European Commission

Mutual Learning Exercise

Evaluation of Complex PPP Programmes in STI

Horizon 2020 Policy Support Facility

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Directorate-General for Research & Innovation
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Directorate-General for Research and Innovation

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The PSF MLE panel

- **Terttu Luukkonen** - *Chair and rapporteur*. Terttu was Chief Advisor, and before that, Head of Unit at the Research Institute of the Finnish Economy (till end of November, 2015). She has previously held positions with the Technical Research Centre of Finland (Chief Research Scientist, Director of VTT Group for Technology Studies, 1995-2001) and the Academy of Finland (1974-1995). She has researched activities related to and evaluated public programmes promoting university-industry relations, knowledge transfer, research collaboration, measurement of research excellence and dynamics of science. Her long-time field of expertise is related to evaluation, both methods, techniques, use made of, and impacts of evaluations of public support of RTD activities, and has evaluated and given advice on science and innovation policies and programmes for international and national-level organisations in several countries. She recently led a research project on external research funding and innovativeness of university research in Finland and the UK. She was a member of the ERC Expert Group for Programme Monitoring and Evaluation (2014-2015). She is on Editorial (Advisory) Boards of several journals in the area, including Research Policy and is Honorary Research Fellow at the University of Manchester, Great Britain.
- **Erik Arnold** – *Expert*. Eric is co-founder and Chairman of the Technopolis Group, part time Professor in International Innovation Policy at the University of Twente and a Visiting Academic at the University of Manchester. He is a member of the editorial board of the journal Research Evaluation. He has worked in research and innovation policy and evaluation since 1980, covering work in a wide range of disciplines handling research and innovation policy. He is an expert in the design, management and implementation of large- as well as smaller-scale evaluations of research and innovation organisations, programmes and policies. He has extensive expertise in designing performance- based research funding systems, having led the first national research assessment exercises in Latvia and Lithuania and the development from scratch and piloting of a new performance-based research funding system in the Czech Republic.
- **Carlos Martínez Riera** – *Expert.* He works at the European Research Project Office, University of Valencia. Carlos combines substantial experience in developing technical, management and political positions in European institutions (Commission, Council), National Government (Director General and Head of the European Office) and Regional Government (European affairs related to RTD&I, Regional RTD programmes and Structural Funds). He has a thorough knowledge of scientific, technical and policy developing issues on regional, national and European level. He has been member of the expert panel advising the President of the French Republic on Innovation Policy (2009), has been member of the peer review panel of the science and innovation system of France (2007) and elected member of the European Research Area Committee (ERAC) Steering Board between 2010 and 2011, and Counsellor for Science and Innovation at the Spanish Permanent Representation to the EU (2012-2014), among other advisory positions.

EXECUTIVE SUMMARY

This Mutual Learning Exercise (MLE) under the Horizon 2020 Policy Support Facility (PSF) is focused on the Evaluation of Complex Public Private Partnerships (PPPs).

The countries that participated in this MLE are Belgium/Flanders, Bulgaria, Norway, and Sweden. Whilst Spain was an observer at the working meetings of the project it was not present at the country visits. The PSF MLE on PPPs was carried out by the following panel of experts: *Terttu Luukkonen* (The Research Institute of the Finnish Economy) as chair and coordinator, and *Carlos Martínez Riera* (University of Valencia) and *Erik Arnold* (Technopolis Group-UK) as experts.

Learning within a PSF MLE requires an understanding of the background knowledge on the topic in question including an understanding from national perspectives. The country specific cases, and the country visits provide a unique opportunity to examine particular questions in great detail. However, participation in intensive discussions and interactions between the participants and experts at the various internal working meetings and in those in connection with the country visits gave rise to valuable learning experiences.

Important lessons emerged in this exercise at the project meetings as what concerns the subject of the strategic contribution of the MLE to the current knowledge on PPPs in STI but also in respect to the MLE as a tool for joint learning and exchange of experience and practices. *The lessons learned exceeded expectations*.

1. Lessons learnt during the exercise: the specific contribution of the MLE project to the current knowledge on public private partnerships in STI

- *PPPs are a system-level tool. A number of systemic features have to be well taken into account for their successful design and implementation*

The successful design and implementation of PPPs requires taking into account some important initial considerations. These include foremost the extent of technological development of the research performing organisations and of industry in the country. Whilst PPPs appear to function well at very different levels of technological development, the stakeholders involved in the PPP need to be able to design Strategic Research Agendas that are consistent with their needs and capabilities. There is, therefore, a need for connectivity among stakeholders. Another relevant factor to consider is the characteristics of the country in terms of its social and cultural capital. This capital affects strongly the degree to which the state funder of the PPP needs to impose control mechanisms and take an active part in the PPP governance. PPPs can be operated, for example, through entities that have the legal form of a company (like in Austria, Finland) or through a consortium agreement (Sweden).

- *PPP programme design and implementation should be flexible in order to permit adjustment to emerging or changing needs*

PPPs require a sizeable commitment of public funds over the course of a multi-year programme. The dynamic nature of economics, societal norms, and the ongoing development of national research and innovation (R&I) systems implies the emergence of new technology needs on an on-going basis. It is therefore most relevant to embed flexibility in the resources to be made available for the PPP in order to meet these evolving needs. It also implies that the overall programme resources should not be allocated to a single policy implementation tool.

Another aspect in relation to flexibility relates to the need for flexibility to reformulate and adjust the goals of the PPP programmes. When designing such a programme it is important to ensure that there is a time perspective for the policy tool with a definite end date and progress checks at regular intervals. There also needs to be a mechanism for reviewing and renewing the strategy periodically, so that the PPP can adjust to changing circumstances. This is time-consuming and there is a need to strike a balance between too frequent and "reasonable" intervals between progress updates. In the country visits we learned that updating PPP process updates were included right from the onset for Strategic Innovation Programmes in Sweden and Norway.

Furthermore, if a PPP programme is intended to promote risk-taking, failure should be tolerated and permitted. Too high a success rate of projects can imply that the research and the activities pursued by the PPP have been incremental in practice. For a risk-taking programme, a certain degree of failure at project level is to be expected. Sweden offers an example of this by allowing risk-taking and potential failures in the subprojects of its PPP programmes.

- *Aligning the interests of stakeholders inside the PPP is crucial for impact and success*

Efforts to achieving a balance between the private and public partners in deciding the strategic research agenda can affect the timescale and impact of the research agenda. Maintaining a balance of power between the industrial and academic stakeholders is key to developing and implementing an ambitious, far-sighted programme of interesting and useful research. This will prevent the PPP governance from 'degenerating' into a situation in which there is an over-focus on fundamental research or a situation in which the 'centre of gravity' moves towards supporting firms' short-term innovation activities. The Finnish example of PPP programme discussed at the MLE (the 'SHOKs' example) indicates that this balance was not totally achieved and this led to the programme being tipped in favour of current incumbent firms leading to too short term orientation and disinterest in the academia towards the programme.

Notwithstanding the question as to whether a PPP is defined top-down or bottom-up, there is a further risk that strong actors and traditional actor groups that have collaborated previously and aligned interests will be better placed to seize the new opportunities. This again can lead to an orientation by the PPP that is too short-term oriented if the firms involved are inclined to implement their current trajectories rather than to adopt a longer-term vision. A bottom up approach in the first wave of calls for Strategic Innovation Agendas in the Swedish Strategic Innovation Programme brought about proposals in areas of traditional strength since stakeholders in these areas had prior experience in formulating roadmaps and agendas. The second and third waves have focused more on newer technology areas and those with societal challenges. The limited resources and/or capabilities of SMEs in general constrain and hinder them from actively participating in PPPs. This can lead to their role as subcontractors, which may not allow them to develop really new capabilities and ground-breaking projects. To enable more radical solutions to be explored, the government agencies have a role to prompt the programme leadership and devise means of engaging innovative SMEs in more active roles in the programme.

- *It is important to steer the use of PPPs for the promotion of public interests*

Attention should be paid to potential ways to provide for adequate monitoring and evaluation of PPP exercise and to create a system that curbs the potential use of PPPs solely to promote the interests of the private (or the public) partners. For example, if resource allocation is delegated to the participants of the programmes, who are themselves beneficiaries, the programme faces potential conflict of interests. Using external experts in the evaluation of programme agendas and the selection of projects as well as maintaining final power to allocate the funds are some of the means available for the funding agencies or ministries responsible for the programmes to avoid a conflict of interest scenario. The management of PPPs requires active input from the government agencies involved in order to steer the instrument towards the desired track.

- *Governance challenges such as IPR questions should be tackled with flexible arrangements*

If the design of a PPP lays down fixed principles concerning the division of intellectual rights, these may conflict with industrial needs and provide disincentives for companies to participate in the programme. This was observed in the evaluation of the Finnish SHOKs where the principle of open sharing of IPR among programme participants created problems. The Swedish and Norwegian programmes that we visited used flexible principles and left the definition of IPR principles in a project to the partners to agree upon. It seems to be a prudent policy to have flexible IPR rules that allow the partners to make special agreements on the basis of the individual situation and needs, as appears to be the case in for example, the Swedish and Norwegian programmes.

- *Monitoring and evaluation are essential for PPPs to be effective and performant*

Defining the life-time, monitoring requirements and stage gates for evaluation and decisions on eventual continuation of the PPPs is important for ensuring their performance keeps on the desired track. It is also important to have the option to stop a programme at various phases during its potential life time, not only to improve its performance but also to make sure that public funds are spent on activities that best benefit the country concerned. Potential radical changes in the social, economic, and technological environment or ecosystem can render it necessary to disrupt a programme and to change direction. Overall, in order to run a PPP programme successfully, it is essential to ensure that a monitoring and evaluation system is put in place from the outset.

Since PPPs are part of the overall policy mix of a country, their effectiveness is to be regarded in the context of the wider set of policy tools used and in comparison with alternatives. PPPs have a range of impacts, which may be evident at different systemic levels, though current knowledge cannot say much of how successful these initiatives are in this respect. The need of a systems level evaluation has consequences for the planning and implementation of evaluation. There is a need to develop evaluation approaches appropriate for complex programmes of the PPP type. We learnt in the MLE project that participant countries Belgium and Sweden are developing such approaches, which in the near future can benefit other countries with their examples. We discussed in the course of the a few potential requirements that such an evaluation needs to fulfil.

2. Lessons learnt during the exercise: the MLE project as a tool for policy learning

- *The PSF MLE provided unique and large opportunities for policy learning, including for 'unexpected learning', as well as policy insights from in-depth discussions and country visits*

Learning in a MLE emerges from the background knowledge offered to the participants by the country cases, and in particular during the country visits which provided a unique opportunity to examine particular questions in more detail. Particularly useful in this learning process were the intensive discussions and interactions the participants and experts had at the various meetings, either working or in connection with the country visits where some of the most important lessons learned in this exercise emerged. Thus, the added value of the MLE project was co-learning and co-discovering PPPs and their most appropriate use in STI and the lessons learned went beyond current knowledge on the phenomenon.

- *The focus of the PSF MLE should not be too narrowly or technically defined in order to make space for unexpected policy learning*

The work provided unexpected insights. Country representatives may start MLE collaboration with expectations to learn about specific questions but can end up learning about many others as well or instead. One of the important areas of learning is a new perspective the process enables the participants to have on the support policies and practices of their own country. For example, in Norway the PPP-type support tools were fully based on bottom-up initiatives in fields in which the PPPs were to be applied, while other county cases (Finland, the Netherlands) used top-down and Sweden a mixed approach. In a similar way, In Norway there was a full delegation of allocation of programme funds to the participants, while in Sweden the government agency Vinnova maintained control of resource allocation. This kind of comparison opens up a consideration of alternative solutions.

- *Actively participating in PSF MLE activities requires an investment of time and efforts … but brings directly proportional learning returns, for participants and beyond*

Active participation in the MLE activities requires a degree of commitment of time use, but offers an important learning experience. If a participating country is willing to help organize a country visit, this offers additional learning opportunities. While the actual representatives of a country learn most from the process, there are, however, different groups that benefit from a MLE project.

The government officials from ministries or funding agencies that the project participants meet during the country visits represent a second layer of learning, since the discussions and questions posed by the MLE participants can provide new ideas and new perspectives for them. A third layer consists of the individual programme managers that the MLE participants meet during the country visits to become more acquainted with PPP programmes. Thus, in Norway there was a group discussion with three managers of the Centres for Research-based Innovation (SFI) and officials from the Research Council of Norway. The three managers had not previously been exposed to experiences from other similar programmes and felt that the joint discussion was useful to them.

- *The optimal number of participating countries in an MLE ranges between 5 and 7, with a maximum of 3 participants per country*

The MLE on PPPs is a fairly small MLE in terms of the number of participant countries. This enabled an effective process and intensive discussions at the meetings. The project started at first with five participants, but after the first scoping meeting the number of participants was reduced by one, and further because of a sick leave of key experts, Belgium could not participate actively throughout the project. This suggests that at the outset, a MLE project should perhaps have 5-7 potential country participants, some of whom might be screened off for various reasons, at least, now that the MLE process is still not well-known among the EU member and associated states. However, having nearly ten participants over the project life-time will probably reduce its effectiveness and does not give space for all participants to be active in the discussions. Each participating country had two to three people who participated in the activities in different combinations. This arrangement worked well: there was continuity in participation and thus understanding of the process and a memory of previous discussions; since senior people cannot be available for all the meetings that take place within a limited time span, it is valuable to have stand-in persons to ensure full participation.

- *The panel of experts plays a crucial role in catalysing a successful MLE*

The external experts played a key role in the MLE process: they provided background knowledge, helped to structure the core issues that the MLE examines, promoted understanding of the issues beyond the current state of the art, and summarize the discussions. It was found important that the experts represented different areas of expertise in the broad field of the MLE topic including evaluation, and that the chair also had substance expertise in the area of the MLE process.

THE PSF MUTUAL LEARNING EXERCISE ON PUBLIC PRIVATE PARTNERSHIPS

Mutual Learning Exercises (MLEs) under the Horizon 2020 Policy Support Facility are project-based learning processes whereby participating countries jointly examine a challenge-driven question in detail and which involve information acquisition and information sharing activities, including country visits.

This concrete project-based learning on PPPs was initiated upon request by the Member States (MS) at a workshop on the Policy Support Facility (PSF) on 22 October 2014. MS agreed that MLE processes should be developed in a dynamic way in order to enable more effective learning between MS than through simple one-off events, such as workshops. MS also agreed that the first MLE be launched on the topic of "stimulating business investment in research and innovation". This MLE on Evaluation of Complex PPPs (henceforward only PPPs) is one of the first three MLE pilots.

The starting point in the MLE process was the recognition of a policy challenge and a need to implement policy change in or to improve policy implementation. An MLE is an in-depth and informal process whereby participating countries intending to learn from each other within the frame of a project and explore specific/ operational policy questions in more detail.

Learning within a MLE project is supported by a panel of experts who provide background knowledge of the take-up and effectiveness of policy instruments used to tackle the specific challenges as identified by the participating countries. Learning from peers, other participating countries, is a vital element.

All participants exchange knowledge and experiences on an equal and forthright basis. Informal interaction by the participants at project meetings and interviews with practitioners during country visits provide the major means to provoke and promote new insights and learning. There is emphasis on hands-on learning and learning by doing whereby the process might indicate more or less effective ways for goal-achievement to implement the initiatives planned by the participating countries, but not to recommend policy choices.

The participant countries of this MLE process included Belgium/Flanders, Bulgaria, Norway, and Sweden. Austria also at first expressed an interest to participate, but then declined. Spain was an observer at the working meetings of the project but was not present at the country visits.

The PSF panel of experts for this project consisted of:

- *Terttu Luukkonen* (The Research Institute of the Finnish Economy) (chair and coordinator);
- *Carlos Martínez Riera* (University of Valencia);
- *Erik Arnold* (Technopolis Group UK).

The MLE on PPPs started in February 2016 with an Opening Workshop with the participating countries and some other interested countries (Spain, Hungary, Austria, Germany). The project had two working meetings in Brussels (in March and June) and two country visits in Sweden (in April) and in Norway (in May) to learn and exchange on countries' best practices.[1]

Special sessions on the interests of the two remaining country participants, Belgium and Bulgaria, were organised in connection with the project meetings.

On the basis of the material exchanged (experts' discussion papers; countries information on their PPPs tools and policies) in the course of the project, the in-depth discussions during the project meetings as well as the country contributions during the visits and the special country sessions, the PSF experts drew-up this report.

