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Supporting New Strategic Models of Science-Industry R&D Collaboration – A Review of Global Experiences

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Abstract

In recent years, an increasing political interest has developed in long-term strategic partnerships for science-industry collaboration in pre-competitive research and development, driven by a perception of a distinct "blind spot" in many innovation systems. In different contexts, such initiatives have been politically supported based on different factual opportunities and according to the options available in specific political frameworks. Nonetheless, the lessons to be learned from them are not by definition idiosyncratic. Against this background, this paper synthesises experiences from different countries and derives generalisable conclusion with regard to the both the nature of the phenomenon and opportunities for future policy actions to promote its development. In short, it finds that viable initiatives tend to be stakeholder driven and policy programmes have to reflect this in selecting competitively, raise clear expectations and endow individual initiatives with strategic capacity.

1 Introduction

Following a decade of discussions on business-driven clusters, a new discourse has emerged around strategic models of science-industry collaboration in research and development (Koschatzky and Stahlecker 2010). In the briefest possible terms, the novelty of these approaches can be found in three core dimensions. Firstly, they address long-term pre-competitive agendas in response to major techno-economic and societal challenges. Secondly, they are organisationally set-up with a long term perspective of often more than five years. Thirdly, they aim at an intensity of integration that is typically not given in business-driven clusters that primarily understand themselves as mediators. Doing so, they address a specific gap in innovation systems.

For many policy makers, these new collaboration models are attractive new levers in their overall support system as, firstly, they provide a welcome means to translate challenged-oriented, high-level strategies into operational policy for initiatives and key stakeholders and, secondly, support for pre-competitive collaborations is comparatively easy to legitimise under state-aid rules. While individual strategic partnerships have existed for decades (Kroll 2011) policy has taken a renewed and concerted interest in them since the early 2000s. Gradually, therefore, the new approach, has found its way from individual pilots into broader policy practice (Koschatzky et al. 2015).

Naturally, the orientation of specific initiatives differs according the particular challenge that they are a meant to address as well as the participating stakeholders driving motivations. Also, different methods of implementation have been chosen depending on regulatory limitations, national political cultures and the available budgetary framework.

Not uncommonly, therefore, the diversity of approaches makes it difficult to even identify their key characteristics and single case study must remain an insufficient basis for draw generalisable conclusions.

Against this background, this paper sets out to analyse different policy programmes and initiatives that have been launched to support the emergence of new, strategic partnerships – in different countries and different technological fields. In this light, this paper seeks to make a threefold contribution: Firstly, it will on an empirical basis specify the object of debate: "new strategic partnerships". Secondly, it will identify relevant factors that determine these partnerships' character and orientation. Thirdly, it will identify general lessons from known processes of their establishment under different framework conditions.

2 Conceptual Approach

For many years, innovation system research has identified the task of functionally interfacing a national innovation system's different subsystems as one of the key tasks of innovation policy (Freeman 1987; Kuhlmann and Arnold 2001; Lundvall 1992; Patel and Pavitt 1994). Turning from a linear (Bush 1945) to an interactive understanding of the innovation process at the level of both the firm (Chesbrough 2003; Kline and Rosenberg 1986) and the overall economy (Boekholt 2010; Hippel 1986), it has become obvious that many traditional assumptions regarding the "transfer" of technologies from conception to application have to be qualified (Bozeman 2000) if not fundamentally rethought (Chaminade and Edquist 2010) to improve the effectiveness of knowledge generation and translation in innovation systems.

As learning theory emphasises, freshly created knowledge cannot simply be "handed over" to create value added in the economy. Even when developed in the course of "application oriented basic research" (Stokes 1997) it has to be translated into application through a process of absorption (Cohen and Levinthal 1990) and context specific learning drawing to no small extent on tacit knowledge (Nonaka and Takeuchi 1995; Polanyi 1958). As studies have shown, not only the first application of a new technology, but also its further development in a specific context routinely draws on external knowledge basis and, if need be, further development efforts (Kline and Rosenberg 1986). For a number of years, therefore, it is conceptually evident that continuity is an important criterion for successful collaboration between different innovation subsystems.

At the same time, it is known that different organisational cultures and regulatory frameworks that certain organisational types are subject to create strong obstacles for interaction between characteristic representatives of different subsystem's initiatives (Edquist 1997; Van de Ven 1976). The research and the business system, for example, are characterised by different rationales to which their actors adhere and by different primary objectives that they seek to attain (Edquist 1997). Consequently, science-industry collaboration have in practice often occurred on a project-by-project, short-term basis, driven by individual interests and personal acquaintances (Koschatzky et al. 2013; Kroll et al. 2015). Without doubt, such short-term collaborations have on many accounts proven effective and fruitful (Asheim et al. 2007; Kaufmann and Tödtling 2001) and can contribute to instil a "boundary spanner" (Wenger 1998; Williams 2002) mindset in future generations. Nonetheless, much of their bridging capacity relies on mere *social* proximity (Boschma 2005), so that too many of them remain ephemeral in nature and cannot contribute to the creation of lasting *institutional* proximity.

