**, in which:

- **CERIC ERIC** is the **Hub** of the infrastructure, instrumentation and expertise network, guaranteeing coordinated access to services and expertise of Bio Open Lab.
- System **Nodes** are the **Operating Units**, which constitute the territorial access points.
- The **connection** between Hub and Nodes is guaranteed by a channel (**Spoke**) which provides access to the entire portfolio of facilities both for the engagement of scientific competences and for provision of services.

The facilities will be used by the applicant or co-applicant to which the Operating Units belong for their own research and teaching activities and managed through "**Open" processes** to maximize their use and ensure their usability by external users.

- The strategic planning, coordination and monitoring of the interventions is governed by a **Steering Committee (SC)** composed of the institutional representatives of CERIC ERIC, of the applicant and of the co-applicants.

The activities are: development and management of research infrastructure's governance; planning and monitoring of activities, level of expenditure and time schedule in compliance through ETS monthly reports; monitoring of objectives; overcoming the administrative, technical and financial problems; management of the qualitative and quantitative self-assessment system.

- The coordination between the SC and the **Operating Units (UU.OO)** and the technical activities are managed by an **Executive Technical Secretariat (ETS),** composed by the Scientific Project Coordinator and the Administrative Manager of the applicant.

The **UU.OO** are headquartered in the applicant and co-applicant sites and are in charge of the activities of their own work packages.

- The use of each facility will be managed and scheduled every three months by a **Coordination Group**, which coordinates and reports to the Control Room and the Technical Secretariat

Area Science Park as a coordinating body of the project, has opened a branch at the Campus of Salerno.

This venue will represent one of the nodes of **Argo System** (Institutional Protocol MIUR-MISE-Region FVG) in a Hub & Spoke vision.

Area Science Park has signed a framework agreement with UNISA which includes the opening of local offices at UNISA Campus where, in addition to the use of the new facilities, technology transfer and research valorization activities will be developed to optimize the impact of the Project on the stakeholders of the Programme Area.

- UNISA will support the expenses related to 2 research fellows;
- Area Science Park will support the expenses related to 3 research fellows;
- Management and maintenance costs will be borne by Area Science Park up to a maximum of € 70,000 and by UNISA for the remaining amount.

The economic activities, carried out in compliance with the set 20 per cent threshold, may contribute to reducing the portion of the operating costs incurred by each of the Parties in proportion[317] to the aforementioned breakdown of expenses.

2. Organisational Model of the Facility

The facilities of the Research Infrastructure (IR) will be managed, to maximize its use and ensure its usability by a community of public and private users, through consolidated "Open" processes of CERIC-ERIC and Area Science Park.

The facilities may also be used by the hosting offices for their own research activities and for joint training projects and training activities. The methods of access and allocation of usage time, depending on the purpose of the activities envisaged, are summarized in Table 1.

Table 1 Access methods and time of use by type of activity

Activities	Access mode	Manager subject	per cent

[317] This is the form used in the partnership agreement which limits the exposure of the "external" partner to the maintenance costs so that any variability is the risk of the hosting institution which can then offset those costs with economic activities within the 20 per cent threshold.

			of use
Research projects of international excellence	***Open Access*** *(Call for Proposals and Peer Review)*	**CERIC-ERIC**	**≥ 10 per cent***
Collaborative training and research projects	**Joint regulation**[318]	**Hosting locations**	**≤ 40 per cent**
Research and training activities	Authorization procedures pursuant to the **internal regulations**	**Single Hosting Office**	**30 per cent**
Service activities and research of industrial interest[319]	***Open Lab***	**Area Science Park**	**≤ 20 per cent**

* percentage estimated based on the current use of CERIC-ERIC facilities; if the number of the projects selected by CERIC-ERIC increases, a redistribution[320] of the access fee for collaborative projects among the project partners will be envisaged.

Key drivers for the use of facilities will be parameters such as machine time and / or dedicated staff units, to be defined with specific regulations and applicable according to the required instrumentation, the complexity of the project and the user's experience.

In this context, the Scientific Calculation facility represents a particular case, as machine time and / or dedicated units are just some of the possible criteria for allocating resources. For example, other allocation indicators may include the amount of memory allocated, the disk quota used, the retention time of the data, the number of CPUs or CORE allocated, the use of FAT, THIN or GPU nodes, etc … Moreover, the use of these resources, which varies according to the type of activity, involves different methods, times and priority of use.