[1] The meetings and visits made within the MLE project are listed in Appendix 2.

INTRODUCTION

Focus of the MLE on complex PPPs in STI

The MLE project addresses Public-Private Partnerships (PPPs) which are strategic (often virtual) centres or network type of organisations for promoting sector- or challenge-based research involving multiple partners and promoting public-private collaboration in STI. They are usually based on long-term collaboration and activities and specific contractual arrangements between the partners.

The participant countries' interests in the MLE project in PPPs included multiple questions. Belgium/Flanders was specifically interested in the question of evaluation of the impacts of PPPs at the system level. Other participant countries were interested in, besides evaluation, fundamental questions in the design, governance and other implementation of PPPs and understanding the rationale and overall usefulness of PPPs in the STI area. Bulgaria offered a case (Sofia High Tech Park) in which policy design is in a formative stage and where the use of PPP instrument(s) as part of the repertoire of instruments was under consideration. This provided a unique opportunity to address design questions in an open case where establishing the major policy objectives is actively under discussion.

FEATURES OF PUBLIC PRIVATE PARTNERSHIPS IN STI

Definition of PPPs in STI

The concept of PPPs is broad and not easy to define in STI (Science, Technology, and Innovation area and policy). Most PPPs outside the STI domain involve the provision of infrastructure or services by the private sector on behalf of the state in exchange for payment. Private partners deliver public services/products sharing the risks associated with the activities. PPPs occupy a middle ground between traditional public supply and full private provision.

Early definitions of STI PPPs were defined as "any innovation-based relationship whereby public and private actors jointly contribute financial, research, human and infrastructure resources, either directly or in kind" organised through formal or informal arrangements (Cervantes, 1998). However, even informal arrangements took on a more structured context when costs and benefits are directly accountable. In current usage, merely ***project-based collaboration programmes do not justify the use of the concept of PPP***. According to the recent OECD report on strategic PPPs (OECD, 2014a), PPPs represent *longer term contractual agreements* between *public* bodies (e.g. governments and their agencies, academia) and the *private* sector (operator and/or financer) to deliver a service or product.

> PPPs are complex policy instruments that involve funding research and innovation activities in partnerships between the 'knowledge infrastructure' (i.e. universities and research institutes) and 'producers' (i.e. mainly companies, but increasingly also state agencies and organisations such as hospitals, welfare services and so on). The companies involved may be public as well as private, on the assumption that the fact that they are organised as companies and operate in markets makes them liable to market- and other failures, which can be addressed through STI policy.

Public-Private Partnerships represent a shift in STI policy from short-term contracts with a relatively limited scope to longer-term, horizontal commitments frequently to ***address strategic and challenge-driven questions with a long-term vision connecting with governmental priorities***. They are horizontal multi-partner arrangements, often among otherwise competing partners, that have a unifying goal. Unlike traditional project-based research and innovation programmes, where a state agency defines a programme and contracts with researchers and companies to implement the projects of which it is comprised, such PPPs involve sharing not only the act of programming but also governance. They often aim to address ***high risk activities*** with new financial mechanisms involving shared investments among the partners, who are expected to be committed to the activities over long periods of time.

The OECD report on strategic PPPs in STI defined 'strategic' as addressing "the lack of core technological competencies and long-standing problems involving the use and application of general purpose technologies for innovation" (OECD, 2014a), though other kinds of strategic challenges are also possible.

Drivers of PPPs

The drivers for the support of PPPs go beyond the traditional reasons for promoting university-industry collaboration that is founded on the abundant evidence of the value of collaboration for knowledge spill-overs and for triggering additional R&D and innovation spending and productivity (OECD 2014a). The traditional drivers for the promotion of university-industry collaboration include, further, a desire to orient public research closer to the needs of industry, and to address financial market failures or to venture into new high risk emerging markets to enable businesses to develop new products and services capitalising on the outcomes of public research. The purpose is thus to overcome market and network failures that inhibit the performance of industrial research and industry's ability to innovate.

> The drivers for the PPPs, which currently tend to be more complex and more strategic than before, include a desire by the governments to address complex societal, environmental and economic challenges. The PPPs involve private partners in a longer-term collaboration often delegating to them powers traditionally entrusted to the state, thus ensuring their commitment and harnessing their capabilities, visions, and resources for achieving productivity gains and improvements in services. At the same time, PPPs reduce the risks for the partners caused by financial and technological uncertainties.

Thus, ***the state aims to increase scientific and technological learning in industry by helping it to address more fundamental or systemic issues that it would not normally tackle***. The increasing global competition and ensuing job losses have created strong motivation for governments to encourage industries to develop new innovative skills and ability to address challenging environmental, societal, and other strategic issues and through these to improve their global competitive position and capacity to create new jobs. Relatedly, the ***PPPs are likely to imply changing behaviour in the research-performing sector***, too, for example by de-fragmenting the research environment, working in a more interdisciplinary manner, refocusing research effort on new or different themes and changing culture to make industry collaboration 'normal' or prestigious. A common characteristic of STI PPPs is that they aim to act as significant ***change agents***: generating discontinuous changes in capability, capacity, behaviour, technology or even socio-technical systems.

Competence centres provide some of the roots for many of latter-day PPP programmes in STI[2]. Competence centre programmes have tended to emphasise long-term funding of research, ***promoting structural and behavioural changes*** in research performing organisations, universities in particular, where they are typically located, to better tackle interdisciplinary problems and those of importance to industry. Furthermore, competence centre programmes have also tended to include PhD training and often involvement of students at the masters' and bachelors' levels. One of the impacts of such programmes is ***developing human resources*** in areas of industrially 'relevant' knowledge.

Some of the recent PPP type programmes in EU member states follow the example of EU-supported PPPs (such as Joint Technology Initiatives (JTIs) under Art. 187 TEFU[3]) and ***place more emphasis on industrial leadership in the definition of the research agendas*** than competence centre programmes, with consequent implications on the type of research and activities stimulated. The Finnish SHOKs (Strategic Centres of for Science, Technology and Innovation) and Dutch Top sectors represent this kind of programmes. The Dutch and the Finnish initiatives have been strongly motivated by a wish to improve international competitiveness of industries and to tackle emerging societal challenges., like the EU-supported JTIs. These new type of PPP programmes tend to have new legal structures to operate the programme activities, while competence centres have typically been located within hosting universities. The OECD review of the Dutch innovation policy suggested that at the outset, the Top sector policy represented a sector-based programme that is a modern version of selective industrial policy emphasising co-ordination and alignment, stakeholder demand, and commitment to monitoring and evaluation, but at the same time, less dynamic than other forms of modern industrial policy because it supported sectors of strength and devoted less attention to a search for new niches (OECD, 2014b).

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[2] The US NSF's Engineering Research Centre (ERC) scheme was the first 'competence centre' programme and was launched in 1985. Its design has since provided an example for many programmes worldwide including the Swedish competence centre programme initiated in 1993 (Stern et al., 2013).

[3] Art 187 of the Treaty of Functioning of the European Union states: "The Union may set up joint undertakings or any other structure necessary for the efficient execution of Union research, technological development and demonstration programmes".

As is evident in the above discussion on the drivers of PPP policies, PPP programmes are expected to have ***system-level impacts***, and therefore, we can regard them as a systemic policy tool. When speaking of system level and innovation systems, we implicitly or explicitly draw on the notions of innovation systems that have been proposed in different forms since the 1960s.[4]

Features common to the different forms of systems thinking include an emphasis on institutions or institutional sectors that are oriented towards technological innovation, and on the importance of relationships and knowledge transfer among the institutions and actors (Godin, 2009). The institutional sectors refer to government, university, industry, and non-profit. However, especially the national systems of innovation school researchers emphasise that ***institutions are not just organisations but rather refer to the rules of the game, norms, routines, practices*** etc. that regulate the relations and interactions between individuals, groups and organisations (Edquist, 2008). In this approach, there are also definitions of key functions that a system of innovation has to perform (Edquist, 2006).

Present-day policies draw on or have been justified by these notions. However, views of the role of government and policy have varied from those regarding the prime responsibility of ***government as a guarantor*** of the performance of the system (King, 1975, according to Godin, 2009) to those considering the role of ***government as a facilitator*** (within the national systems of innovation approach, by Godin, 2009). Importantly, early on, these notions have emphasised a need to ***integrate innovation (science, research, technology) policy to other policy areas***, such as economic and social policies. The focus on the 'Nation' of the national innovation system approach has in more recent years attracted criticism on account of the fact that industrial activities and knowledge search and collaboration are increasingly globalised, which makes a solely national focus redundant or insufficient (i.a., Godin, 2009), though this view has been contested because the central institutions affecting economic performance are national or regional (Freeman, 1995).

Design of PPPs

We use the concept of 'design' of PPPs to refer to all the principles and arrangements of a PPP with the purpose to efficiently and effectively fulfil its mission.

In reality, the principles may be a compromise between different notions supported by stakeholders who participate in the research policy process and the formation of PPPs. Furthermore, how efficient and effective the proposed principles are in practice is often not known.

This implies that "design" has to take into consideration aspects of subject (what?), actors (who?), functioning (how?) and of span (how far, for how long, how big, how much), questions all needed to best address the mission (what for?) derived from the original drivers (why?). Other aspects fall farther from these core questions, but can also have a substantial role, in particular the environmental, regulatory or historical constraints (why so?). Design includes basic aspects of implementation and governance.

(a) System level issues

To succeed, PPPs have some important basic preconditions. ***First, the promotion of horizontal multi-partner industry-public sector collaboration*** requires the existence of potential industrial partners with competencies and absorptive capacity in the fields in which the tool is expected to be applied. The same principle applies to academic competencies needed in these areas. In PPPs agenda setting and management are delegated to the stakeholders to a varying degree. This is not possible without a minimum degree of connectivity and collaboration among the stakeholders, that is, industry-university (public research organisation) partners in the fields in question. Complex multi-partner collaborative arrangements need knowledge and organisational capabilities or pre-existing experiences, connections and trust that can develop of such experiences among the central partners; in other words, ***a well-developed ecosystem***. In the absence of this kind of connectivity, less complicated arrangements, such as more conventional public-private collaborative R&D grants and loans can be a more appropriate response to a need to promote research/technology areas and knowledge-seeking behavioural patterns.

[4] These notions were first presented within the OECD and its work towards developing national policies in science and technology as an important means to promote growth and economic development (Godin, 2009). As of the 1980s, these notions were further developed by innovation researchers who elaborated the frame of the national systems of innovation and created variants in this school of thought (Nelson and Winter, 1977; Nelson, 1993; Freeman 1995; Edquist, 1997; Edquist, 2006).

PPP design needs to take account of further aspects of the development or characteristics of a country. One is the ***extent of technological development*** of the research performing organisations and of industry. In practice, PPPs appear to function well at very different technological levels ranging, for example, from the furniture industry in the province of Upper Austria to the US aerospace industry, but clearly the stakeholders involved need to design a Strategic Research Agenda that is consistent with their needs and capabilities. The other factor is the ***characteristics of a country in terms of social and cultural capital***. This particularly affects the degree to which the state funder of the PPP needs to impose control mechanisms and take an active part in the governance. In high-trust countries such as Sweden, while such mechanisms need to be in place, they can be quite 'light touch'. In lower-trust countries like Austria, the practices needed tend to be more formal and may involve a greater administrative burden.

A systems view regards PPPs as part of the overall policy mix of a country. Their needs and assessment of effectiveness is thus to be seen in conjunction with other intervention tools of a country. Important in this context is that PPP tools are, as any policy intervention, time-limited. In practice, some of them develop into permanent institutions, but in a systems view in principle, their needs and effectiveness has to be reconsidered and justified anew.

PPPs entail a commitment of sizeable public funds in multi-year programmes. The dynamic nature of economic, societal, and research and technology systems implies that new needs will emerge thus highlighting the importance of flexibility in terms of the resources that are available for those needs. This implies that no single policy tool is allocated too much of the overall resources at hand. Another aspect of flexibility related to reformulation of the goals of specific programmes. A prudent policy for ***PPP programmes entails that there is a time perspective for the policy tool with a definite end date and progress checks at regular intervals***. There also needs to be a mechanism for reviewing and renewing the strategy periodically, so that the PPP can adjust to changing circumstances.

If a programme is intended to promote risk-taking, this implies that failure is tolerated and allowed. Too high a success rate of projects can imply that the research and the activities pursued have been incremental. ***In a risk-taking programme thus a certain degree of failure at project level is to be expected***.

Experimentation at programme level can also lead to less successful outcomes. This can be capitalised on if those responsible for a programme have an active policy learning approach in programme design and implementation. It can entail gradual implementation of PPP programmes including a potential need for reformulation of programme goals or tailoring programme tools to fit with specific new needs. ***A well-designed evaluation system for the PPPs can provide feedback to policy learning*** and inform potential decisions to change or refocus a programme. Policy learning, however, requires a high degree of trust among the stakeholders in the integrity of the government and other central stakeholders.

> In Sweden, in order to support radical innovation within the Strategic innovation Programmes, Vinnova considers that it is important to allow risk-taking in the subprojects. This usually implies that some of them will fail, which is regarded to be as it should. It is considered that there are important lessons to be learned from projects that fail and this knowledge can be used in the development of new projects. There is an ongoing and open dialogue between Vinnova, Sweden's Innovation Agency, and the Strategic Innovation Programmes about their project portfolio and their ability to contribute to the societal challenges and transitions through radical innovations and new solutions.

(b) Design choices

Centre' vs. 'network'

Centre and network types of PPP refer to two basic types of organising public-private partnerships, though the distinction is not clearcut and, in practice, PPPs often entail varying degrees of characteristics. *'Centre' PPPs* are organised around physical or virtual research centres to extend traditional research and innovation collaboration between the knowledge infrastructure and companies in ways that generate changes in structure and culture within the knowledge infrastructure itself (especially, in practice, in the universities). Centre PPPs define strategies focused on the work of the centre itself, which is executed by a consortium that works at the centre to varying degrees.

'Network' PPPs are focused not on a centre but on a community of firms and research organisations working in concert on a common, innovation-related agenda devised by a branch of industry, a supply chain or another grouping with common economic, thematic and technological interests. Network PPP strategies are constructed to identify and address research and innovation needs

across the whole community, so members of the community, outsiders or a mixture may execute their research work. There seems to be a trend for network-based PPPs to be on the rise.

Our definition excludes organisations such as research and technology organisations (RTOs, e.g., the Fraunhofer institutes), which exist to support industrial innovation and research but which have a market or quasi-market relationship with their customers. PPPs in our sense do not have customers: they involve 'partners' or 'members'. RTOs are very important in the European innovation and research landscape (Arnold, Barker, & Slipersæter, 2010) but their objectives and mechanisms of operation are different from complex PPPs in our sense, as is their form and ownership.

Competence centres provide examples of both 'centre' and 'network' type of initiatives. Competence centres are focused on academic-industrial collaboration "to expose industrial firms to longer-term, strategic research which would otherwise be too costly for them to support on an individual basis" (Report of the CREST, 2008) and "to support strong hubs of excellence in key competence areas". The 2008 CREST report on industry-led competence centres differentiated three types: 1) the ones strongly based in academia but having industry on their boards, as the Swedish Competence Centres and the Austrian K+ Centres; 2) virtual centres such as some Dutch Leading Technological Institutes; and 3) dedicated 'physical' Centres such as IMEC in Belgium, or the Dutch Telematics Institute which "aim to get real depth in expertise and facilities as a core support to the development of industry sectors". Competence centres thus cut across the archetypes of centre and network-based PPPs.

Strategic Innovation Programmes in Sweden provide an example of a network type of PPP. They aim to catalyse long-term, broad-based and strong commitment of key innovation actors towards a common vision in an area of substantial potential (or importance) for the future competitiveness", in which the agendas and the consecutive roadmaps should generate cross-sectoral, cross-industrial and cross-technological fertilization. Usually, this kind of PPPs are industry-led or the research agenda is driven by the visions as defined by industry, as in the case of the Swedish Innovation Programmes, and exemplified by the Dutch Top Sectors or the Finnish SHOKs.

Societal Challenge Consortia in Sweden is a yet another network type of PPP, addressing specific societal challenges and offering concrete solutions. The research agenda requires long term commitments from the partners, the research questions are complex, and the challenges for the governance structures are especially great, but the public sector plays a major role in driving the agenda.

Degrees of openness

Degrees of openness refer to ***the ability and practices to change/expand the membership of the PPP***. In 'closed' centres a consortium applies for funding and its membership is at least to some degree, if not formally, frozen during the life of the grant. Such consortia often try to prevent the recruitment of new members, which they see as generating undesirable spill-overs.