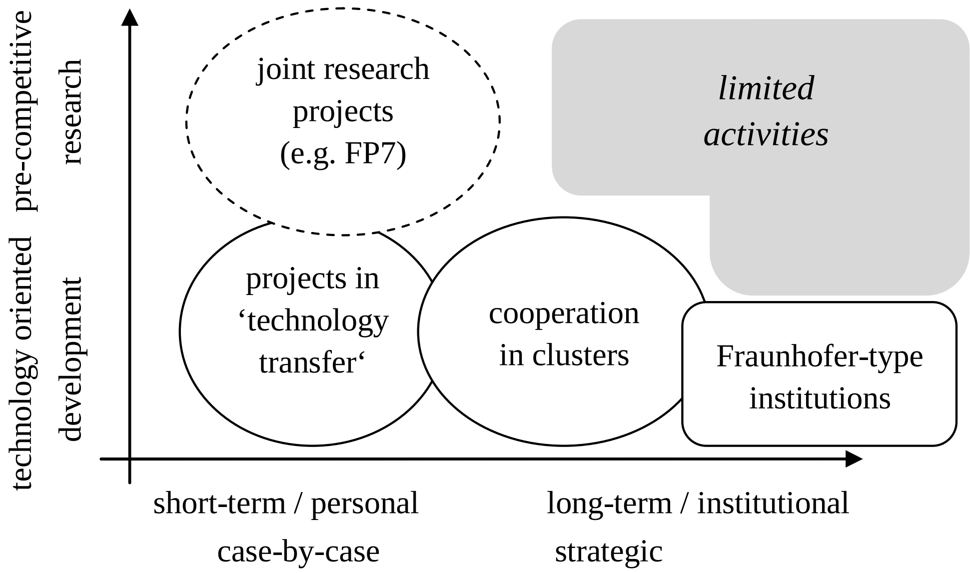
Moreover, an integration of science and industry is often pursued with an emphasis on the commercialisation side of the innovation system. Science-industry collaborations are conceived of as actions to transform technological knowledge into practice – requiring universities and research organisations to extend their functional role in this direction. Conceptually and factually, however, there is an equally relevant option for science-industry collaborations in the field of knowledge generation. As is known, many companies invest substantially into pre-competitive research yet without necessarily aimed to pursue them in isolation (Boekholt 2010). Precisely because such activity do not address markets directly and issues of intellectual property are thus less pressing, drawing on additional insights, specific capacities and the broader perspective of public research partners can harbour great benefits even for those enterprises that could, from a purely technological perspective, pursue strategic research activities on their own. This holds true in particular where technological research becomes intertwined with societal "grand challenges" like demographic change, sustainable mobility or the digitisation of industry which, in the past decade, became guiding notions of research and innovation policy (Daimer et al. 2012; Lindner et al. 2015).

If pursued individually, high-frequency, short-term, and low-volume collaboration cannot be sufficient to address such long-term technological challenges. Firstly, most individual collaboration projects hardly last longer than two, at best four years, a timeframe insufficient to address strategic pre-competitive issues. As all objectives have to be achievable by the project's end, individual collaborations remain focused on clearly defined, short-term ambitions (Kroll et al. 2015). Secondly, individual collaboration projects neither bring together sufficient resources nor require substantial own commitment from the project partners to create robust, lasting bridges between science and industry (Koschatzky et al. 2013). To improve the integration of the science and the business sector, they would have to trigger structural change within their organisation for which, by and large, they remain too insignificant and based on personal relations.

At the same time, industrial clusters, under discussion and implemented as a policy tool since the 1990s (Porter 1998) cannot comprehensively address this issue either. While they bring together partners from science and industry in a long-term perspective and seek to establish linkages between them (Stahlecker and Kroll 2012), their activities are – as a tendency – directed towards market-oriented development rather than aimed at long-term pre-competitive challenges. More often than not, clusters are predominantly business-driven so that their activities will answer to the needs considered most pressing by a majority of their stakeholders, i.e. short- to mid-term rather than long-term as well as applied rather than pre-competitive issues (Kroll and Schricke 2012). Also, most clusters tend to pursue a loosely coupled, facilitation-oriented approach that does not guarantee the abovementioned, conceptually called for intensity of collaboration. While some cluster members do engage in joint projects, these are only in exceptional cases constitutive for the clusters own strategy. Instead, most clusters tend to help organise bidding consortia that are the financed from third parties and depart on their own strategic endeavours, independent from the clusters' strategic reach and ambition.

In short, conceptual considerations suggest that there is a certain, crucial area within the national innovation system which has, for the past two decades only been addressed based on self-motivated, bottom-up initiatives of particular stakeholders (Gray and Walters 1998; Kroll 2011) rather than actively driven and incentivised by public policy.

Figure 1: A conceptual "blind spot" in national innovation policy



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In recent years, however, more and more polities have identified this "blind spot" and initiated programmes to prompt the establishment of more cooperation models of the abovementioned type (Koschatzky et al. 2015). Their precise ambition to do so, however, varied considerably, as did their overall political orientation (Hall and Soskice 2001), the size of the corresponding economies, and the scope and structure of the academic and industrial sector that were to be matched. To the author's knowledge, however, no systematic, comparative analysis of these policies has so far been conducted.