The **coordination in the planning of the activities and in the allocation of the time of use of the facilities for the different types of activities will be guaranteed by a Coordination Group (GdC)** that works in synergy with the STE and the Steering Committee, composed by:

- For CERIC-ERIC: Users' Office Manager;
- For the hosting offices: Scientific manager of the facility (Scientist Responsible for the Implementation Objective or delegate);
- For Area Science Park: Open Lab Manager.

Open Access by CERIC-ERIC

- CERIC is open to researchers from all over the world, free of charge for non-proprietary research. In exchange for free access, users are required to publish the results of the experiments, with appropriate references to the CERIC facilities and to the local scientific and technical staff involved.

Regular calls

[318] Agreed between the participants to the collaborative projects.
[319] Economic activities.
[320] If the research organisations in Bulgaria were to choose to form part of an ERIC, they will have to follow similar rules, making machine time of the RI available to international projects but if it goes unused distributing it between the partners.

- Submission within the first deadline allows a pre-evaluation of the proposal at the facilities and, if necessary, two weeks for editing on the basis of the suggestions received, before final submission at the second deadline. Although we suggest taking advantage of the pre-evaluation, expert users may decide to submit their proposals directly at the second deadline.

- Both **single- and multi-instrument** proposals should be submitted online through the Virtual Unified Office (VUO). The best projects will be selected by peer review through an independent and international panel of experts

Fast track access

- In addition to regular calls (two per year), CERIC offers the possibility to gain access to some of its instruments for feasibility studies or very short measurements.

Promotional open access

- In the frame of the European project ACCELERATE, personalised support for the preparation of proposals and measurements is offered, as well as for data analysis and publication of the results.

Promotional Open Access Pilot

Upon request, CERIC researchers can provide a personalised support for the:

- Design of the experimental plan and proposal writing,

- Follow-up during the measurements,

- Support in data analysis, reporting and publication.

Internal Regulations of the Single Hosting Offices

The Hosting Offices will have to regulate, apply or modify their own guidelines or regulations related to the methods of access by users of the facilities for research and training activities, in line with the Project Implementation Objectives and with Commitments, Roles and Responsibilities defined by the call.

These guidelines or regulations must specifically indicate:

- The Structures of the University / Institute in which the equipment is managed, also at the accounting level (eg Centres of Responsibility);

- The indication and methods for managing the inventory, use and maintenance records of the equipment;

- Authorization procedures for direct access, articulated for internal and external users, and by type of service (eg self-service, service with technical assistance, full-service);

- A rate card, or alternatively the guidelines for determining tariffs, consistent with the regulatory and accounting framework of the University / Institute.

In addition, the Host Office must provide the facility with dedicated staff, including at least:

- a scientific manager of the facility (identified in the figure of the Responsible Scientist for the Implementation Objective or delegate), who participates in the Coordination Group and to which he / she will also assign: (i) pre-feasibility assessment and technical evaluation; (ii) support in defining access requests;

- technical personnel specialised in the use of equipment and authorized to operate on the same for the provision of services and technical assistance to users.

Open Lab by Area Science Park

In order to ensure the utilisation of the new facilities by industry (respecting the 20 per cent threshold of the economic activity carried out) and to support the interaction process and the definition of experimental projects of industrial interest, Area Science Park's OPEN LAB methodology will be applied.

The activation of incoming proposal flows and the scouting of project ideas will take place through a single channel (Open Lab), managed by Area Science Park, which, in order to allow a planning of activities c/o facilities, will manage in two phases the request by potential industrial users.

Scientific and technological platforms are *places* where open research infrastructure - based upon core facilities and skills - creates specialised functions, capable of providing know-how and services to carry out experimental tests as well as applied and industrial research projects.

The platforms are a relevant asset to support research and development, since they **provide companies with optimal scientific and technological conditions to carry out** their experimental activities. They do so by granting access to research laboratories with core scientific expertise as well as equipment and instrumentation not easily found elsewhere.

A **dedicated channel is made available to companies** for them to be able to submit technical issues or innovation needs, thus initiating a process which, starting from an idea, a need or an identified opportunity, leads to the provision of services or the development of collaborative research projects.