The EU contractual PPPs and Joint Technology Initiatives (JTIs) represent network type of PPPs across groups of stakeholders in industries, supply chains or technologies, which are not focused n individual centres. They are, however, in practice closed, because their members participate in strategic planning and the definition of the strategic research agenda and are in a privileged position in terms of access to information, networks, and consequent resources to utilise the opportunities the programme offers. Yet, provisions exist to enlarge membership during the life-time of these PPPs. Some of the recent PPPs in individual Member States (e.g., the Netherlands and Finland) are similar in many principles. ***A risk*** with these arrangements is ***that they can easily support structures (national branches of industry, even de facto cartels) that ought to be challenged in the interest of more effective research and innovation***. Especially SMEs are less able to be actively engaged, while many SMEs develop new radical departures. A policy issue is to what extent to require such arrangements to open up over time.

There are arrangements that can, to some degree, be regarded as open network PPPs. Examples include research associations that work through commissioning research from competing contractors.

The challenge for policy-makers would thus be to devise rules of the game and incentives that make spill-overs likely without relying overly on opening-up measures that undermine the self-interest of the participants.

Bottom-up vs. top-down

The selection of research and technology areas for a PPP is an essential design feature where approaches can differ. When launching strategic PPPs, ***governmental agencies tend to select***

the research and technology/societal challenge areas in which PPP programmes will be launched based on diagnosed societal/economic need and future prospects (*top-down*). That is an important driver and rationale for the support form. In this approach, as exemplified by the Dutch Top sectors and the Finnish SHOKs as well as the EU PPPs, the supported sectors have been pre-selected and the programme logic is built in the support of areas of existing strength to improve their overall competitiveness.

However, as the examples of the Swedish Strategic Innovation Programmes or the Norwegian Centres for Research-based Innovation indicate, ***governments can launch a call for stakeholders to suggest areas in which these are prepared to collectively build research agendas*** and programmes (*bottom-up*).

> In Norway the Centres for Research-based Innovation are selected on the basis of periodic calls for proposals. So far, there have been three calls in 2005, 2009 and 2013, each decided one year after its issue date. The calls have a bottom-up approach, not having either sectoral or thematic orientation. The selection is made on the basis of the judgement of the quality of the following aspects: research, innovation, potential for innovation and value creation, internationalisation, researcher training and recruitment, partners and funding and organisation.

The Swedish Strategic Innovation Programmes provide an example in which agenda- building can be a multiple-step process and where the government agency can play an active role in the alignment of interests and consolidation of the research agenda. The division into bottom-up vs. top-down thus has different shades of grey rather than a strong distinction between black and white. The experiences as observed during our country visit to Sweden further highlighted that ***the process of agenda-building itself can be an important mechanism to build 'knowledge value communities' and collaboration across industries in a way that did not exist before*** *and* ***tackle new multidisciplinary and multisector problems in a more adequate manner***. This took place because the innovation agency Vinnova had an active role and prompted the original proposers of agendas in nearby areas to merge their ideas together and submit a joint proposal.

> In the Swedish Strategic Innovation Programmes (SIP) the consultation process to generate the SIPs was wide and involved a large number of relevant actors. Originally there might be several proposals for a Strategic Innovation Agendas in related areas. On Vinnova's advice these were in instances merged and the proposals resubmitted as a combined proposal. In such cases, as previously maintained, the process could bring together stakeholders from areas and organisations that had not previously collaborated, and the consultation process could take many rounds of submissions.

Competence centre type of PPPs tend to be based on bottom-up proposals concerning the selection of the fields and areas that become centres. For example, the NSF ERC centres are generated as a result of peer-reviewed competitions generated by program announcements (ERC Association; http://erc-assoc.org). ***It is also possible to mix bottom-up and top-down modes***, as Vinnova has done is Sweden.

> Vinnova's original competence centres programme was entirely bottom-up. But after a number of years, Vinnova realised that launching 28 competence centres with 10-year funding all at one point in time meant it had created a 'snapshot' of areas of Swedish strength that was going out of date. It therefore identified thematic gaps in the portfolio and launched special calls to fill these and launched subsequent bottom-up calls for centres in smaller and more frequent tranches.

Stakeholders that are able to seize the opportunity to build an agenda and programmes usually need to have previous collaboration and organisation; for example, based on industrial associations or other formations. Such a situation favours established and strong actors and interests, though the agenda formation process can require adoption of new cross-cutting agendas and the development of cross-sectoral collaboration, if the public agencies in charge of the process so require. There are thus means for the public agencies to mitigate against prevailing interest formation. However, it seems that **both top-down and bottom-up processes in PPPs can favour existing interests and competencies**. These arrangements are, therefore, not the most

effective means to stimulate radical new innovation and new entrants in technological and industrial areas.

Achieving the goals and avoiding standard difficulties requires care and a degree of sophistication in the arrangements under which the PPPs work. The economic incentives need to be appropriate, encouraging the change of behaviours that are desired (typically longer term orientation, the development of collective or 'club' goods[5] and the encouragement of spill-overs that companies normally try to avoid). Funders therefore have carefully to set up the 'rules of the game' under which the PPPs operate, not least in ***governance arrangements***, which ***need to balance the interests of the parties involved*** and consider how the 'boundary' of the collaboration works, ***in order to make sure the beneficiaries do not only reap private benefits but also create public benefits and goods***. A long time perspective is a pre-condition for complex PPPs to work well so they may need to be supported by changing the way funding rules and horizons work.

Principal-Agent relationships

It seems helpful to think of some of the choices made in the design of a PPP in the light of principal-agent theory, that is, the idea that when someone (a 'principal') engages an agent to do something for them, because they do not have the knowledge to do it for themselves, they expose themselves to the risk that the agent may not act in their best interests. This will lead to a situation in which the ministry has to depend upon the beneficiary community to decide how to give itself the money. While of course ministries and agencies build in all sorts of checks and balances to constrain adverse selection, the incentives for adverse selection persist[6].

Complex PPPs make the double principal-agent problem - agency being both an agent of the ministry and principal to the programme beneficiaries - even more difficult because to a varying degree they hand over portfolio design and project selection to a small beneficiary group. Like peer review panels, beneficiaries have strong and explicit motives to select projects in their own interests, but they also have fewer checks and balances to constrain their conflict of interest. Yet there are very good reasons why they need to be involved in strategy and the project level. ***Tight governance and strong roles for monitoring and evaluation are therefore especially necessary in the case of complex PPPs***.

In the SFI programme of *Norway*, Centres for Research-based Innovation, resource allocation is delegated to the participants of the centre programmes, who are the beneficiaries, thus facing potential problems of double principal-agent, as outlined above. By contrast, in *Sweden*, the Strategic Innovation Programme funds to individual projects are evaluated by the innovation agency Vinnova on the basis of the agenda and project proposals from the programme participants. Vinnova uses outside experts to evaluate the excellence of the proposals thus establishing governance principles to avoid conflict of interest problems while the relevance is evaluated by the fitness of proposals within the programme agenda.

Spatial questions

An important aspect in designing PPPs is the spatial or regional aspect, namely, the rules that determine where the partners may come from. The Norwegian examples of National Innovation Clusters included an example of a programme that in practice was regionally-based. This raises the question of whether and the degree to which regionally-defined partners are the very best to improve the competitiveness of the industries – and the public research organisations – engaged in the programme or whether partners found in other regions of the country or abroad would have filled the role more effectively. ***A restriction of the supported partners to the nation state is a pressing problem in all countries given the increasingly globally competitive environment.*** Norway has solved this question in a positive way by allowing for such partners if these clearly benefit the Norwegian participant industry. The evaluation of the benefit is done by the participating industries. The Swedish and Austrian competence centres programmes work in the same way; and in general PPPs are becoming more open to the inclusion of a small number of non-national partners, providing that their presence adds value to the PPP as a whole.

Other design issues

[5] Club goods are excludable but nonrival; excludable meaning that it is possible to prevent someone else from using the good, if that is wished for; nonrival that someone else's use does not prevent others from using it.
[6] Conflict of interest or 'adverse selection', where the agent chooses a course of action that suits the agent's rather than the principal's interests.

The intellectual property right rules matter in research collaboration. Agreements on ***the rules concerning ownership and exploitation of the intellectual property are vitally important for keeping the private partners on board*** and are connected with the industry, time horizons, and practices in the area. A wide sharing of IPR within the network of participants in the PPP, though positive from the point of view of promoting knowledge spill-overs, may hinder the industrial partners from bringing their core and strategic activities to the PPP and thus reduce its potential for radically new openings. Furthermore, if the design of a PPP tool lays down fixed principles concerning the division of intellectual rights, these may become in conflict with some situations and industrial needs providing disincentives for companies to participate in the programme. This was observed in the evaluation of the Finnish SHOKs where the principle of open sharing of IPR among programme participants created problems (Lähteenmäki-Smith et al., 2013). The Swedish and Norwegian programmes that we visited used flexible principles and left the definition of IPR principles in a project to the partners to agree upon. ***It seems to be a wise policy to have flexible IPR rules thus allowing the partners to make special agreements on the basis of the situation and needs,*** as seems to be the case in, e.g., the Swedish and Norwegian programmes.

The financing rules of the PPPs play a significant role. The share of co-funding, the way it is expected to be calculated (on the overall programme activities or on a project-by-project basis), the shares of co-funding required, the degree to which in kind or cash payments are accepted, and potential repayment rules are among the features that need to be specified and to be in accord with the EU state aid rules. The Swedish Strategic Innovation Programme was built on a principle that the 50% funding of the private partners was to be achieved over time in the programme, not immediately after the programme start, which seems a sensible principle once its achievement is monitored. As in all research and innovation funding, ***the amount of subsidy needs to be related to the type of work being done*.** The market failure that discourages companies from funding basic research is an important factor, so in schemes (like some competence centre programmes) that aim to increase companies' involvement with fundamental research, the level of subsidy needs to be high. Other programmes that focus more directly on the innovation process need lower rates of subsidy.

The funding tools government agencies can use in PPPs include conditional R&D grants, R&D tax credits, loans, and other funding tools that governments use in other contexts to promote private R&D.

Governance

'Governance' refers to the act of governing or steering. In PPPs it needs to address a complex set of institutions and actors with a range of differing interests but which need to establish and implement a common plan that is in their own interests, and in those of their funder.

There is a string relationship between the institutions involved in the network and the PPP, though in practice the boundaries between and within the public and private sectors are blurred. Governing a PPP usually involves, at least to some degree, delegation of powers from the public authority to the institutions in charge of the PPP and these can often exercise self-governance within the limited set of activities pf the network (Stoker, 1998).

Governance refers to a core set of well-defined arrangements and is, basically, a learning-by-doing process in areas where a trade-off is needed in order to share uncertainty and risks, accommodate different interests, procedures, constituencies, jurisdictions and cultures, and, at the same time, to accomplish goals at a reasonable cost. ***These situations require a great deal of creativity and flexibility to respond to a variety of situations***.

In PPPs in STI there is a wide variety of partnership arrangements. One of the aspects that vary is the formal position and degree of independence of the entities that operate the PPP. The EU PPPs (like the Joint Technology Initiatives, JTIs) have created clearly defined legal entities, joint undertakings, that run the programmes according to the rules, obligations, and responsibilities as defined and agreed upon. In the Netherlands, each Top sector has signed an innovation contract with the Dutch government setting out the innovation agenda and at the head of each Top sector is a "top team" consisting of an innovative SME entrepreneur, a scientist, a government representative, and an industry figurehead. In Finland, each SHOK is managed by a limited company and the partners, companies and research organisations, are shareholders. The different legal status categories and national legislation determine the formal status and responsibilities of these entities. Competence centres can have similar type of representative and deciding bodies

(general assemblies and boards), but centres are usually hosted (by universities) and do not constitute legally independent entities.

With regard to the project selection and government support, there are usually special evaluation mechanisms in place as set by the government to guarantee a minimum quality, whereas relevance is defined and evaluated by the programme mechanisms on the basis of fit with the strategic research agenda and programme objectives.

> The Climate KIC - Knowledge and Innovation Community set up by the European Technology and Innovation Institute (EIT) provides an example that partnership arrangements can evolve over time. After an initial period in which governance with co-location centres was based on more informal arrangements, the management of the KIC is moving into a more business-like structure where all the components of the core partnership are established as companies using the appropriate legal form available in each country, therefore legally reinforcing the corporate management which is now linked to specific business objectives for each unit.

Challenges in governance

There are important challenges in the design and implementation of PPPs. PPPs are collaborative structures between different type of actors and need contractual arrangements for the distribution of rights and obligations.

There does not exist systematic knowledge of the governance of PPPs in STI in particular, and its relation to their success in achieving their targets. We have, therefore, to draw on anecdotal evidence and knowledge that exists in a few evaluation reports or other written sources available on PPPs in STI as well as draw on the experiences of the MLE participating countries, the country visits we made and the sessions we had during the MLE project.

> Transparency of the rules and accountability through monitoring and evaluation are important means to provide legitimacy to such public intervention and initiatives to promote private stakeholders.

However, as regards the principle of *fairness*, ***PPPs in STI by definition privilege select areas and select stakeholders no matter whether it is defined in a top-down or bottom-up manner***. Participation in PPPs is constrained by the capacity of potential partners to participate. Often attempts are made to promote the opportunities of less well-resourced partners such as SMEs to increase their involvement, not only from the point of view of fairness but especially from the point of view of knowledge spill-overs and the system effectiveness.

The question of societal accountability of PPPs is, however, wider. The PPPs increasingly tend to deal with grand societal challenges, or have specific ethical, environmental, or labour implications. Because of this, citizens become interested parties. However, it is challenging to empower and engage them in the processes and activities of the PPPs other than indirectly.

> A pertinent question in connection with governance is the effectiveness and efficiency of the governance arrangements. There is more or less anecdotal rather than systematic evidence of these questions.

The following is a tentative list of pertinent challenges in the governance of PPPs we have been able to observe.

- ***Efficient governance and management structures*** have to solve the challenges brought about by a divergence of interests across different actors and to suggest a process to converge the short term and long term visions by the partners. PPPs, especially those aiming at strategic and systemic impacts, involve constituencies crossing many boundaries and jurisdictions. Thus, besides the public-private partition, there is a need to accommodate different perspectives from cross-boundary constituencies; between industrial sectors; large companies vs. SMEs (Wettenhall, 2007); knowledge generation versus product delivery cultures; and across jurisdictions (regional – national – trans-national or international).
- ***Balance between the private and public partners*** in deciding the strategic research agenda – if any – can affect the time horizon of the research agenda. In complex PPPs a key tension arises between academic and industrial innovation horizons, with the researchers tending to

push towards fundamental understanding and industry looking for relatively short-term solutions. Resolving this tension is not only a difficult governance task but is also necessary in order to reorient the perspectives of the two sides: the academics towards industrially important problems; the industrials towards an interest in more fundamental understanding, leading ultimately to better and more radical innovations. Maintaining a balance of power between the industrial and academic stakeholders is key to the ability to develop and implement an ambitious, far-sighted programme of interesting and useful research, without degenerating either into over-focus on fundamental research or the 'centre' being co-opted into firms' short-term innovation activities. If the balance is tipped in favour of current incumbent firms, this can lead to too short term orientation because the firms are inclined to implement their current trajectories (Lähteenmäki-Smith et al., 2013; OECD 2014b). One factor in the difficulties of the SHOKs in Finland seems to have been the fact that the industrial side had too much power, diminishing the interest in the SHOKs from the universities and discouraging the Research Councils, that is, the Academy of Finland, from funding them (Lähteenmäki-Smith et al., 2013).

- In order to stay at the cutting edge, or at least, well-informed of changes in the technological, industrial, and research environment, once defined, ***the strategic research agenda*** needs to be redefined and revisited at regular intervals. This is time-consuming and there is a need to strike a balance depending on the area and its development between too frequent and a reasonable interval between updates. In some areas an annual updating is appropriate while in others it may take place less frequently. The country visits indicated that updating processes were part of the normal processes of Strategic Innovation Programmes in Sweden.
- The way in which the ***selection of projects*** is designed and organised is vitally important to avoid the selection of less qualified teams and second-rate projects. Using independent external expertise with clear guidelines as to the objectives and the desired quality of the programme is important to ensure the selection of the best teams and projects and the degree of risk, novelty, short vs. long term, and the cutting edge nature of the activities which the programme aims to fund. A complete delegation of the project allocations to the PPP partners can create principal-agent problems related to transparency, accountability, and fairness, but also the quality of teams and projects. A selection by the agency can be a formality rather than a critical evaluation if it does not rely on independent external expertise. Using external experts in project selection does not present great problems in confidentiality if the programme is not intended to fund close to market research.