3 Research Questions

In line with the abovementioned conceptual considerations this paper's analyses will address three main research questions as follows.

Firstly, what common rather than context-specific characteristics can be identified among the supported "new strategic partnerships", in particular viable ones, with a view to the main stakeholders involved, the objective of their activities, and their process of development.

Secondly, how can a suitable relation be defined between specific challenges and more generic political objectives that support programmes have been launched to address in a specific socio-economic as well as political framework.

Thirdly, remains to be clarified which type of political process and contextualisation can be considered most conducive to not only put new strategic partnerships into operation but also to create robust and self-sustaining business models that survive in the long run.

To address these research questions, this paper will analyse case studies from six countries facing different economic challenges and characterised by different types of political cultures. On that basis, a synthesising summary will outline main findings and be transformed into generalisable policy conclusions fur the future support of similar activities.

4 Case Studies

4.1 Method and Selection

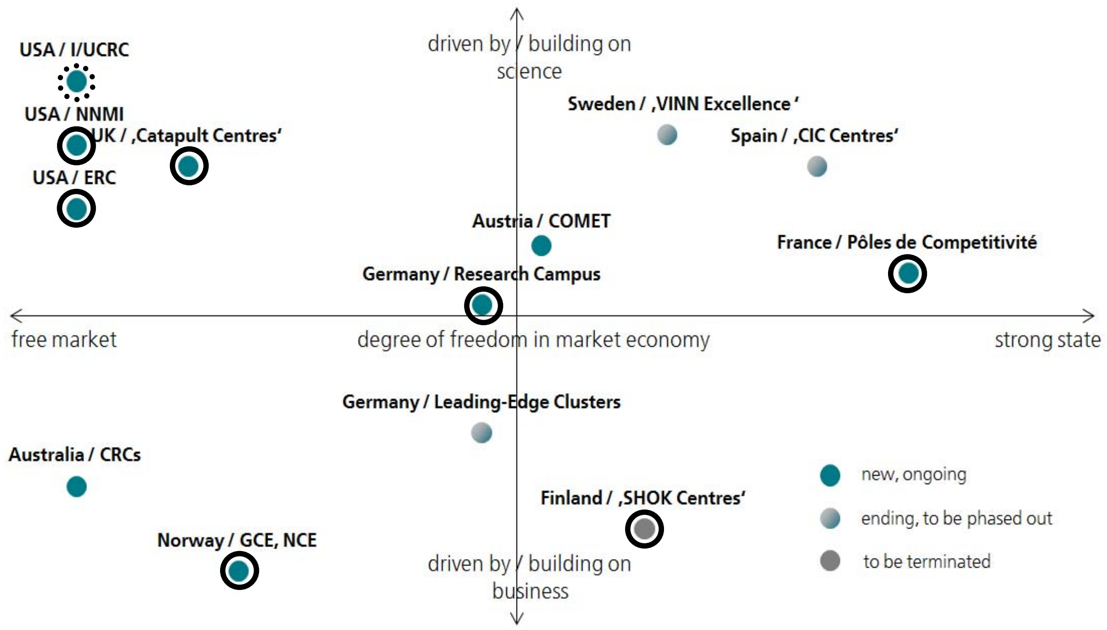
During the past two years, the author has participated in different research and consulting projects that allowed him/her to study various international support programmes for new strategic partnerships in detail. Beyond an in-depth analysis of the documents cited, yet not limited to them, semi-structured interviews have in all cases been conducted with the political programme owners, at least one manager of an individual initiative and, in some cases, third parties such as academics and consultants involved in their evaluation. In the case of the French and the UK programmes, the author additionally draws on work of colleagues who will be duly acknowledged below.

Depending the set-up of the particular economy they operate in, certain types of public support for strategic cooperation projects are either viable or not. Depending on the question of whether science or industry is the main driver behind (and beneficiary of) projects and programmes, different types of actors tend to be involved on the outset and a different levels of commitment become likely from different sides. As outlined above, it is in light of these known differences in starting conditions, that this study will seek to demonstrate that there are nonetheless common lessons that can be learned with regard to strategic co-operation approaches and that, at the same times, their relevant differences do not in a deterministic manner result from well-known framework conditions alone.

Consequently, case studies were selected in a two step procedure. First, the author conducted in-depth desk research of available information on potential case studies (e.g. BMBF 2015a; 2015b; DGCIS-DATAR 2011; Koschatzky et al. 2015; ; Magro and Navarro 2015). Second, he conceptually arranged them according to their main driving actor (either science or industry) and the type of economy that they are located in (either liberal or coordinated) to enable a representative selection.

Figure 2 gives an overview of known models of science-industry cooperation that could have been studied. To ascertain variety with regard to both framework conditions and main driving actors while holding characteristics like strategic and long-term engagement constant, a representative, broad-based selection made. In detail, one example was selected from each quadrant and one from close to the middle of the coordinate system. Where possible, preference was given to ongoing programmes.