Table 2 Steps of activation of incoming proposal flows and the scouting of project ideas

Stage	Activity	Timing
First Contact	Fill in the form at the following link: https://www.areasciencepark.it/piattaforme-tecnologiche/piattaforma-materiali-innovativi/ (Italian only at present) or Send an email to: openlab@areasciencepark.it	Recall within 1 working week
Need definition	Request and acquisition of technical information to focus on the company's needs and identify the best-suited technical and scientific competences to address them. In this phase an NDA may be signed to better share important information.	2 working weeks (from need definition)
Scientific and technical analysis	Follow-up meetings (which may also take place by teleconference) with the involvement of the most suited technical and scientific experts to further analyze the proposed topic	
Feasibility checks	Testing and experiments are conducted to ensure the feasibility of the identified techniques to address the proposed topic	Initiation within 2 working weeks (from follow up meeting)
Definition of a work-plan for experimental activities	Results of feasibility checks are shared and a work-plan elaborated for experimental activities, including detailed descriptions, machine time for the required instrumentation, definition of goals and milestones, estimated timing and costs	2 working weeks (from completion of feasibility checks)
Contractual agreements	Definition and signing of contract (research project or collaborative project agreement) including clauses for the management of know-how and intellectual property either pre-existing or resulting from the implementation of the work-plan	2 working weeks (net of negotiations)
Project implementation	Implementation of experimental activities work-plan compliant to contractual agreements	n/a

3. Joint training activities

The facilities will represent the place where, in a synergistic way the "technologically advanced interdisciplinary" training activities will be carried out, taking into account the educational activities of the single institutions.

The ability of the universities to train highly competent professionals at all levels (from pre-graduation to post-doc) will be strengthened. Integrating disciplines and providing cycles of seminars and / or in-depth workshops to cover specific topics on Bio Open Lab.

"Training through research" includes the inclusion of students and PhD students in research projects in the context of joint research programmes between the facilities.

Programmes are managed through the activation of peer-review processes in which the evaluation of collaboration between the facilities is entrusted to a panel of experts.[321]

The selected projects will be submitted to the **Coordination Group** for the definition and evaluation of the experiment plan, with particular reference to the definition of time and methods of use.

[321] Applies not only to the training programme but also to R&D collaborations.

LIST OF ABBREVIATIONS

BAS – Bulgarian Academy of Sciences

Centre/CoC/CoE – a Centre of Excellence or a Centre of Competence funded through the Bulgarian Operational Programme Science and Education for Smart Growth with resources from the European Regional Development Fund 2014-2020, and developed as a project for construction of research infrastructure and its subsequent operation by partnerships of research organisations in the period 2018-2023 becoming sustainable thereafter

CoC – Centre of Competence

CoE – Centre of Excellence

CROs – Clinical/contract research organisations

DEEBD - Digitisation of the Economy in an Environment of Big Data

DRI - Distributed Research Infrastructure

EGI – European Grid Infrastructure

EOSC – European Open Science Cloud

ERDF - European Regional Development Fund

ERP – Enterprise Resource Planning

FEC – Full Economic Costs

FTE – Full time equivalent (employment)

GBER – General Block Exemption Regulation

GLP/GCP - Good Laboratory Practice / Good Clinical Practice

HEIs – Higher Education Institutions

HPC – High Performance Computing

ICGEB – International Centre for Genetic Engineering and Biotechnology

IOT – Internet of Things

IP – Intellectual Property

IPR – Intellectual Property Rights

ISSS – Innovation Strategy for Smart Specialisation of Bulgaria (2014-2020)

JIC – Joint Innovation Centre at the Bulgarian Academy of Sciences

KPI – Key Performance Indicators

MA – the Managing Authority of the OP SESG

MIS – Minimally Invasive Surgery

MoU – Memorandum of Understanding

MSL - Medical Science Liaison

MU – Medical University

NCIPD - National Centre of Infectious and Parasitic Deceases

NDA - Non-disclosure agreement

NGO – Non Governmental Organisation

OP SESG – Bulgarian Operational Programme Science and Education for Smart Growth

Partner(s) – one or more of the founding partner organisations of the Centres of Competence and Centres of Excellence. These are mostly public research organisations (universities, institutes of the Academy of Sciences, other public institutes), but also several private research organisations (associations, foundations, a private university), which have all committed to develop jointly the projects for Centres in the form of consortia partnerships.

PCT – Patent Cooperation Treaty

PLM – Product lifecycle management

PoC – Proof of Concept

PPP - Public-Private Partnerships

PRACE - Partnership for Advanced Computing in Europe

PRO – Public Research Organisation

R&D&I – Research Development and Innovation

RES – Renewable Energy Systems

RI – Research Infrastructure

SICT – Scientific Institute for Clean Technologies, a partner organisation in Centre HITMOBIL

TT – Technology Transfer

TTO – Technology Transfer Office