  The Norwegian Innovation Cluster (NIC) and Centres for Research-based Innovation (SFI) programmes have a complete delegation of project allocations, in spite of potential double principal-agent problems.
- There is a further problem and risk in project selection if the programme is not attracting a sufficient **number and/or quality of proposals** thus making the selection a tricky issue. This was found in some of the Swedish Strategic Innovation Programmes (SIP). It is difficult to establish the success rate of proposals that is sufficient to ensure quality but at the same time, not too low to discourage potential partners from applying.
- The PPPs have to ***keep the central partners committed*** so as these will not terminate or decrease their activities in the undertaking. Academic partners need to find the research challenging enough for their academic careers to be interested. There is a risk that enthusiasm at the outset of a new PPP among its stakeholders will be replaced by routinization and complacency.

  In Norway CenBIO - Bioenergy Innovation Centre (FME Centre for Environment-friendly Energy Research since 2009) was initially set up with 19 companies, nine of which have dropped out for various reasons, mostly because of reasons not linked to the relevance of the activities. Four of the surviving companies are members on the board, but none has wanted to be Chair of the Board. A few companies are only interested in very specific Work Packages. The CEO of CenBio considers that maintaining the commitment of companies is a major challenge. Face-to-face contact and a dynamic, continuous relationship with the representatives of the company are essential for keeping companies actively involved. In order to be able to achieve that the number of companies in the consortium needs to be limited.

- The competitive ***situation of individual firms*** *and the strategies* they adopt may change causing disruption in the planned activities. The firms facing such changes may completely drop out of the programme or radically reduce their activity. This can cause grave difficulties for their project and programme partners especially if the firm has been a central partner in a given activity.

- In a similar vein, ***political changes*** can affect multi-year complex tools such as PPPs. Change of government can cause discontinuities in policy and abrupt change in PPP policy (the decision to discontinue the PPP programme SHOKs in Finland after government change in 2015). The position of STI can vary across countries both in terms of its weight in government policy and in terms of its organigrams. Besides, complex tools such as PPPs usually require cross-ministerial collaboration to cover the whole value chain from knowledge to products and services for market and society (OECD, 2014a). The strategic nature of many PPPs requires the commitment and involvement of many ministries and administrative sectors, which may not have a tradition to collaborate and coordinate their activities. This may prove especially challenging when for some of the ministries R&D and innovation is a means to an end rather than an end in itself.

  Overall, governance arrangements need to prevent instability, tensions and member dissatisfaction from arising.

- The co-investment of public and private money as well as quality control and evaluation of projects for funding can create ***administrative procedures*** that are complex and take a long time thus creating further hindrances for participation especially by the private partners. There are further procedural, managerial, and financial issues to be solved.

- ***Monitoring the performance of a PPP*** is important for fine-tuning the instrument. It will also feed into more thorough evaluation efforts to be conducted at intervals. Furthermore, the changing industrial and technological environment can create a need for a re-design of the instrument. Learning from the monitoring and evaluation activities and adapting the programme design accordingly requires an active involvement of the government agency or ministry that is responsible for the programme in its development Thus, a programme once initiated requires active policy engagement in order for the government to reap its societal and economic benefits.

- A question that has not attracted attention in literature relates to the ***appropriate life-time of an instrument*** such as PPPs. Clear criteria for entry and exit of PPP programmes in specific fields need to be created and it is one of the factors that need to be considered in the evaluation of such a programme. Time limits for the overall programme in a specific area and stage gates for monitoring and evaluation are needed especially taking into account the changing environments and needs to reconsider the need for further specific support or the form of support to a specific area. Overall, too little is known about the effectiveness of the design of the PPPs and how this new support model can be aligned to social and economic objectives in STI policies. However, one thing is clear: centre PPPs tend not to survive the end of their programmatic funding. While policymakers sometimes wish that companies would learn the value of participating in a centre and become willing to fund it themselves, in practice market failure persists. Studies of centres that have 'graduated' from the US ERC and Vinnova Competence Centre schemes, show that most centres disappear when the funding goes away and that the few that survive do so at smaller scale and in a changed form that focuses on close-to-market work rather than the more fundamental agenda they had during the period of subsidy (Stern et al, 2013).

Impacts of PPPs

A number of studies have attempted to chart impacts of PPPs and there have been some attempts to quantify economic benefits. The effects of the Australian Cooperative Research Centres on GDP have been estimated to be about €10m over a period of years (Allen Consulting Group, 2012). A retrospective impact study of the Swedish Competence Centre programme found that the state's cumulated investment in the programme of about SEK 1.3 billion had – based solely on ten successful cases of innovation and neglecting all other economic impacts – produced an annual return to industry in the range SEK 5-11 billion (Stern, et al., 2013). The same study found that the mechanisms of industrial impact included

- Direct impacts on industry through generating directly usable outputs in the form of products and (less often) processes
- Direct impacts through behavioural additionality such as learning the value of more open innovation forms, more networking, and recruitment of technical specialists
- Economic impacts on participants in the form of increased revenues or, in some cases, protecting existing market positions exposed to technology-based competition
- Economic development of individual SMEs participating in the programme
- Indirect effects through adding to the firms' stock of internal resources, notably human resources and research capability
- Spill overs from the participating firms and universities to other knowledge users

- Indirect effects, via the university system, such as access to more, more relevant graduates.

As suggested competence centre PPPs act in several ways as mechanisms of change, first by drawing attention to economically important areas of research and innovation opportunity and encouraging the public and private sides to focus their efforts on these ('focusing devices') (Rosenberg, 1976; Arnold et al., 2008). A second role is in developing human resources involving communities or networks of researchers ('knowledge value collectives'), which tend to survive individual companies' changes of fortune and therefore have a lasting value (Bozeman and Rogers, 2002; Bozeman et al., 2001) as well as short-term value in improved networking and knowledge sharing (de Bresson, 1999). Last but not least, PPPs set agendas either through the strategies of centres or through a Strategic Research Agenda agreed by the community involved. This reduces uncertainty and focuses effort and is therefore expected to produce collective as well as individual benefits for participants.

Evidence for more recent network type or industry-led PPPs is hard to come by. The US New Generation of Vehicles (PNGV) network[7] has been analysed, but only really in terms of its ability to reach technical milestones, in which it has had a fair degree of success. But its effect on the competitiveness and success of the US automotive industry is unclear (Standing Committee to Review the Research Program of the Partnership for a New Generation of Vehicles, 2001) (US General Accounting Office, 2000). The ENIAC and ARTEMIS JTIs have been evaluated by panels (Bernotat et al., 2010; Goetzeler et al., 2013), again with a great deal of focus on process but little analysis of impact. It is clear that the agenda-setting aspect of these network PPPs has been reasonably successful. PNGV was in effect able to manage the flow of research money and this may have been a factor in its technical success. The EU network PPPs do not have money of their own, so the need to go to multiple sources and to compete in order to implement their strategic research agendas has been an impediment. Other national network PPPs, such as the Top Sectors in the Netherlands and the Swedish SIPs, are not yet sufficiently mature that it is possible to assess their impact.

EVALUATION OF PPPs

Evaluation of PPPs can serve many purposes. Usually ***'formative' evaluation*** refers to evaluation that takes place during a project's/programme's implementation with the aim to improve its design and performance. By contrast, ***'summative'* evaluation** aims to assess the impact of the initiative on the target group. There are many variations of these and attention is increasingly devoted to impacts that are broader than those of a single project or programme.

In addition to, and in order to provide factual basis for the evaluations, there is ***a need to develop appropriate indicators and other monitoring data on the programmes funded***. This is a basic requirement in any publicly-funded research and innovation activities. It is also important to do at the outset and in such a way that programme managers and participants will not afterwards be unduly laden with extra data collection efforts.

The plans for the evaluation of the Strategic Innovation Programmes in Sweden – to be explained in more detail in Appendix 1 – exemplifies a well-designed evaluation of PPPs combining both (formative and summative) aspects: after the first three years into programme implementation, evaluation pays special attention to the management and implementation of the programme towards impacts as expected in its objectives following the impact logic, as outlined by the stakeholders proposing the programme. If the programme gets a positive evaluation and is awarded funding for the next three years, after this period it will be evaluated again, but this time, on the basis of the targeted objectives and impact logic. It can again obtain further three years' funding, and after a yet another evaluation, at the maximum, further funding till the maximum 12-year funding period is at the end. According to the plans, evaluation at the later stages will be targeted more and more at broader and more system-level impacts, thus representing a 'summative' evaluation, but within a system perspective as the programme is intended to achieve these. Currently, the technology agency Vinnova is funding a research project to develop a framework for such a system-level evaluation.

[7] PNGV was one of the first very large-scale network PPPs set up on US government initiative in 1993 with the aim of doing precompetitive research in government labs and in the automotive industry that would enable drastic increases in vehicle fuel efficiency. Its focus was not only on industrial competitiveness but also on a societal challenge.

This MLE project paid special attention to system-level evaluation. At the outset such evaluation was of special interest to Belgium/Flanders, which wished to gain feedback to the plans to conduct an evaluation of its Strategic Research Centres. In the end, system-level evaluation approach was of great interest to practically all participants. The next section reports our discussion of what a system-level evaluation could entail.

System-level approach

The implications of the systems view would suggest that, when evaluating policy initiatives and policy tools, attention should be paid to the broader context in which the policy is launched*.** Pawson and Tilley (1997) have shown convincingly that the ***success of an intervention depends not only upon the intervention itself but on its context, so that the impact of the intervention is in effect the result of both. Thus, policy interventions and programmes need to be tuned to their environment. Context dependence is awkward not only for programme designers and managers but also for evaluators, who need therefore to explore and understand the context. This would include, i.a., questions related to the challenges and failures in performance that have justified the initiative, to other policy initiatives potentially aiming to rectify the same problems, or whether there are institutions facilitating or hindering the impacts of the evaluated policy tool and whether facilitating and/or necessary complementary institutions are lacking altogether.

***Context dependence also raises a question-mark against the idea of benchmarking similar interventions across different national or even regional contexts often used in evaluation*.** Thus, how could one compare the effectiveness of an innovation voucher scheme between a country with well-equipped and educated SMEs and one where the level of technological education and ability to adopt and adapt new technology is low? Just as awkward, whether it makes sense to compare the apparent economic benefits of similar-looking programmes in different places?

System-level overall evaluation

The OECD has published several reports with innovation system in their titles and has produced country reports of the innovation systems of different member countries since the mid-90s[8]; reviews of the innovation policies of countries since 2005[9]. The country reports aim to provide a holistic view of the policy area, make judgments on the different policy initiatives in that area and assess the appropriateness and effectiveness of the policy initiatives (programmes, institutes) in relation to the overall performance of the system to make policy prescriptions. ***The object of such a systems-level evaluation is the policy mix in place at a particular time*** and its results tend to be recommendations for changes to that policy mix.

Despite the production of statistical indicators[10], ***it has turned out to be really challenging to measure and assess institutional aspects in a systemic view***. In addition to a variety of quantitative indicator data, which provide rough – often lagged - indications of the situation of a country, the OECD country reviews draw on a variety of qualitative type of interview, survey, documentary etc. material collected by both the country concerned, but importantly by OECD experts.

Because of the complexity of the factors affecting systemic performance, it is difficult, if not impossible, to establish causalities between factors that presumably influence the outcome and their impact.

With all their limitations, the OECD innovation policy country reviews are the flagbearer and provide the best examples of system level evaluations of various countries' innovation policies and the overall performance of the system. There are further individual examples of evaluations conducted at the national level (e.g., Veugelers et al., 2009). However, usually, since OECD country reviews or similar type of general country-level evaluation exercises have to answer a

[8] http://www.oecd.org/sti/inno/nationalinnovationsystemsphaseicountryreports.htm

[9] http://www.oecd.org/sti/inno/oecdreviewsofinnovationpolicy.htm. Since early 1960s until mid-1990s, the OECD conducted country reviews on science and technology policy.

[10] In order to enable the assessment of the performance of the innovation systems, the OECD was active in developing R&D indicators and statistics as early as early 1960s; first these were mainly based on input statistics, and were later complemented with indicators developed in other institutional contexts (i.a., Community Innovation Survey, bibliometric and patent indicators to mention a few).

great many questions, even at best, they provide only fairly general comments on each policy tool, or perhaps more detailed comments on the issues and tools that are under special attention, but it is not possible to be detailed on the whole range of policy instruments. The question then remains what other approaches might be possible.

System-level evaluation of a single element (initiative, programme, centre)

In order to conduct a system-level evaluation of PPPs, one needs to go beyond the boundaries of a single programme (or programmes if these together constitute a policy or a PPP tool) evaluation in terms of its objectives. However, where to stop and draw the line, is not self-evident. A system level evaluation could imply that one would have to include following features in the evaluation:

- Overall indications of the system performance using indicators and other information
- Take into account the considerations that led to the launch of the evaluated programme or, if it is a long-standing programme, changes in its objectives and expected impacts
- Consider other programmes that fulfil objectives close to or similar to the evaluated programme
- Compare programme impacts with close to or similar programmes, if such information is available or can be achieved.
- Consider potentially hindering factors for performance such as institutional features (a lack of or poorly performing institutions)

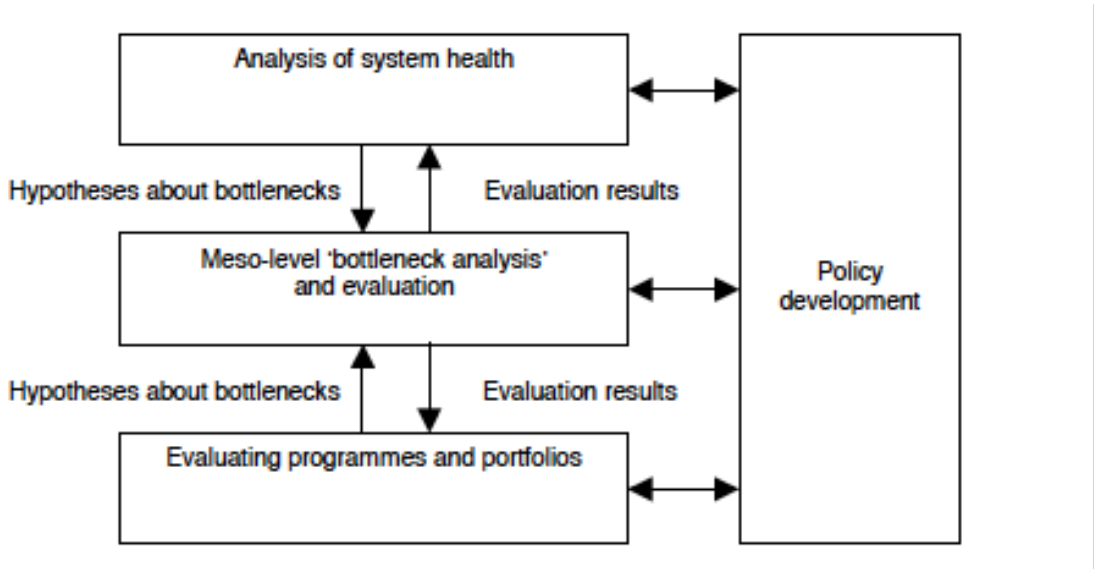
The first point in the above list implies that the evaluation does not take for granted the self-analysis which is propounded by the policy establishment as a justification for policies but, as in the OECD reviews, ***attempts to understand the situation independently of current policy analysis***. This suggests that attention be paid to the appropriateness of policies to address the specific situation, a question, which is not usually posed in an evaluation. The last point would refer to a situation in which, e.g., non-achievement of the nature and degree of RTD collaboration between industry and universities in a programme is diagnosed as an outcome of, i.a., insufficient ***absorptive capacity in the industry*** or insufficient ***orientation and quality of scientific research in the universities*** or equivalent, in addition to programme specific factors.

Overall, this is an indicative and an ambitious list.[11] It is to be noted that it is challenging to attribute impacts or system stages to any individual programmes or to compare their impacts in a strict sense. Too many factors intervene in any case and singling out their respective influences is difficult. Furthermore, because of sometimes abrupt changes in the policy context and economic environment, policy analysis of the appropriateness and effectiveness of particular policies may also change. Because of typical time and money constraints, evaluations are usually framed only within their own objectives and do not attempt to answer a wider list of questions.