Figure 2: Context of Strategic Co-operation Models



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4.2 German Research Campus

The German Research Campus programme (officially: *Forschungscampus*) was launched in 2012 in addition to several other science-industry support mechanisms like the Leading-Edge Cluster Competition. With the Fraunhofer Society and several strong technical universities, moreover, Germany already features strong players in application oriented science-industry collaboration so that there was no need to rebuild the overall structure from its foundations (BMBF 2014). Overall, larger German firms are used to collaborate with public research on major issues and there are no specific constraints in political culture that preclude such collaborations. Quite to the contrary, German policy makers have promoted science-industry collaboration at different levels for decades. Nonetheless, most tended to limited to an at best a mid-term perspective i.e. not really suitable to serve as a basis to create structural bridges between subsystems. While there were notable exceptions from this rule in some of the larger clusters, many of those still remained limited to immediate needs identified by those cluster's industrial boards rather than long-term societal challenges. In that light, German policy makers perceived a lack of long term efforts that could help prepare the country's business sector for different key challenges that the economy is likely to face in the coming years (BMBF 2014b).

Against this background, the Federal Ministry of Research and Education launched the Research Campus programme with a threefold objective: firstly, to support collaborations that address long-term, pre-competitive challenges in the economy rather than short-term technological issues; second, to require the partners in these consortia to set-up a robust framework of localised joint facilities ('campus model') and joint teams working within those; thirdly, to provide a support commitment for up to 15 years that allows consortial partners to strategically engage with own commitments and to make the needed investment into the legal and factual set-up of joint structures worthwhile. Public investment amounts to up to € 2 m per initiative annually (BMBF 2014a). Thus, the programme aimed to match the country's best players in their respective fields while at the same time leaving it up to them in which exact area they would like to launch such an initiative and how they would like its business model to look like. Hence, a call for proposals was launched to be assessed by a jury of key representatives from industry and science. Policy makers oversaw the process as moderators and took final decisions based on the independent jury's recommendations. As it turned out, the mobilising effect of the call was enormous, resulting in more than 90 initial applications of high-ranking consortia were submitted of which, in the end, only ten were selected for support.

Stipulating that a good proposal alone does not yet guarantee a viable initiative, the jury put all but one of the selected campus initiatives 'on probation' for a 'pre-phase' of at least 6 months during which they received seed funding for strategy development, organisational consolidation and the finalisation of financial commitments from both public and industrial partners. Only after clearly, and individually defined criteria had been met were the initiatives allocated the full amount of support. In between, they had to bridge an intentional gap between the 'pre-phase' and the main phase of funding. In short, both the selection and the approval process were designed to only keep those initiatives in the support system which a based on a robust and self-sustaining commitment of public and business partners. In fact, one initiative did finally not meet these high requirements and had to be phased out before it reached the main phase of funding. At the same time, some consortia that had unsuccessfully applied for funding on the outset chose to pursue their efforts along other lines and have, in the meantime, found funding for their initiatives from other sources.

Characteristically for this specific support approach, the ministry put a relatively limited set of initial stipulations regarding the technical set-up of the initiatives with regard to legal model, IPR regulations or internal organisation. Instead, general criteria were defined such as that the legal set-up must be robust, going beyond project level, internal IPR rules had to be defined in a way to allow for collaboration 'at eye level' and the concrete projects to be supported had to be based on joint work 'under one roof' (BMBF 2014a). If and to what extent these criteria were met was left for the jury to decide which included high-ranking experts, such as a former high-court IPR judge and executives of self-motivated science-industry campus models that had existed before the launch of the programme.

Consequently, the nine supported models display a large degree of variety. Firstly, their legal set-up can be anything from incorporated stock-holding companies to collaborations without own legal entities resting on long-term framework contracts. Secondly, the composition of partners, while next to exclusively driven by one major corporation and one major university, includes small- and medium-sized firms and non-university research organisations to quite different degrees. Thirdly, the balance of financial commitments can be anything from strongly dominated by one major firm, to notably enabled by regional governments, depending on the role of the initiative for regional policy. Finally, the approach by means of which joint work 'under one roof' is realised differs fundamentally, depending not least on the fact whether the new research system is integrated into an existing ecosystem of science industry collaboration or had to be set up on the green field (BMBF 2015b).

In short, the German model is characterised by a strongly competitive, yet at the same time very context-sensitive approach that allows key stakeholders to respond to both sectoral and regional specificities. While addressing core, long-term challenges at a very aggregate level, it considers these challenges as very specific and thus leaves it up to individual stakeholders to address them and to experienced, high-level experts to decide about the adequacy of these approaches.

4.3 United States I/UCRC / ERC / NNMI

In the United States, public support for industrial firms, even when in strategic cooperation with public research remains a politically contested issue. In general terms, support for corporate R&D is only then considered permissible if it more or less directly serves the needs of government departments that have commissioned it to achieve own objectives in the pursuit of a public mission. Sizeable programmes providing tax-funded allocations to enterprises that these can use for their own strategic purposes will have very limited chances to pass congress. Against that background, programmes in which corporate consortia define strategic research projects in a bottom-up manner to, for those, receive public support cannot be launched by ministries directly. Nonetheless, there has been a long-standing perception that this very situation leads to a structural "valley of death" between public technology development at very low TRL levels and corporate implementation and commercialisation at very high TRL levels. In general, the U.S. knows very few organisations with a dedicated mission to address the decisive middle-field. Also few suitable financing options are available to sustain such activities on a project level. Against this background, the National Science Foundation launched its first pilot programme for science-industry collaboration in 1973, building on earlier, self-motivated efforts of lead stakeholders and resulting in the I/UCRC programme in 1980.

Among those two, the I/UCRC programme, described in more detail in Gray and Walters (1998), Gray (2011) and Rivers and Gray (2013), does not really fulfil the criteria of new strategic partnerships as the cooperation models it supports are, in terms of requirements for support, insufficiently based on long-term commitments, insufficiently oriented towards generic, pre-competitive challenges and too often of a virtual, project based nature. Also, due to the abovementioned political framework, the support volume for individual centres remain minimal (below $100,000 annually) with no public support provided to the participating firms. In practice, however, some of them have developed further, using the small I/UCRC as a stepping stone on which, following the conclusion of the support phase, they built long term initiative which than indeed fulfil many of the characteristics of "new strategic partnerships" (Koschatzky et al. 2015).

Instead, two other programmes appear more relevant. Firstly, the Engineering Research Centres (ERC) programme set up in close succession of the I/UCRC initiative in 1984. Currently, more than 17 ERC centres are supported across the U.S. each with around 3-4 million annually per site. Like the I/UCRC, ERC status is awarded based on open calls for proposals of the National Science Foundation thus communicating the effort as an activity to improve the economic relevance of public research rather than as public investment into the business sector. By 2014, 31 formerly supported centres had become independent and self-sustaining, only seven had to be disbanded when support ended. Overall, the programme can thus be considered very successful.

To increase the threshold, ERC application have to fulfil a number of clearly specifies criteria including a multi-site set-up, the participation of at least three faculty per university, substantial financial commitments by the universities, robust letters of commitment from several companies, the inclusion of local development agencies and pre-university education partners as well as further requirements regarding diversity and international orientation. Overall, the ERC model seeks to not only create a public-private partnership with higher critical mass, but also with a more proactive, even generative role in its regional innovation ecosystem, are point that has been increasingly stressed during the programmes more than 20 year history – and in some cases prompted universities to prefer multiple, less integrated I/UCRC to a single ERC that comes with a lot of strategic commitment. Initially, ERC awards are given for five years, with an (often used) option to renew them for a further five years in two steps, following interim reviews in years three and six (ERC 2015; NSF 2015).

In addition, recent years have witnessed the Obama administration's set-up of the National Network of Manufacturing Innovation (NNMI) driven by the motivation to respond to an obvious crisis in America's manufacturing which, in some areas, borders de-industrialisation. In the light of this, the administration now supports the set-up of National Institutes for Manufacturing Innovation (IMI) through the Inter-Agency National Advanced Manufacturing Programme Office hosted by NIST. Notably exceeding the scope of even ERCs, IMI have to cover applied research, development and demonstration projects, engage with education and training at all levels, develop new approaches for supply chain integration and expansion, engage with enterprises large and small and provide access to substantial shared facilities of the 'lab factory' type reaching beyond mere technological demonstration. Hence, they openly aim at building a bridge between science and industry rather than simply supporting a more business oriented type of science (Koschatzky et al. 2015).

As outlined above, this type of approach does not meet with broad-based enthusiasm among America's policy makers and therefore has to be approved stepwise by congress. While the proclaimed aim is to set up 45 centres nationwide, the short-term political target is to approve funding for a network of 16 by the end of the administration's term in 2016. Currently, seven institutes have been set up, with 2 more pending. Technically, institutes are set up in response to open calls for proposals launched by NIST of which at least two further are currently planned. Nonetheless, regional governments are strongly involved in the development of proposals and promote them actively on the political stage, as the challenges they address are relevant for regional growth and employment. The annual budget of individual centres shall range between $ 10-50 million of which less than $10 million are provide by NIST directly. In speeches on the effort, the Fraunhofer model has been mentioned as a point of reference, indicating that all public money invested will be matched with equally substantial commitment by industry. In early, 2015 $ 481 million had thus been invested in the at the time five existing institutes. Compared to the ERC and certainly the I/UCRC programme, the regulations on how to set up an individual IMI are much less specific. The consortium can be tailored to the requirements of the technological field and IPR regulations can be adapted to the interests present in specific consortiums, as long as they are clear, do not stand in conflict to existing regulations, encourage smaller firms to join and discourage free riding (Koschatzky et al. 2015).

In summary, the American model has long been characterised by a standardised approach focused on supporting the public research side of potential partnerships. Motivated by factual economic challenges, however, this approach has in recent years, despite substantial political opposition, been complemented by a more case specific and industry oriented model. Both programmes, however, place notable emphasis on the integration of initiatives in their regional economic ecosystem.