A system level evaluation of a single programme represents a middle level in the hierarchy of evaluation as shown in Figure 1. Analysis at this level is typically concerned with bottlenecks and imbalances. An evaluation at this level would focus less on the 'goodness' of individual programmes and more on the collective. It might conclude that a very well designed programme is superfluous. In other words, this level is more interested in policy alternatives and is therefore likely to use resources to examine several initiatives.

[11] An example of an evaluation that followed the principles mentioned (with the exception of the first and last points) and e) was the evaluation of the Finnish SHOKs (Lähteenmäki-Smith et al., 2013).

Figure 1 Levels of evaluation in a systems context



Source: Arnold, 2004.

Methods and approaches in system-level evaluation

If such a system-level evaluation is to be conducted and an ambitious set of evaluation question is posed, what are the means to obtain information and to make judgments?

First, ***the way in which the evaluation questions are framed is vitally important***. Evaluation questions play an important role in focusing attention to system level issues and can counteract the strong drift towards 'business as usual', evaluation with a narrow focus on the achievement of programme-specific objectives and programme-specific reasons for their achievement or not.

Second, ***various evaluation methods and techniques can be applied in many ways and combinations***. Multiple methods and approaches are available and can be used in such an evaluation in different combinations depending on the specific type of programme, nature of its target audiences, and programme objectives, as follows:

- Intervention logic
- Economic impact analysis
- Small versus big firms – what is really feasible*?*
- Document analysis
- Surveys, interviews with participants and stakeholders
- Scientometrics
- Peer review; quality; strategy
- Human capital analysis, Knowledge Value Collectives
- Social Network Analysis
- Long-term tracing (backwards and forwards)

If an evaluation is aimed at system-level, it is, first, essential that approaches and methods relevant for the particular case be used in parallel. One of the questions to be addressed concerns the way in which the target groups for surveys and interviews are defined and how extensive they are. ***For a system level evaluation, key stakeholders at high policy and policy design and management levels need to be interviewed***. Furthermore, the way in which quantitative analytical methods are used can vary a great deal and need to be applied in a relevant way.

Further, ***interpretation of the various data sources is vitally important for the evaluation***. Drawing system-level conclusions on the basis of these several data-gathering exercises presupposes ***good acquaintance with the institutional context of the country concerned***. Such expertise could be gained, e.g., by a team of experts that combines experienced (professional) evaluation experts from outside the country (to provide an external view) and the country (to provide a good acquaintance with the system). High-level scientific and industrial panellists are probably not the most appropriate means to draw system-level conclusions though they can fulfil a highly useful role in the evaluation by assessing more specific questions such as the scientific and/or technological level of programmes or adding a validation panel for preliminary evaluation findings and conclusions.

Many of the above principles are applied in the example of the system-level evaluation presented by the Belgian/Flanders team in this MLE exercise.

In Belgium, the system-level evaluation of the three Strategic Research Centres (SRCs) (Imec, VIB and iMinds) pays attention to the following aspects:

- Contribution to the overall policy goals, added value, additionality, position in the system, and leverage effects
- Strategic co-operations that the SRCs have had, the extent to which they have utilised funding instruments including those intended for valorisation of research
- Future use and role of the SRCs, e.g., in connection with the cluster policy

The system-level evaluation complements and enriches the separate (punctual) evaluations of the separate centres. The main elements of this evaluation include the following:

- The division Strategy and Coordination of the Flemish Department of Economy, Science, and Innovation (EWI) first created an action plan for the evaluation in collaboration with the research division of the Flemish Department of Economy, Science, and Innovation that is responsible for the annual monitoring of the government subsidy of these SRCs.
- This action plan was communicated to the SRCs and was the basis for a call for tenders to find consultants to conduct the evaluation.
- The separate (punctual) evaluation of each of the three SRCs used
    - key performance indicators as specified in the management contract of each
    - self-evaluations conducted by each of the three SRCs
    - Bibliometric and financial analysis
    - Interviews with the management of each SRC, government, benchmark institutions, and other stakeholders
    - Site visit by panels by experts (one for each SRC) with experience in innovation activities and management of large top-level research institutions in their respective fields
    - A SWOT analysis of each SRC
- System-level evaluation used:
    - The findings of the separate evaluations of the three SRCs
    - Interviews with various stakeholders including the government, the management of the SRCs, and other parties
    - A site visit by a system-level evaluation panel with expertise in research and innovation policy
    - The system level evaluation drew on a framework of analyzing technological change in innovation systems (Hekkert et al., 2007).
- The final evaluation report will include as a separate element the report by the system-level evaluation panel, and the consultants responsible for the conduct of the evaluation will use the panel's conclusions in the formulation of the overall conclusions and recommendations.

To conclude, in order to incorporate a systemic perspective to an evaluation exercise, one needs to design the evaluation in a purposeful way, to formulate evaluation questions and use multitude of information in an appropriate way, and pay attention to the phase of the interpretation of the material acquired and the drawing of conclusions and formulating of recommendations.

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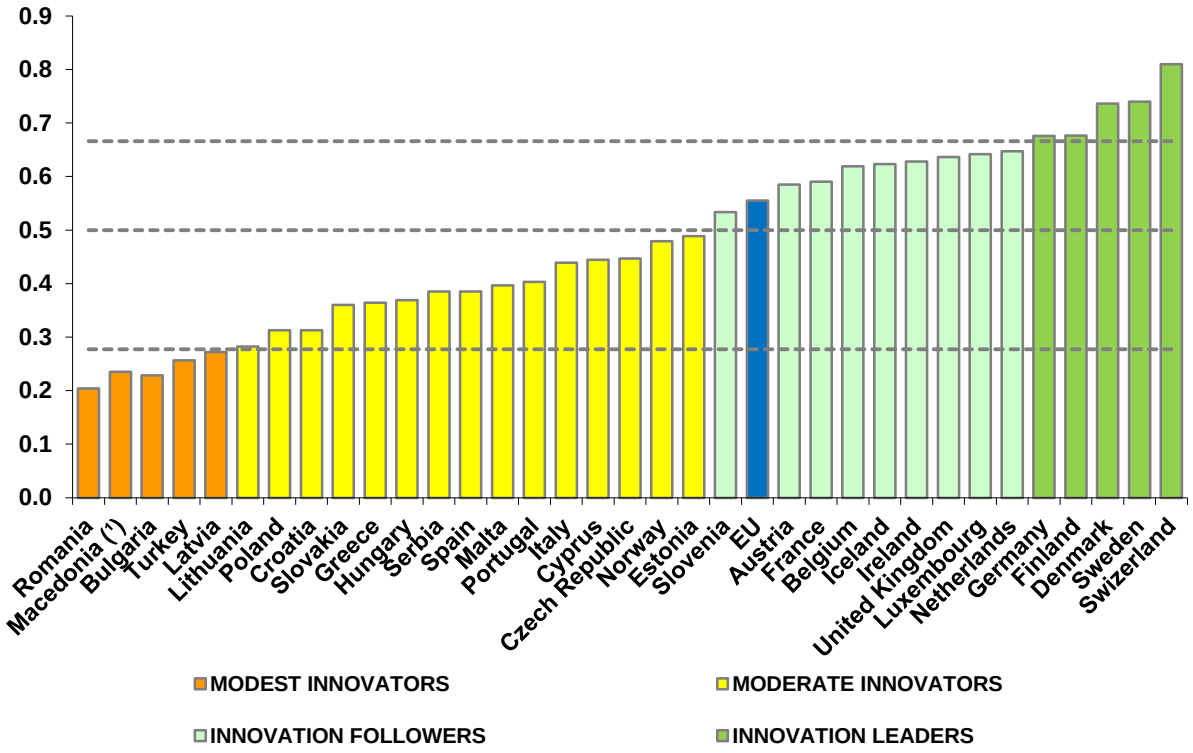
APPENDICES

APPENDIX 1. PARTICIPANT COUNTRIES

Short characterisation using STI indicators

Four countries participated in the project: Belgium (Flanders), Bulgaria, Norway, and Sweden. In addition, Spain has been an observer and has participated in the working meetings in Brussels. The participant countries provide a diverse set of PPP or PPP like tools, as will be seen in the chapter on the country cases. The four countries also present diversity in terms of R&D intensity and other indicators based on STI.

Figure 1. Innovation Performance in Europe



Source: DG Research and Innovation - Unit for the Analysis and Monitoring of National Research Policies
Data: Innovation Union Scoreboard (2015)
Note: (1) the Former Yugoslav Republic of Macedonia

The participating countries each represent different groups in the EU Innovation Union Scoreboard: Sweden the innovation leaders, Belgium the innovation followers, Norway the moderate innovators, and Bulgaria the modest innovators, as seen in Figure 1 above. This grouping is reflected in each of the more specific indicator data series in the following tables 1-5. Sweden has the highest R&D intensity, and Belgium outperforms Norway in many of the indicators: Belgium has a higher R&D intensity than Norway (Table 1) - and Flanders is performing even slightly better than in the whole of Belgium - , the BERD Belgium as % of the GDP is higher (Table 2), and Belgian firms fund a greater share of government sector and university research as a percentage of GDP (Table 3), but in human capital aspects, Norway outperforms Belgium and has a higher share of researchers of total labour force and employment (Table 4) and a higher share of new doctoral graduates per thousand population aged 25-34 than Belgium (Table 5). Bulgaria has a rapidly growing R&D intensity and GERD.

Table 1. R&D intensity (Gross Domestic Expenditure on R&D (GERD) as % of GDP

	2007	2008	2009	2010	2011	2012	2013	2014
EU	1.78	1.85	1.94	1.93	1.97	2.01	2.03	*2.03*
Belgium	1.84	1.92	1.99	2.05	2.16	2.36	2.43	*2.46*
Belgium/ Flanders	1.93	2.03	2.06	2.20	2.31	2.48	2.53	*2.43*
Bulgaria	0.43	0.45	0.50	0.57	0.54	0.61	0.64	0.80
Sweden	3.26	*3.50*	3.45	*3.22*	3.25	*3.28*	*3.31*	*3.16*
Norway	1.56	1.56	1.72	1.65	1.63	1.62	1.65	1.71

Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research policies
Data: Eurostat
Values in italics are estimated or provisional.

Table 2. Business Enterprise Expenditure on R&D (BERD) as % of Gross Domestic Expenditure on R&D (GERD)

	2007	2008	2009	2010	2011	2012	2013	2014
EU	63.6	*63.2*	*61.7*	*61.8*	63.2	63.5	63.5	*64.0*
Belgium	69.5	68.3	66.1	67.1	68.7	70.9	70.7	*71.2*
Belgium/ Flanders	68.9	68.2	65.5	66.7	68.0	69.7	69.4	68
Bulgaria	31.2	31.0	30.0	50.3	53.2	60.5	61.1	65.7
Sweden	73.0	*74.1*	70.9	*68.7*	69.1	*67.8*	68.9	*67.0*
Norway	52.5	53.2	51.6	51.2	52.2	52.3	52.5	53.7

Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research policies
Data: Eurostat
Values in italics are estimated or provisional.

Table 3. Government intramural Expenditure on R&D (GOVERD) plus Higher Education Expenditure R&D (HERD) financed by business enterprise (not including financed by business enterprise abroad) as % of GDP

	2007	2008	2009	2010	2011	2012	2013	2014
EU	*0.047*	*0.048*	*0.053*	*0.051*	0.051	*0.052*	0.052	:
Belgium	0.058	0.064	0.070	0.061	0.062	0.064(1)	0.072	:
Belgium/ Flanders	:	:	:	:	:	:	:	:
Bulgaria	0.021	0.017	0.023	0.017	0.018	0.014	0.017	:
Sweden	0.042	:	0.046	:	0.042	:	*0.038*	:
Norway	0.045	:	0.050	:	0.046	:	0.045	:

Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research policies
Data: Eurostat
Notes: BE, BG, SE, EU, NO: 2007-2013; (1)BE: Break in series between 2012 and the previous years
Values in italics are estimated or provisional
: = not available

The share of GOVERD and HERD financed by business enterprises is one of the indicators that is presumed to measure links and knowledge transfer between universities and other public research organisations and industry. In this respect the innovation leader Sweden is not leading, but is well below EU average and Belgium, which outperforms other participating countries. Since the PPPs are oriented towards improving these links this information is quite pertinent. It is to be noted that

while Bulgaria is catching up the other countries in many respects, its performance in business enterprise-public research organisation connectedness is not improving.

Table 4. Researchers as % of total labour force and total employment

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
% of total labour force										
Belgium	0.72	0.75	0.77	0.77	0.80	0.83	0.88	0.93	0.94	0.94
Bulgaria	0.30	0.30	0.32	0.32	0.34	0.32	0.36	0.34	0.36	0.39
Sweden	1.17	1.17	0.95	1.03	0.96	1.00	0.97	0.97	1.25	1.29
Norway	0.89	0.93	0.98	0.99	1.02	1.02	1.04	1.04	1.05	1.07
EU	0.59	0.60	0.61	0.64	0.65	0.67	0.68	0.70	0.72	0.72
% of total employment										
Belgium	0.78	0.82	0.83	0.83	0.86	0.91	0.95	1.01	1.02	1.03
Bulgaria	0.34	0.33	0.34	0.34	0.37	0.36	0.40	0.39	0.42	0.44
Sweden	1.27	1.26	1.01	1.09	1.05	1.09	1.05	1.06	1.36	1.40
Norway	0.93	0.96	1.00	1.02	1.05	1.06	1.07	1.08	1.09	1.11
EU	0.65	0.66	0.66	0.68	0.71	0.74	0.75	0.78	0.80	0.81

Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research policies
Data: Eurostat

Table 5. New doctoral graduates per thousand population aged 25-34

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
EU [2]	1.45	1.51	1.58	1.61	1.49	1.53	1.74	1.81	1.97	1.97
Belgium	1.16	1.25	1.25	1.37	1.38	1.53	1.52	1.65	1.70	1.78
Bulgaria	0.47	0.53	0.56	0.55	0.59	0.57	0.62	0.97	1.21	1.38
Sweden	2.40	3.28	3.40	3.16	3.10	2.93	2.88	2.83	2.79	2.91
Norway	1.33	1.41	1.59	1.99	1.74	1.92	2.05	2.17	2.32	2.11

Source: DG Research and Innovation - Unit for the Analysis and Monitoring of National Research Policies
Data: Eurostat
Note: [1] Break in series between 2013 and the previous years. Data up to and including 2012 are based on ISCED 97. Data from 2013 onwards are based on ISCED 2011.
[2] Elements of estimation were involved in the compilation of the data.

POLICY CHALLENGES AND EXPERIENCES OF THE PARTICIPATING COUNTRIES WITH PPPs

This section will summarise the information that the project has collected on the policy challenges that prompted the participating countries to take part in this MLE project and their experiences of PPPs in STI and as well as observations made during the country visits. It is evident that the PPPs that the participating countries have are diverse highlighting the complexity of the concept of PPPs.

BELGIUM/FLANDERS

SRCs within the overall policy context

The main PPPs in Flanders with respect to STI-policy are its five strategic research centres (SRCs[12]). These SRCs are important actors within the STI-system and annually, a substantial budget is provided to them following a five-year management agreement (between each SRC and the Flemish government). These institutions are competence centre type of institutions. All have physical core facilities and many have also research groups located in different universities and they are thus partially virtual centres.

These centres are the following, with their year of establishment in parenthesis:

- Imec (1984) (nanoelectronics)
- VITO (1991) (The Flemish institute for technological research)
- VIB (1995) (Flanders Institute for Biotechnology)
- iMinds (2004) (Fanders Digital Research Centre and Incubator) (to be merged with Imec)
- Flanders Make (2013) The strategic research centre for the manufacturing industry

The Flemish Government concludes multi-annual management agreements with each of these institutes, under which each has to fulfil a number of result-based performance targets and in general strengthen the Flemish knowledge base with an emphasis on commercialisation of their research. In return they receive an annual grant that varies between €23 and €45 million per institute. The research department of each SRC develops a strategic plan to define their mission, long-term focus and main research questions to address. The aim is to bring together companies, authorities, knowledge centres, and non-profit organisations to join forces on research projects. At the end of each multi-annual management period, the SRCs are subject to an in-depth evaluation organised by the Department of Economy, Science and Innovation of the Flemish Government. This evaluation is conducted by external consultants and independent international experts. Thereby, the performance of the targets of their strategic plan is assessed with a focus on their activities related to research and scientific output (publications), technology transfer (patents, licensing agreements, start-up companies, etc.), and communication. Moreover, the impact on the Flemish research landscape is analysed and the economic added value quantified. Imec that was founded in 1984 is now able to draw most of its funding from sources other than the Flemish Government and only 12 % of its resources now comes from government sources. This is justified by the risky nature of the basic research pursued essential for staying at research forefront and providing the knowledge base for more applied research.