4.4 United Kingdom Catapult Centres

In the United Kingdom, the last two decades had seen a strong policy emphasis on the university system alongside, to the government's own acknowledgement "disparate policies and decisions" on public research organisations regarding which there has been "little in the way of consistent policies" (DBIS 2015, p. 8) at times aiming to downsize rather than to structurally strengthen the system. In the past, "few, if any such institutions were set up in response to a perceived market failure with regard to the economic of innovation" (DBIS 2015, p. 10), leaving a blank space in the national innovation system where Germany has Fraunhofer and the U.S. numerous individual institutions.

At the same time, Britain is facing a period of de-industrialisation as a result of its 1980s free market policies. Today, the decline and collapse of its formerly leading or at least competitive industries goes along with some of the most substantive challenges that the country had to experience in recent history. In large areas of the country, manufacturing jobs have lost their attractiveness in line with a loss of international competitiveness and innovative dynamism in the surviving firms. Young, qualified people tend to look for service sector or governmental jobs, located in the more attractive areas of the country, while more and more of the remaining strongholds in traditional industries tend to be lost to emerging economies or European competitors. For the UK as a country, this situation is particularly untenable as, at the same time, it is home to one of the world's leading research systems whose results can no longer be turned into economic benefit for the own population.

Against this background, an influential 2010 report on "The Current and Future Role of Technology & Innovation Centres in the UK" (Hauser 2010) recommended the set up of a new type of research centres to connect universities and the remainder of the nation's industrial base that the government responded to with a £200 million spending programme for the 2011-15 period, aiming to set up seven "Catapult Centres". The technological or sectoral areas in which today's Catapult centres were to be established were determined in a top-down process informed by a broad-based consultation effort. Based on a prospectus circulated by Innovate UK in early 2011, the House of Commons Science and Technology Committee conducted an enquiry into the prospects for technology and innovation centres in different areas, involving multiple stakeholders. The resulting report not only strongly supported the initiative but also included practical recommendations on how and in which areas the planned programme should best be taken forward.

As conditions for a set up of centres in a particular field, the call for proposals specified: relevance for global markets; world-leading UK research capabilities in the area; business ability to exploit the technology and embed related activities in the UK; potential to enable the UK to attract and anchor activities of globally mobile companies in the field; and close alignment with national strategic priorities. More or less, the programme was inspired by existing initiatives that had been set up based on the entrepreneurialism of individuals and individual organisations since the early 2000s (AMRC 2015). These centres, such as Sheffield's AMRC, were integrated into the new programme while at the same time, they were considered a template to be emulated by other initiatives.

Catapults are not-for-profit, legally independent, physical centres which connect businesses with the UK's research and academic communities. They operate in the middle levels of technology readiness and provide services that address market failures, enable capital investment by firms, and are meant to pay off over longer timescales. Each centre offers a space with the facilities and expertise to enable businesses and researchers to collaboratively solve problems and develop products on a commercial scale. In concrete terms, they aim to build strategic relationships, launch collaborative projects between science and industry, enable access to existing as well as specifically created facilities and capacities, informing policy development and developing people and skills. This pronounced emphasis on education is specific to the Catapult model, in particular the Advanced Manufacturing Catapult, in response to the daunting national challenge in this field (Innovate UK 2015).

Public funding for the Catapult programme is provided through "Innovate UK", the UK's innovation agency. In addition to the initial £200 million investment, a further £239 million of public funding were provided since 2010 (Hauser 2014), raising the average investment into individual centres to around £50 million or £10 million annually. Technically, public funding is provided to the Catapult centres directly, explicitly not to the university as would often be the case in Germany or the United States. Nonetheless, the centres work closely with partners in the Research Councils and Higher Education Funding Council that complementary funding opportunities to develop the relevant university's research base in line with the centre's requirements are sufficiently made use of.

According to its publicly stated ambition (e.g. Hauser 2014), the Catapult programme is inspired by the Fraunhofer model, meaning that, in the long-term, basic funding for the centres shall only amounts to about one third of their overall budget while a further two thirds are to be acquired from competitive public projects and industry respectively. Over a 5 year period, the Catapult programme thus hopes to leverage a total of £1.4bn through public and private investment, based on the initial investment and current basic funding. As an encouraging example, the High Value Manufacturing Catapult already generated a private sector income of £65 million in 2013/14, as well as £44 million of collaborative R&D. Due to their potentially deterring effect on SMEs, none of the centres levies membership fees so that their services and facilities can be used and accessed on a project to project basis.

As in other countries, Catapult centres are primarily developed in cooperation with large corporations in the respective field. Typically, those corporations provide the lion's share of private sector financial contribution needed to keep the centre operative as well as the majority of in kind contributions by industry partners to the physical centres. While some Catapults have actively sought to improve their outreach to SME by creating regional centres of excellence; developing regional led projects; and trialling processes like incubation deals, a relative lack of SME engagement with Catapults can still be observed (Hauser 2014). Consequently, the extent of long-term commitment to the centres has to be considered in a differentiated manner. Larger partner's contribution is constitutive to the centre itself and without them the centre could not survive. Consequently, the centres and their key partners tend to be organically connected in an implicit mutual commitment that would be politically difficult to terminate for good reasons. Knowing this, key companies tend to second personnel to work in Catapult centre facilities continuously and to, de facto, form joint teams with university researchers. Smaller companies, to the contrary, tend to join on a project by project, concrete interest driven basis, as they would in U.S. ERC or I/UCRC.