In 2013 the STI-policy of Flanders became more focused on innovation and especially at the system level. The new Flemish Government of 2014 defined the following objectives for the research and innovation policy:

- Demand driven and market driven support
- Simplification of the instruments
- Lowering thresholds
- Valorisation of human capital
- Taking responsibility (by actors)

In January 2016 the Flemish Government launched a *cluster policy* in order to reform strategic co-operation between government, knowledge, institutes and companies. Key-words of the reform are

[12] Abbreviated to SOC in Dutch ("Strategisch OnderzoeksCentrum").

focus, co-operation and impact. Focus will be on strategically important fields for Flanders and the initiatives should emerge bottom-up. One of the inspirations for this policy was given by the Norwegian example.

Flanders Innovation and Entrepreneurship, AIO[13], is in charge of managing the cluster policy. For 2016 a specific budget will be allocated: 7.5 million Euro for spearheads and 6.75 million Euro for networks. An open call has been launched accordingly.

Other leading principles of the policy are:

- simplification and streamlining of the large number of various intermediaries, structures and innovation actors;
- increasing innovative entrepreneurship and business involvement, and thereby increasing impact of public policies;
- Building on (and continuation of) Innovative Platforms & intermediaries.
- Improving overall **human resources, skills and capacity** and building a **demand-driven and market-oriented** public policy in the field of economy and innovation.
- Addressing challenges of STI globalisation and increasing international cooperation, with a greater focus on **business-oriented innovation and valorisation**, strong knowledge organizations with **excellent research and a growth path for the 3% target for R&D**, whereby public outlays strive towards 1% by 2020.

As part of the cluster policy *Innovative business networks* are small scale, bottom-up, have a future potential and originate from emerging markets or from the bundling of various small initiatives. A maximum of 50% government support of €150,000 is foreseen annually per network and the support is provided for a three-year period.

In addition to innovative networks of companies, a restricted number of *spearhead clusters* will be supported. The latter are substantial strategic sectors where Flanders can realise an added value, both internally as internationally. The spearhead clusters will be supported for 10 years and the government provides, at most, half of the necessary funding, however, restricting the funding to 500,000 euro annually. Bringing together several players and search for interesting developments and international contacts, the cluster organisation that will realise the specific spearhead cluster will be assigned to develop an ambitious competitive programme. Mutual engagements and objectives will be outlined in a cluster pact.

The five SRCs have been established earlier and are active in strategic domains complementary to those cluster policy aims at.

As Flanders aims to be a front-runner in the European knowledge society and economy by continuing to build on and utilise its existing knowledge base and by increasing its innovation potential, substantial support for its strategic research centres remains a constant in current STI-policy. Each of the SRCs is active in a specific research area and should combine excellent research to valorisation (as a tool for realising the economic potential of the research). In that respect, the SRCs are considered important actors in the transformation of the Flemish economy. Since they were established, Imec, VIB, iMinds and VITO have created multiple (over 100) spin-offs. In 2016 the total budget for the 5 SRCs amounts to 182.03 million Euro.

The Government of Flanders launched vision paper "Visie 2050" outlining the tendencies and challenges for the future and developing a long term vision regarding the future of Flanders (up towards 2050) seen from a broad societal point of view. This vision paper envisages a system transition including technological and societal transformations and outlines priorities to support envisaged change.[14]

A governance model to support a transition policy is envisaged to ensure a long term approach and stimulate co-operation across all kinds of borders. Based on previous actions and experiences in transition management, efforts will be directed at system innovation, fostering changes at system level or innovation of the whole system.

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[13] The former agency for Innovation by Science and Technology (IWT) partly integrated with the Agency Entrepreneurship (AO).

[14] A comprehensive overview of STI-policy and key figures up until 2015 is available in the publication http://www.vlaanderen.be/nl/publicaties/detail/sti-in-flanders-science-technology-and-innovation-policy-and-key-figures-2015-1

The process will be monitored and matched against the initial ambitions, hence introducing system evaluation as a way of monitoring the whole system on a regular basis in order to measure progress and possibly adjust transitions.

Evaluation of the SCRs

Evaluations within the STI area have been conducted on a structural base and are co-ordinated or conducted by a dedicated evaluation unit within the Department of EWI since 2007. This evaluation unit is not involved in the preparation and or realisation of STI policy, which means that the evaluation function is strictly separated from the other functions within the department.

The evaluations conducted up until now consist both of evaluations of projects, (research) institutions, programmes and other policy instruments.

Evaluations are affected by the relations between the Flemish government and third parties. These are typically outlined either in agreements (mostly for projects and institutions, but sometimes for the management of programmes) or in Directives by the Flemish Government (mostly about specific programmes distributing funds for research or research infrastructure (on a competitive base)). The former are generally concluded for a period of five years[15], whereas the latter may have an indeterminate validity (although the provisions of the Directive may change over time, resulting in an alternate or even new Directive).

In general, all relations comprise evaluation provisions and Directives in most cases also provide for evaluations after a five-year period of implementation of the measure outlined in it.

The evaluation unit has developed an evaluation approach. In practice this means that after the first four years of the life-span of the management agreement, a specific evaluation is to be conducted. With regard to longer-term support measures, the evaluation unit aims to conduct evaluations after each five-year period in a way that each evaluation adds value. This means that an evaluation can be different from the evaluations conducted before, still taking into account the specific provisions of the relation under consideration. As these allow for some measure of freedom, it is possible to tailor the evaluations to specific needs and also to obtain added value as compared to the previous evaluation.

Examples of such "evolution in evaluation" are the 2011 evaluations of the SRCs Imec and VIB and the 2012 evaluation of VITO. As these institutions had been evaluated several times already, instead of an institutional evaluation, a broad evaluation was conducted spanning in each case the period since the institute was established. In that sense these evaluations were "meta-evaluations".[16]

However, these evaluations still remained at the level of the institute itself, and although the policy context is taken into account in each evaluation, the evaluation unit felt that a complementary approach should be taken. Following the evolution of STI-policy to system innovation, the proposal was made in 2013 to take evaluation to a higher level and introduce system evaluation as a complement to specific/punctual evaluations.

System-level evaluation

As a way of developing a methodology tailored to the specific needs of the EWI-domain the first step was taken in 2015 when the evaluation of the SRCs Imec, VIB and iMinds was envisaged in 2016. These three SRCs would be evaluated both individually and together as part of a systemic evaluation. The evaluation exercise is expected to provide insights into system level evaluations with that have a broader scope.

Another challenge in this respect has emerged recently (announced on 19 February, 2016): Imec and iMinds will be merged by the end of 2016 in order to create more impact in Flanders, Europe and beyond.[17] The merged institute will be a high-tech research and innovation institute at world

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[15] Not necessarily corresponding to the 5-year period of government a Flemish Government is elected for.

[16] Management summaries of these evaluations available at: http://www.ewi-vlaanderen.be/sites/default/files/meta-evaluation_imec_2011_-_executive_summary.pdf; http://www.ewi-vlaanderen.be/sites/default/files/meta-evaluation_vib_2011_-_executive_summary.pdf and http://www.ewi-vlaanderen.be/sites/default/files/bestanden/Evaluation%20VITO%20MngtSum%20UK.pdf.

[17] http://www.iminds.be/en/news/20160219_pr_iminds-imec

level with a maximal regional impact. iMinds activities will become a third business unit of Imec, based in Ghent, while maintaining the iMinds community of researchers in the five universities. The systemic evaluation of the SRCs conducted in 2016 is envisaged to take into account this new situation.

The system-level evaluation of the three SRCs pays regard to the following aspects:

- Contribution to the overall policy goals, added value, additionality, position in the system, and leverage effects
- Strategic co-operations that the SRCs have had, the extent to which they have utilised funding instruments including those intended for valorisation of research
- Future use and role of the SRCs, e.g., in connection with the cluster policy

A system-level evaluation is seen to offer an opportunity to develop a more strategic perspective on the (combined) effect and impact of the SRCs and their (combined) role, position and added value in the Flemish innovation landscape. It can also help to improve the SRC as an instrument in innovation policy. The system-level evaluation complements and enriches the separate (punctual) evaluations.

The evaluation was ongoing during this MLE project and its plans and methods were presented to the project.

The main elements of this evaluation include the following:

- The division Strategy and Coordination of the Flemish Department of Economy, Science, and Innovation (EWI) first created an action plan for the evaluation in collaboration with the research division of the Flemish Department of Economy, Science, and Innovation that is responsible for the annual monitoring of the government subsidy of these SRCs.
- This action plan was communicated to the SRCs and was the basis for a call for tenders to find consultants to conduct the evaluation.
- The separate (punctual) evaluation of each of the three SRCs used
    - key performance indicators as specified in the management contract of each
    - self-evaluations conducted by each of the three SRCs
    - Bibliometric and financial analysis
    - Interviews with the management of each SRC, government, benchmark institutions, and other stakeholders
    - Site visit by panels by experts (one for each SRC) with experience in innovation activities and management of large top-level research institutions in their respective fields
    - A SWOT analysis of each SRC
- System-level evaluation used:
    - The findings of the separate evaluations of the three SRCs
    - Interviews with various stakeholders including the government, the management of the SRCs, and other parties
    - A site visit by a system-level evaluation panel with expertise in research and innovation policy
    - The system level evaluation drew on a framework of analyzing technological change in innovation systems (Hekkert et al., 2007).
- The final evaluation report will include as a separate element the report by the system-level evaluation panel, and the consultants responsible for the conduct of the evaluation will use the panel's conclusions in the formulation of the overall conclusions and recommendations.
- The research division of the Ministry first created an action plan for the evaluation
- It used a call for tender to find consultants to conduct the evaluation process.
- The separate (punctual) evaluations of each of the three SRCs used
    - key performance indicators as specified in the management contract of each
    - self-evaluations conducted by each of the three SRCs
    - Bibliometric and financial analysis
    - Interviews with the management of each SRC, government, benchmark institutions, and other stakeholders
    - Site visit by panels of experts (one for each SRC) with experience in innovation activities and management of large top-level research institutions in their respective fields
    - A SWOT analysis of each SRC

- System-level evaluation consisted of:
    - The findings of the separate evaluations of the three SRCs
    - Interviews with various stakeholders including the government, the management of the SRCs, and other parties
    - A site visit by a system-level evaluation panel with expertise in research and innovation policy
    - The system level evaluation drew on a framework of analyzing technological change in innovation systems (Hekkert et al., 2007).
- The evaluation report will include the experts' reports as one of the elements and overall conclusions and recommendations to be drafted by the evaluation consultants.

The evaluation findings will become public and widely available after new management agreements have been made with each of the three SRCs.

BULGARIA

Many studies and reviews of Bulgaria in recent years, among others the Horizon 2020 PSF Peer Review Report of 2015 have noted the low public expenditure on RD&I activities and a fragmentation of research and innovation in the national innovation system (Peer Review, 2015). One of the challenges is to create links between the Higher Education Institutions and the rapidly developing entrepreneurial ecosystem and to mainstream the third mission in the HEI and PROs. A systemic challenge lies in a widely perceived lack of trust among the stakeholders and actors in the system hindering the implementation of reforms.

The government recently adopted a new strategy and a vision to promote innovation. The vision included three major goals: 1) the allocation of funds to public organisations on the basis of performance; 2) addressing the human resource situation in research and innovation (brain drain and demographic developments); 3) the promotion of public-private collaboration. These goals have been well received.

Considering the fact that Bulgaria is still at an early stage in developing PPPs in the area of R&I, Bulgaria has two major policy challenges related to the PPPs. The *first challenge* concerns how to embed new PPPs in the bigger ecosystem for R&I in the country and more concretely to link them to the overall strategic process for financing, developing, monitoring, and assessing the impact of publicly funded projects and programmes. Currently there are different funding mechanisms in this area, Ministry of Education and Science and the National Science Fund, Ministry of Economy and the Innovation Fund and two Operational Programmes under the Structural Funds. There is no common assessment tool concerning these instruments.

One of the main tasks of the government is to *develop a coordination mechanism* for all the funds in the scope of the implementation of the Innovation Strategy for Smart Specialisation (ISSS). The idea is to have an interlink between the public funding bodies so as to assure smooth transfer of mature research projects to innovation development (basically dividing the funding according to the TRLs) and to avoid overlapping and dispersal of the financial resources. In this regard, it is highly important that this coordination mechanism includes, besides management of funds and co-ordination of programmes, a common monitoring and assessment tool. For the moment, there is no concrete proposal for common monitoring and assessment instrument.

For the current programme period 2014-2020 the biggest concentration of financial resources is for big projects in R&I sector, especially oriented towards creation of:

- Centres of Excellence
- Centres of Competence
- Joint Collaborative programmes with the industry
- Research Infrastructures under the National RI Roadmap

In addition, *SofiaTechPark* (STP) funded under the previous Operation Programme is expected to be fully operational onwards and the STP will also depend on public funding.

The *second policy challenge* concerns the implementation and the lifespan of the newly created research and innovation infrastructures. Currently, the public funding bodies are following mainly the existent practice in other MS that made a great use of the Structural Funds and the Framework Programme to develop Centres of Excellence, Centres of Competences, Science and/or Technology Parks. This practice shows that although the governments are/were relying on industry to assure the sustainability of the PPPs this is very unlikely to happen in the scope of the next 10-15 years.

The reasons include financial crisis, mindsets, a lack of administrative and managerial capacity but most important economic reasons.

Although the new generation of projects in Bulgaria is planned drawing on the best experiences for creating PPPs opening up the research infrastructure to business and collaboration with private stakeholders, encouraging and funding also spin-off and start-up companies, the reality shows that it is very unlikely all the planned CoEs, CoCs and TechParks will run on their own after seven years.

One of the measures includes the implementation of sound monitoring and assessment from the start in order to be able to predict and/or if needed, to divert or stop some of the public funding thus to avoid committing errors or taking too big risks for government funding. Further, sound evaluation will help to streamline the funding sources.

Monitoring and evaluation

Because of the dominance of the funding from the Structural Funds, the monitoring that is envisaged is based mainly on the criteria and Regulations of the EC on ESIF, which as such is necessary but the question is about the degree to which it will provide an assessment of the added value and the contribution of these projects to economic growth (1) and contribute to grand (2) and societal (3) challenges.

As a pilot initiative the Ministry of Education and Science is launching this year an overall assessment of the research activities of the public research performing organizations including universities and the National Science Fund. The new Regulation does not correspond to the objective described above which aims to measure the impact and the added value of the new programmes and projects envisaged for implementation in 2014-2020.

This creates a risk of not fulfilling the overall ambition of the government set under the Innovation Strategy for Smart Specialisation to create enhanced infrastructure and potential in key strategic economic areas for the country. The design and implementation of a common approach for continuous monitoring and assessment of all existing instrument and funded projects which can be regarded as PPPs will give predictability to the political management and to the business partners also. It will be helpful from the point of view of the sustainability of the projects too.

Evaluation is in this context seen as an important means to promote change and a restructuring of institutions on the basis of rewarding institutional performance and capacity. To address some of the perceived deficiencies of the National Science Fund (NSF; the basic research funding organisation), the regulation by Bulgarian government on the monitoring and evaluation of the activities of the NSF entails annual evaluations of the NSF's performance by a commission of independent experts appointed by the Minister of Education and Science. The regulations defines in detail the data on which the evaluation will be based (such as lists of calls, programmes, reviewers/experts, call documents and decisions, complaints filed against NSF decisions, reports on the implementation of projects, lists of research infrastructures and patents.) Detailed instructions have an aim to guarantee a quality of evaluation, but as a drawback can become counterproductive if they are too detailed. Thus the Horizon 2020 PSF Peer Review report (2015) suggested, i.a., more leeway in in what information they request and the way in which they will perform their task. This report also paid attention to ensuring the independence of these experts and perhaps a need to use one commission for monitoring both NSF and NIF (the National Innovation Fund) to help coordinating expertise and experiences across the funds as well as their ministries.

Knowledge transfer mechanisms

The Horizon 2020 PSF Peer Review report further noted that Higher Education Institutions do not have a clearly defined role in promoting innovation and entrepreneurship and that knowledge exchange is not yet part of the core-strategy of HEIs (Peer Review of the Bulgarian Research and Innovation system, 2015). However, the challenges faced with are also related to institutions such as intellectual property right systems or to demand factors, enterprise sector capable of and willing to utilise knowledge in its innovation processes, that are needed for well-functioning research-innovation interface.