In summary, the Catapult centre programme can be considered as a conscious attempt to restructure if not rebuild a national innovation system which has, in several ways and areas, lost much of its former effectiveness. Beyond this above average ambition, characteristic features of the programme can be found in its intended openness to external users as well as its strong emphasis on education.

4.5 French Pôles de Compétitivité

The French pôles de compétitivité (competitiveness clusters) initiative is a country-wide policy decided at national level which started in 2005. The aim of this national policy was to reinforce the competitiveness of the French economy through innovation in order to foster long-term sustainable economic development. One of its specific features was that it was an inter-ministry policy right from the beginning, which is rather unusual in France. The intention is to combine efforts in the fields of research, innovation and territorial development.

Other than the abovementioned programmes, therefore, it consciously pursued three parallel objectives from the outset, to improve cooperation between private and public R&D activities, to support small and medium-sized firms, and to increase the economic attractiveness of "territories" through the development of local innovation ecosystems. In particular with a view to the latter, funding each of the supported pôles is not only sourced from an inter-ministerial fund at the nation level, but also through parallel investment from the national, regional and local level government, making them joint undertakings of many different actors with in part diverging agendas. On the operational level, each pôle de compétitivité is supposed to draw up a five-year strategic plan based on the shared vision of various participants. This allows the cluster to establish partnerships between participants with complementary skills, set up collaborative R&D projects and promote an overall environment that fosters both innovation and growth among the cluster's members (DGE-CGET 2015b).

As in the British case, the pôles de compétitivité were selected in a top-down procedure, drawing on a set of criteria that emphasised critical mass in terms of international visibility, the robustness of the partnership between actors potentially involved, obviousness of R&D-related synergies between those actors, and, most specific to France, coherence with local and regional economic development plans. While a close interaction with a specific initiatives host regions has also been outlined in prior case studies, the idea of regional partnership is particularly important in the French case and produced particular hopes linked to the development of the initiatives. More importantly, possibly, the French approach foresaw a more or less complete coverage of the nation's regions with a total of 66 projects selected from a total number of 105 applications in 2004. After an interim phase that differentiated between 7 world-class pôles, 11 high-potential pôles and 53 national poles, connected to specific benefits and requirements (BCG - CM Int. 2008), this differentiation was once more dropped, leading back to a somewhat indistinct total of 71 pôles de compétitivité across the nation.

Geographical proximity is the core philosophy of the pôles de compétitivité programmes which postulates that the concentration of different types of actors on a limited territory encourages synergies and supports innovation. Nevertheless, it does not aim a localised collaboration in the same way than e.g. the Research Campus or the NNMI. Different from ERC or the Catapult Centres, however, it does not aim at national networking either, but understands pôles as limited to joining partners from one region, even if not necessarily strictly from within administrative ones (some pôles include adjacent regions). In general, the largest share of funding for the development of the pôles is provided from public sources at different levels of national and regional government, by allocating funding to R&D projects, mutual innovation platforms (see below) as well as through partial financing of cluster governance structures, alongside contributions of local authorities and firms. Additionally, the pôles seek to access funding by involving the French National Research Agency and the national support organisation for small and medium sized firms, OSEO (now part of bpifrance), into their activities. Furthermore, a national "Future Programme" foresees additional investments into pôles de compétitivité.

Overall, France's competitiveness clusters bring together 7,200 firms covering total employment of 760,000. As SME support is one of the pôles' main objectives, the extent and intensity of SME involvement is on average higher than in the programmes of other nation. With a view to a typical pôle's membership structure 73% are SMEs, 15% are mid-sized firms and 12% are major companies. Moreover, SMEs benefited from 64% of funding allocated to businesses by the Single Interministerial Fund and other public investment entities so that their involvement can be considered substantial rather than an ephemeral (DGCIS-DATAR 2011). Nonetheless, large corporations play a driving and constitutive role for many initiatives, in France as in other nations.

From a financial perspective the so-called "Investments for the Future Programme" contains two budget lines earmarked for the pôles de compétitivité: on for R&D projects (€ 300 million) and one for innovation platforms (€ 200 million) (DGCIS-DATAR, 2011). Between 2005-2011 public-sector support for more than 800 R&D projects in the pôles de compétitivité exceeded € 1.5 billion and led to some € 4.4 billion in overall R&D expenditure, including substantial private contributions. Due to the high number of pôles, however, the individual units' average budget amounted to hardly more than € 1 million in 2011 (BearingPoint France SAS et al. 2012). In 2011, the share of self-raised funding in the average pôle's budget amounts to 28% having increased substantially since 2008 (20%). However, less than 30% of these resources come directly from private sector actor involvement in project. Instead, it is mainly based on an increase in the number of member organisations and thus membership fees.