The activities supporting knowledge transfer and open innovation at university level are still at initial stages of development. There is very little cooperation between academia and industry and very little interaction, which is reflected in the table 3 in the previous section. Universities and HEIs show little engagement with stakeholders at regional or industry level and there is a substantial gap between the university supply of professions and the labour market demand. The decline of GERD since 2006 has rendered the situation worse. The relatively low level of privately funded public R&D (less than €7m for 2013, or only 2.6% of GERD is an evidence of the barriers for collaboration with the public sector R&D. This situation is confirmed with the relatively low place of

113 (out of in total 144 places) that Bulgaria occupied in the WEF Competitiveness Report of 2014 regarding the global ranking for university-industry collaboration in R&D.

The country has taken some initial steps in a number of measures to counteract the negative trend in government budget allocations on R&D and R&D performance. One of the initial policy measures managed by the Ministry of Economy is a project 'Science and business' with an aim to improve the environment for science and business interactions. Specific activities financed within this project have been: improving the communication "science-business" through networking across sectors; promotion of research results and new scientific developments; presentation of successful research products for society and business; improving the qualifications of researchers, including young researchers to meet the needs of the labour market. The programme has a budget of €2.6m, but the Ministry of Education, Youth and Science (MES) has not released yet the evaluation of the outcomes. Among the target activities under this programme is the development of an interactive national platform to integrate three distinctive systems – BulCRIS *(*Bulgarian Current Research Information System); information from the Bulgarian patent office and information from the 'National information and documentation office' on PhD dissertations.

The foundations of a system of technological centres, business incubators and technology transfer offices were established during 2011-2014 under the Operational Programme 'Development of the Competitiveness of the Bulgarian Economy' (OPC), where the Ministry of the Economy (ME) successfully financed 33 organizational establishments, including; four technology centres for the value of €3.9m (20% implementation from the budget of €20m); twelve business incubators with a total value of €5.4m (30% implementation); sixteen technology transfer offices (with a total value of €1.0m (38% implementation); and the new Science and Technology Park 'Sofia Tech'.

The policy framework for creation and development of *technological centres* aims to promote entrepreneurs' access to research knowledge and commercialisation of R&D activities. It uses financial mechanisms, whereby beneficiaries of the grant have to contribute 30% of the project value. The key performance indicators of this scheme are: number of supported / created TTOs; number of enterprises using the services of the TTOs; number of jobs created in supported TTOs; investments generated in TTOs; number of projects in support of business, entrepreneurship and new technologies; number of implemented investment projects.

One of the key projects in this framework is *Sofia Tech Park*. The managing authority for this project is directly the Ministry of the Economy, and it is established with the aim to strengthen the competitiveness of science and entrepreneurship in Bulgaria, to improve the exchange of knowledge between academia and the business community, to become a platform for the development of start-up companies, and to accelerate the process of commercialization of research. The Technopark has already established a broad consortium for its implementation including leading universities, the Bulgarian Academy of Science, business clusters, large international companies, Sofia Municipality, the Ministry of Education, Youth and Science, the Ministry of Labour, NGOs and other institutions.

One of the latest initiatives of ME is the Technostart programme with a budget of €205 thousand, which aims to encourage the innovation activity of young entrepreneurs in Bulgaria – students, PhD and graduates in the earliest stage of the entrepreneurial cycle – to submit and work on a new business idea. Under this programme 169 candidates received a grant of €10,000 towards the cost of fixed assets (including equipment, computers and hardware), and the cost of intangible assets (including software, registration of new products / services, patents, licenses, trademarks, utility model or industrial design)

In a nutshell, Bulgaria is right at the beginning of investing in PPPs and creating better ecosystem for enhancement of the research and innovation potential of the country which is basically long-term process. At the same time, Bulgaria is facing the challenge offered by the political, social and global dynamics which should make the country to think how best to assure healthy and sustainable PPPs but also accountable to citizens (also from the point of view of taxpayers) needs.

NORWAY

Overview of Norwegian PPP-like Schemes

Norway has a concept for Public Private *Cooperation* (PPC), not for Public Private *Partnership* (PPP). PPCs are more limited, like for the construction of highways where the private actor covers costs to be refunded through the collection of highway tolls. The involvement of R&D is limited. PPCs cannot be said to be covered by the OECD's PPP definition. However, there are some other Norwegian national measures more in line with the PPP concept – but for which the PPP concept has not been applied:

- Norwegian Innovation Clusters (NIC) – a government funded cluster programme aimed at contributing to value creation via sustainable innovation
  - Objectives:
    - Increased competitiveness in regional clusters through long-term internal and external collaboration between companies, R&D and educational institutions
- NIC programmes, addressed to increasingly mature clusters;
  - The Arena programme implemented in 2002, has since then supported around 70 cluster projects
  - Norwegian Centres for Expertise (NCE) implemented in 2006, is supporting 14 cluster projects
  - Global Centres of Expertise (GCE) established in 2014 and expanded to a total of three cluster projects in 2015.

- Centres for Research-based Innovation (SFI) – a government funded scheme promoting innovation by supporting long-term research through close cooperation between R&D intensive companies and prominent research institutions.
  - Objectives
    - The main objective is to enhance the capability of the business sector to innovate by focusing on long-term research based on forging close alliances between research-intensive enterprises and prominent research groups.

- Centres for Environment-friendly Energy Research (FME) **–** can be considered as a special case of SFI (with which it shares overall objectives and procedures), although thematically ring-fenced
  - Objectives
    - As SFI, although focused on energy research (renewable energy, energy system, energy use) and research on carbon capture and storage (CCS).

Policy challenges regarding the schemes

The guidelines for both PPP or PPP-like schemes Norway has, NIC, SFI and FME, specify when midterm and ex-post evaluations shall take place for each centre and what these evaluations shall include, i.a. in order to determine (in the case of midterm evaluations) if the centre will continue to receive funding for the remaining part of its planned duration. However, no full evaluation of the results of the schemes as such has yet been conducted. A more result oriented ex-post evaluation system is gradually being introduced to all government funded schemes supporting research and innovation. Documentation of the results from the NIC and SFI schemes is therefore somewhat patchy at present but efforts are being made to provide a more systematic and comprehensive documentation.

A clear difference between the Arena and NCE parts of NIC on one hand (1) and the GCE part of NIC as well as the SFI and FME schemes on the other hand (2) is that the schemes under (1) are subject to exemptions in state aid rules related to current expenditures for networking etc., while schemes under (2) are subject to exemptions related to investments in research. A cluster under (1) can only receive support for a period of 10 years and cannot "re-invent" itself and receive support for a new period – because this is support to current expenditures. A cluster under (2) can re-invent itself and receive support for a new period because this is support to research. Clusters under (1) are facilitators that can be agile and flexible; they do not need to concern IPR issues. Clusters under (2) involve deeper R&D cooperation with challenging IPR issues to be solved etc. When Arena or NCE status is awarded, the cluster with such a status can be established within a few weeks. For the other clusters (under (2), in particular, those involving international companies with strong IPR requirements – as is the case for some SFIs – the time between the date for the approval of the application for SFI status and the date for the formal launching of the SFI after negotiations between all partners have been concluded, can in some cases be as long as a year and a half.

Highlights from the Country visit

Centres for Research-based Innovation (SFI)

The SFI scheme, funded by the Research Council of Norway (NRC), supports industrially-oriented research through the active cooperation between innovative companies and prominent research groups from Universities and Research Institutions. The projects need to carry out high quality international research. Recruitment of talented researchers and a doctoral programme are mandatory elements of the project. The contract is concluded between the Research Council of Norway and the Host.

Each SFI is hosted by a University, Research Centre or Hospital. Unlike until recently, companies will no more be able to be hosts because of the limitations imposed by State Aid rules and in order to avoid possible conflict of interests. The host institution should have a strong reputation within the disciplines or industrial areas the centre addresses. The host institution's administration must make a declaration of intent stating that it will undertake the obligations entailed by hosting, and explain how the SFI's research will fit into the host institution's research strategy.

The partners (enterprises, public organisations and other research institutions) must contribute to the centre in the form of funding, facilities, competence and their own efforts throughout the life cycle of the centre. User partners must point out the commercial potential they envisage resulting from the centre's activities.

The SFI centres must have high potential for innovation and value creation, develop active cooperation between innovative companies and prominent research groups, high scientific quality of research, be bridgeheads for international cooperation and an active policy for recruitment of talented researchers.

Programme support

Since its establishment in 2006, the scheme has funded 38 centres so far through 3 calls. Each centre receives between 10-12 M NOK per centre per year (1 to 1,2 M €), which represents 50% of the total funding of the centre. The rest is contributed by the host institution and research partners (25% of the total) and by the business partners (25% of the total), both in cash or in kind. Each centre is funded for 5 years, that can be extended to 3 more years, subject to a successful mid-term evaluation after 3,5 years of its start.

Governance

The Host institution concludes the contract with the NRC. The centre has a rather large autonomy to establish its own internal governance arrangements, but companies must be part of the Board, although their number vary from centre to centre.

The implication of the companies is also variable, depending both on their own interest in being involved and on the personal style of management of the SFI Director. This variability, though, serves the purpose of adapting the SFI activity to the specific characteristics of the field and industrial sector involved.

The internal work programme is decided on annual basis within the overall plan established in the contract with CNR.

NRC has a framework for IPR arrangements of SFI. Yet, each centre faces very different situations depending on the Companies involved and the type of projects carried out. So, some centres do focus on pre-competitive activities therefore reducing the IPR issues to a minimum, while others need to face very tough IPR negotiations for Multinational companies to join in (see specific cases highlighted below).

Collaboration with foreign firms within the programme is possible in these programmes. Norway allows foreign firm partners to obtain support if these clearly benefit the Norwegian participant industry. The evaluation of the case is done by the participating industries.

Resource and project allocation is delegated to the participants of the centre programmes, who are the beneficiaries, thus facing potential problems of double principal-agent.

Selection

Centres are selected on the basis of periodic calls for proposals. So far, there have been 3 calls in 2005, 2009 and 2013, each solved one year after its issue date. 14 SFIs of the first call have already finished, having presented their final reports in 2015. 7 SFIs of the second call are still active, having undergone a mid-term evaluation in 2014. The last 17 SFIs were launched in 2015. There is no date for a new call. In total, 24 SFIs are running in 2016.

The calls have a bottom-up approach, not having either sectoral or thematic orientation. The selection is made on the basis of the judgement of the quality of the following aspects: research, innovation, potential for innovation and value creation, internationalisation, researcher training and recruitment, partners and funding and Organisation.

Evaluation and monitoring

The guidelines for both PPP or PPP like schemes Norway has, NIC and SFI, specify that a midterm (after 3,5 years) and ex-post evaluations shall take place for each centre and what these evaluations shall include, i.a. in order to determine (in the case of midterm evaluations) if the centre will continue to receive funding for the remaining part of its planned duration.

Technopolis' evaluation of the Research Council (2012) pointed out that the centre schemes have contributed to renewal, improved quality and less fragmentation of the research system; been structuring the host institution's strategies and focused resource allocation; contributed positively to the research training and international exposure.

From the individual evaluation reports of the centres, some general comments have also been made by the evaluators about the scheme, which are so far positive, but lacking specificity and detail. However, no full evaluation of the results of the schemes as such has yet been conducted. A more result oriented ex-post evaluation system is gradually being introduced to all government funded schemes supporting research and innovation.

Environment-friendly Energy Research (FME)

FME is a special case of SFI limited to energy research (renewable energy, energy system, energy use) and research on carbon capture and storage (CCS).

The scheme responds to a Parliamentary initiative that aimed at tripling the Governmental budget devoted to Energy initiatives.

The selection criteria are similar to the FME, although it adds the assessment of how the proposed FME may help solve key challenges in the energy sector and generate solutions for the low emission society.

FME scheme is supporting 11 centres, 8 having been established in 2008 and 3 more in 2011. New centres are being announced in 2016 as this report is been written.

Points for discussion

A general question is that SMEs do not participate much in SFI, in spite of Norway having some SMEs involved in research at a high level as indicated by for instance results in Eurostars. The Research Council of Norway (NRC) does not impose any condition or requirement in terms of the size of the participating industries. Companies can contribute in kind or in cash, so money is not necessarily always an issue.

SFI and FME raise the issue of the dual principal-agent problem, since resource allocation is decided by the centres themselves. NRC acts as an intermediary between the Government and the Centres and oversees fair application of rules. NRC sees the Centres as agents for real change in Norway concerning the way research is done and cooperation has been implemented. Although funded by the Ministry of Knowledge and research, the Ministry of Industry keeps a close eye on how the projects evolve.

Only one FME centre is reported to be closed down after the 5-year evaluation due to the weak industrial involvement.

Participation in H2020. Reluctance of some companies to participate, although they will be obliged by future NRC rules. This is linked to the question of the "fat-cats" (well-funded centres that do not need to seek for funding elsewhere). Is this happening in Norway? This could be the case in Health, where there are generous budgets pouring research groups in Norway. This can be the case also in Sweden.

Norwegian Innovation Clusters (NIC)

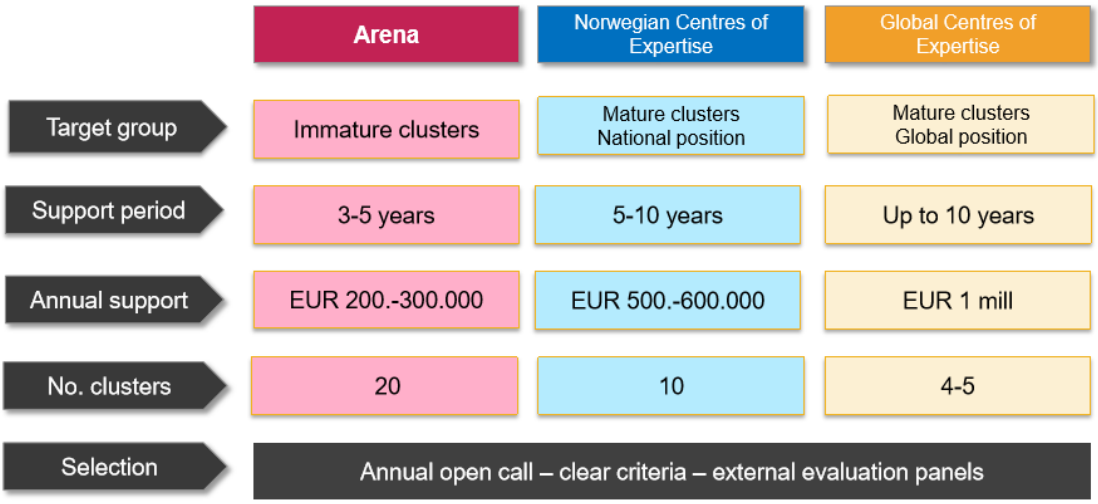
NIC scheme aims at supporting clusters with a growth potential, through long-term internal and external collaboration between companies, R&D and educational institutions. Clusters need to be based on strategic collaboration between companies, knowledge providers and public sector. The ultimate goal is to increase value creation and competitiveness.

As for the actual nature of the Cluster programmes as partnerships, they may not be actual PPP for STI in the sense, for example, of the OECD definition, but they are a step towards establishing PPPs. The problem is how to move from this stage to fully fleshed PPPs.

Funding is provided for advisory services, promotion of knowledge and skills, networking and profiling, therefore not directly used in research or innovation projects.

NIC scheme has been developed through three complementary programmes, each funding clusters of higher maturity and influence with more funds for longer time. So far the cluster programme support is 16 million euro.

PROGRAM OVERVIEW



Source: Innovation Norway, 2016

The *Arena* programme started in 2002, it has supported since then some 70 clusters, of which 20 are currently being funded. Arena centres can apply to become Centres of Excellence (NCE).

Norwegian Centres of Expertise were launched in 2006 and since then has supported 14 projects, of which 10 are ongoing projects.

Global Centres of Expertise were established in 2014 and expanded to a total of 4 projects in 2016 (one is in the pipeline in the final stages of negotiation and is expected to be still funded in 2016).

Apart from these differences, the three schemes share many features in terms of governance, selection and funding schemes. Clusters are selected through a bottom-up process via annual calls for proposals. The clustering pursues to provide a common view for all partners. Most clusters have successfully developed and only in few cases the collaboration did not work out.

Programme support

The clusters receive 50% of the funding from the Ministries of Industry and Fisheries and Local Government and Modernisation, the remaining 50% being contributed by the partners either in cash or in kind. The operational Agencies implementing the programme are Innovation Norway (that also receives funding from the Ministry of Industry, although depends on the Ministry of Education and research), the Research Council of Norway and SIVA, which provides the physical infrastructure (e.g. incubators).

The programme pursues also overall strategic objectives, involving cluster development, knowledge links, collaborative innovation, cluster to cluster collaboration and collaborative innovation, which, all together, should improve the strategic positioning leading to increased value creation and attractiveness of the clusters and its companies.

Governance

Innovation Norway oversees the instrument through the Programme Board. Programme managers from Innovation Norway negotiate the contracts and gear the strategic dialogues with the clusters.

Innovation Norway provides also cluster advisors on matters linked to financing and daily operations, sectoral experts supporting the strategic dialogues, seminars and courses and helps clusters in internationalisation activities through Innovation Norway offices abroad. Regional involvement is not mandatory, but the connection with the regions is assured through the regional representatives of Innovation Norway in the regions. The Industrial Development Corporation SIVA through its regional representatives, provides infrastructural support.

Each cluster is organised around the partnership formed by its members which establishes the necessary internal agreements, and which selects a Steering committee. All clusters include the figure a "Facilitator", a professional manager or management team that supports both the Steering Committee and the Partnership. A strategic platform provides input from relevant stakeholders.

Selection of clusters

The selection process is unique for the three types of clusters with specific criteria for each of them. The annual call process involves a two-stage procedure, with an initial recommendation issued by the Programme Board on the basis of a proposal outline followed by a final decision on full proposals adopted by the Board taking into account the opinion of a panel of external experts.

Evaluation and monitoring

The evaluation and monitoring is project centred and include different stages of project selection (ex-ante evaluation), monitoring (through annual reports), mid-term evaluation (depending on the duration of the type of cluster) and the final evaluation. There is no specific evaluation of the instrument as such.

The impact of the programme is assessed through a categorisation of quantitative and qualitative outcomes (Key indicators).

NCE Clusters may keep using the label if, after the completion of the cluster support, they report annually to Innovation Norway on their activities and performance.

Sustainability

There is an emerging shift in Oil and Carbon dependence, which affects Norway's industries. Innovation Norway is tackling the challenge by contributing to the sustainability of their industries. The approach has focused in rewarding the best, improving the middle and rejecting the worst.

Six areas of opportunities have been identified where sustainability considerations are crucial: clean energy, bio-economy, health, ocean space, smart society, tourism and creativity, selected on the basis of the particular Norway's competences and competitiveness.

The programme has established a 6-level categorisation of companies according to the level of abiding to the sustainability good-practice objectives. The ones abiding to good practice will get a certification.

Points for discussion

Although there is no formal requirement for the clusters to be regional, they have a clear territorial component as a consequence of the location of partners in the clusters. The important thing is that there is a National and global impact eventually.

Yet, the regional funds are not mobilised in support of clusters as the 50% rule leaves no room for other public funding than the one provided by Innovation Norway. Nevertheless, the Agency funds projects always through the local offices, which ensures the appropriate link with regional policies, according to Innovation Norway officers.

Funding for a cluster is funding for current expenses and not funding for research, even though cluster members may be heavily involved in research. However, some members of such clusters have been parts of SFIs before.

It was pointed out the necessity to distinguish between a cluster and a cluster organisation, the latter being the contracting organisation promoting the formation of a cluster. In Sweden, the legitimacy of those cluster organisations is a big issue, some struggle to continue surviving. If they are not actual actors but intermediaries, their legitimacy is at stake.

An important aspect is how to connect the clusters with other clusters and other clusters abroad.

In relation with the financial support mobilised, it was noted that, although the absolute amount is not impressive, a long term commitment of 10 years makes a difference.

SWEDEN

The programme portfolio and the policy challenges

As is befitting to a country in the innovation leader group, Sweden has well a developed policy portfolio in PPPs, each addressing different kinds of innovation policy challenges, *Competence Centres, Strategic Innovation Programmes, and Societal Challenge Consortia*.

- *Competence Centres* – aim to generate and support strong hubs of excellence in key competence areas, attract talent and capital, companies of high international level and Higher

Education Institutions (HEIs). This will hopefully influence strategies and behaviour of firms and HEIs and their overall patterns of relationships as well as stimulate innovative HEI-research and HEI-research agendas. The activities are located and steered in HEIs. The basic framework is a research agenda for centre partners. The Swedish Competence Centres Programme was initiated in 1993 and the first centres started in 1995. Each centre status is awarded for ten years (Stern et al., 2013). There have been nearly thirty centres in the programme so far. The evaluations conducted on the programme indicate that the research has been longer term and has tackled more fundamental problems than in normal bilateral research relationships funded by the innovation agency Vinnova (Stern et al., 2013).

- *Strategic Innovation Programmes* were initiated in the 2012 Research and Innovation Bill. Their aim is to catalyse key innovation actors towards developing long-term and broad-based collaboration and a common vision connected to an area of substantial potential and importance for future Swedish competitiveness. The agendas and consecutive roadmaps are expected to generate cross-sectoral, cross-industrial and cross-technological fertilization, to be implemented through calls and other measures, and to be strategically steered by key stakeholder groups. Main PPP-partners are firms, HEIs, but also the public sector. Firms are often the main drivers of the agendas. The programmes are administered by managing organizations which differ and each of which has a specific legitimacy. Basic framework is an innovation agenda for Sweden, implemented through R&I-calls.
- *Societal Challenge Consortia* were launched as a concrete measure to tackle societal challenges signalled by the Lund declaration of 2009. They aim to catalyse step-wise targeted and strongly committed consortia addressing urgent societal challenges which could be practically addressed in Sweden, but would have potential for scaling up at the international level. The efforts in this area are limited. The consortia are based on potential public sector benefits and private firm revenues, if successful, in generating envisaged solutions. Via municipalities and county councils, the public sector is almost always steering, but in collaboration with innovative firms. Often several firms are involved and they are expected to connect their solutions in order to generate viable businesses and to contribute to the solving of the societal challenge. Main PPP-partners are public sector agents and private firms, often together with HEIs and/or public research institutes, and increasingly with public regulatory institutions. The basic framework is a project plan in three stages.

Two key indications that have provided the basis for the rationale in *Strategic Innovation Programmes* and *Societal Challenge Consortia* (generated within the "Challenge Driven Innovation Programme", CDI) include the following:

- Societal Challenges are weakly, or even at best, incrementally addressed. It would require substantial transitions and cross-sectoral, cross-industrial, and cross-technological silo-breaking thinking and decision-making processes. At the same time, such consortia offer great opportunities for the development of business opportunities and capabilities in emerging and rapidly growing markets, as global needs related to corresponding societal challenges are transformed into demand for solutions. In order to catalyse such innovation processes, there is a need of PPPs of a different kind where the lead users and business firms as well as relevant consortia partners have capabilities to efficiently address solution search. Their development should, in turn, be characterized by stage gate processes with increasing consortia partner commitment, related to key strategic priorities in the partnering organizations.
- Future industry competitiveness would require mutually reinforcing investments and innovation processes nationally, with a focus on global value chains. PPP-programmes that stimulate ambitious and strong strategic partnership between key actors, notably key actors in different industries, could generate and catalyse such mutually reinforcing development blocks and, thereby, strengthen national attraction for advanced development, while simultaneously facilitating development of new cross-industrial and cross-technological development paths. This could stimulate more radical renewal. Previous industrially oriented PPP-programs have been dominated by narrow industry programmes, which have tended to limit innovation scope to existing paths and more incremental ambitions. In the broad and open scope of the Strategic Innovation Programmes, the potential of addressing societal challenges is greater, which in turn opens the possibility and, in many cases, necessity of also including public sector agency challenges and capabilities. This then calls for relationships between PPP-initiatives generated through the CDI-program and agendas and projects generated through Strategic Innovation Programmes.
- Competence Centre programs have a core rationale in that they systematically twin industry and HEI research agendas and research competence and personnel through direct cooperation and project based mobility, in order to solve research issues of key innovation relevance but are yet basic type of issues. A key part of the rationale is that these long-term relationships would impact HEI research agendas towards new and industrially relevant areas, natural patterns of relationships between industry and HEI, and facilitate individual competence development and industrial employability, hence employability. These PPP-initiatives have generally served these

purposes and have had significant systemic impact. Large changes have, however, occurred in the system, not the least in the HEI-sector, in which strong emphasis have been put on incentivising HEIs to strategically integrate and mainstreaming "competence centre" mechanisms, as part of natural strategies of excelling in third mission performance. Striking a good balance between competence centre initiatives through specific PPP-programmes and industry-HEI-cooperation mainly driven by basic HEI-incentives that stimulate HEIs to excel in this domain provides an important and still quite immature policy debate.

Highlights from the Country visit

Strategic Innovation Programmes (SIPs) *(strange follow titles)*

Background and governance

The MLE project made a country visit to Sweden on 18-19 April, 2016. During the visit the project was focused on the Strategic Innovation Programmes (SIPs). The project participants were given an overall introduction to the programme, were able to interview the managers of three Strategic Innovation Programmes: STRIM in Swedish Mining and Metal Producing Industry, PIIA in process industrial IT and automation, and Produktion 2030 in manufacturing. The MLE participants were given information of and had a discussion on the evaluation on the programmes. The following section will summarise some of the characteristics and observations made of these programmes.

The initiative on which the SIPs are based, is called Strategic Innovation Area (SIO) and was announced in the 2012 Research and Innovation Bill. Three agencies were given the task to manage the program in cooperation: Vinnova, Swedish Energy Agency and the Swedish Research Council Formas. The initiative had an aim to improve international competitiveness of Swedish industries and to find solutions to global challenges through enhancing interactions between the varied actors in the innovation system (OECD, 2016). The initiative entailed supporting the design of strategic innovation agendas (SIA) and launching a number of strategic innovation programmes (SIPs) implementing the strategic innovation agendas. There were two aspects in which the programme was radical for the innovation agency Vinnova; 1) whereas previously Vinnova had designated priority areas top-down, though in consultation with stakeholders, the latter could now propose SIPs in areas they deemed strategic, and 2) Vinnova transferred the managerial responsibility for the SIPs to programme participants, with somewhat different organisational arrangements in each case. Vinnova, however, retains the final say in in the selection of activities/projects for funding and used external peer reviewers to evaluate the proposals.

The consultation process to generate the SIPs was wide and involved large numbers of relevant actors. Originally there might be several proposals for a SIA in related areas. On Vinnova's advice these were in instances merged and the proposals resubmitted as a combined proposal. In such cases, as previously maintained, the process could bring together stakeholders from areas and organisations that had not previously collaborated together, and the consultation process could take many rounds of submissions.

Each SIP implementing a SIA was initially provided funding for three years with a possibility of renewal for a maximum of twelve years based on a multi-stage review process.

There have been three waves of calls for SIAs to be formulated and submitted as part of the process of designating SIPs. The first wave brought about five proposals in areas of traditional strength (such as mining, metallic materials, process industries and automation, and production technology). Stakeholders in these areas had prior experience in formulating roadmaps and agendas of this nature. The second and third waves have focused more on newer technology areas and those with societal challenges. A more detailed and excellent description of the Strategic Innovation Programmes is given in the OECD review of Swedish Innovation Policy of 2016 (OECD 2016).

So far 16 SIPs have been launched based on the formulation of SIAs. Annually 10-50 million euro is expected to be invested in co-financing. Each SIP is managed by an external co-ordinator and overseen by a board of directors responsible for designing the SIP activities and implementing them after the approval by Vinnova. Often SIPs have an agenda council consisting of select members of the community.

Nowadays it is also possible to launch individual 'strategic projects' without issuing a call if both the SIP leadership and Vinnova agree that this course of action is desirable to achieve a specific objective. Such projects are usually larger and organised in a direct process, which means that the potential participants in such a project are limited in terms of their capabilities and resources and thus a call process would not make sense. In addition to calls for proposals the SIPs have several other activities. Important among these are roadmap and agenda consultations to update them.

The SIPs are expected to create processes to update their research agendas and roadmaps regularly, in order to ensure that these continue to be pertinent and relevant.

In order to support radical innovation within the Strategic Innovation Programmes, Vinnova considers that it is important to allow risk-taking in the subprojects. This usually implies that some of them will fail, which is regarded to be perfectly in order. Important lessons can also be learned from projects that fail and this knowledge can be used in the development of new projects. There is an ongoing and open dialogue between Vinnova and the Strategic Innovation Programmes about their project portfolio and their ability to contribute to the societal challenges and transitions through radical innovations and new solutions.

During the course of our visit the MLE project participants were able to identify a few challenges present in the SIP programmes. These included the following:

The difficulty for SMEs to become engaged. This was tackled, i.a., with special brokerage events, but there is not information of how effective such events were.

- In spite of trust among the participants, large firms did not usually bring their core business and novel projects to the programmes, thus potentially undermining the degree of novelty and innovativeness in the programme.
- The network that had proposed the SIA and SIP programme was strong and it was difficult for newcomers to bring in new ideas and new business models. Especially innovative start-ups were not attracted.
- In some of the SIPs, the calls did not prompt a sufficient number of proposals to enable desired competition (having as high as 50% success rate).
- Even though the rules concerning IP questions were flexible participants did not always find these easy to implement. In this, the SIP management office was able to help in the writing of the contract concerning IP, but also that on publishing taking into account the need of PhD students to publish.

Evaluation

Vinnova is currently starting the first evaluation of SIPs that have run their first three-year period and after this evaluation Vinnova will decide whether to continue the funding of the individual SIPs. The evaluation criteria are listed in the following table.

Table. Evaluation criteria in the first SIP evaluation

Leadership/Management	Initiation/Implementation
National effort (aggregating national strengths/resources): - Whether the agenda and strategies are up-to-date and plans for renewal are adequate - Maintaining a strategic dialogue with actors - Attraction of new national and international participants	- Whether the activities are in line with the impact assessment goals of the SIP - Do the activities complement national and international activities in the area
Openness and impartiality in the implementation - Establishing openness, trust and transparency - Interest of stakeholders in the innovation area	**Communication** - Whether communication concerning the programme, results etc. is sufficient - Dissemination of information concerning other funding sources outside the SIP - Creating activities that connect actors with the same interests
	Project support - Creation of activities that link and support the projects supported

Since this is the first evaluation, attention will be paid to the management of the programme towards the expected outcomes based on the impact logic of the SIA underlying the SIP programme that had been proposed. Later evaluations will pay attention directly to the impacts that the programme aims to achieve.
Data for the evaluation will be based on a self-assessment to be made by the SIP, a survey among stakeholders, and indicator data. The overall evaluation will be conducted by a panel of external experts.
In addition to the evaluation described above, Vinnova is funding a study conducted at the University of Lund to create an evaluation framework that would provide a more system-level evaluation of the SIPs taking into account factors enabling and constraining system transition that is sought by the policy initiative. Attention will also be paid to the overall policy mix influencing these conditions, and developing methods for policy-learning concerning the role of SIP in the policy mix. This project is still at a very early stage and so far, no results are available.
It is also to be taken into account that the overall impacts of the programmes on the capabilities and competitiveness are expected to be seen in 10-20 years. A time perspective as long as this will make it quite difficult, though not impossible, to link potential longer-term benefits to the programme.

APPENDIX 2. MEETINGS AND VISITS MADE IN THE MLE PROJECT

Opening workshop in Brussels, 2 February 2016
Working meeting in Brussels, 1 March, 2016
Country visit to Stockholm, Sweden 18-19 April 2016
Country visit to Oslo, Norway 19-20 May 2016
Working meeting in Brussels 21 June, 2016

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This report summarises the work and lessons learnt by the Mutual Learning Exercise (MLE) on Evaluation of Complex Public-Private Partnership (PPP) Programmes in STI. MLE is a project-based learning process whereby participating countries, assisted by a small group of experts, jointly examine a challenge-driven question in more detail. Belgium/Flanders, Bulgaria, Norway, and Sweden were the participant countries in this exercise. The MLE project addressed PPPs which are strategic (often virtual) centres or network type of organisations for promoting sector- or challenge-based research involving multiple partners and promoting public-private collaboration in STI. The MLE examined the PPPs within a policy cycle frame, drawing on available knowledge on public-private partnerships in research and evaluation literature, and lessons learnt on the concrete cases and experiences of the participating countries

Studies and reports

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