Although localised collaboration is no prerequisite and indeed also not present in many of the pôles, a specific call for tender in 2011 enabled pôles to set up additional "mutual innovation platforms" (PFMI), organisations for service provision to and local firms and other organisations. As legally independent organisations, distinct from the pôles themselves, they provide access to high-quality facilities and services to cluster members. On a project to project basis, their offers can also be used by non-members. They facilitate R&D projects, testing, the development of pre-series and prototypes, or even serve as a "living lab". For example, the new organisation S2P in the plastics field engages in 3d-mid-prototyping, conception, quality control, and pre-serial development for local firms. On the basis of submitted technological concepts, 13 projects were selected by an independent jury (including government representatives) following a call in 2011. In a second stage, the technological concept had to be complemented by a financial and a legal concept on how to set up the new society. Taking these into account, the selection of projects to be supported was narrowed down to eight by an "investment committee" of the public investment bank (CDC) responsible for their financing. As in other bottom-up programmes, the concrete shape, service portfolio and cope of the 'PFMI Corporations' differs substantially, depending on whether they address issues in additive manufacturing or agriculture. Overall, about € 200 million were invested from public sources, amounting to an average of € 25 million per platform organisation – within the limits of € 8-50 million stipulated in the call for proposals (DGE-CGET 2014; 2015a).

In summary, the French pôles de compétitivité programme is a more concerted and top-down effort than those under consideration in prior case studies in particular with regard to the more or less open ambition to cover the whole nation with regional development initiatives. Arguably, it is also that with the most complex and at the same time least consistent target system. While involving all government levels in a broad based partnership secures equally broad based access to funding it at the same time creates a situation of competing interests that no single initiative can easily fulfil. Nonetheless, it has at several times sought to develop models with the nature of "new strategic partnership" under the heading of "world-class pôles" or more recently "mutual innovation platforms".

4.6 Finnish SHOK Centres

The roots of Finnish SHOK programme date back an economic recession in the 1990s as a response to which eight national cluster programmes had been implemented but by the mid 2000s had achieved more limited objectives than hoped for. Against this background, a new type of "Strategic Centres for Science, Technology and Innovation" (SHOK) were proposed that sought to merge a critical mass-based and long-term approach (known from science policy) with an application oriented strategy (known from technology policy) to renew Finland's industrial clusters, increase their international competitiveness, create new expertise and give rise to more radical innovations. In addition to standard, project-level funding, SHOK initiatives intend to support the emergence of internationally attractive and competitive innovation environments in Finland. To a much stronger extent than prior cluster programmes, the SHOK initiative aimed to prompt more intensive co-operation, interaction and even co-creation (i.e. joint work on the same physical site). Against this background, testing, piloting and demonstrator facilities were a central element of the new programme (TEM 2013; 2015).

Politically, the SHOK initiative was launched following recommendations elaborated by Finland's Research and Innovation Council in 2006, including general suggestions of areas in which such centres should be established. These involved that SHOKs must be highly significant in terms of their potential socio-economic impact, involve significant investments in R&D, large in terms of resources (annual budget of € 50-100 million), constructed around applications central to the future of the sector in question, based on strong commitments of central stakeholders, both public and private, and draw on world-class expertise available in Finland. When the official call for proposals was formally launched in 2007, therefore, substantive prior discussions on concrete areas of intervention had already taken place among Finland's policy makers resulting in the swift selection of six centres in close to all obvious areas of strength of the Finnish economy. Only one of these selected initiatives followed bottom-up lobbying of a particular group of actors from science and industry whereas the other five were more or less directly 'proposed' by public policy and then taken up by larger firms (TEM 2013; 2015).

To create leverage and room for the desired business-driven yet long-term approach, the centres were intentionally set up as separate legal entities, self-governing public-private partnerships driven by their central stakeholder. Their corporate form should not only give the SHOKs greater strategic leverage and independence from the usual process of public funding administration and approval but also the opportunity to own property and act as full partner to legal agreements of different kinds. At the same time, however, it made them comparatively dependent on the agenda and particular interest of the largest contributors to the initiative's projects, i.e. the country's key corporations. These tended to lead most projects supported under the SHOK umbrella and determine the centres' orientation accordingly. Consequently, their ability and interest to adequately integrate SME was on many accounts more limited than elsewhere (TEM 2013). Today, there is often a more conscious definition of roles for SME within individual projects and the centres' are seen as a opportunity to increase Finnish SMEs' access to international technologies.

On the public side, the SHOK programme was funded by the Ministry of Employment and the Economy and administered by TEKES, the country's main funding agency that, however, not only dealt with the allocation of existing funds but had considerable independence in its decisions on the continuation, extension or reduction of SHOK activities on a project and programme level. Between 2008 and 2013, Tekes funded SHOK projects with a total of € 450 million that were complemented by a sizeable amount of industrial funding. Importantly, the centres themselves do not have a large budget, often employing no more than three facilitators. Likewise, they required a private sector contribution of no more than € 100,000 (€ 10,000 for SME). At the same time, their initiated and coordinate substantial, TEKES funded projects with budgets exceeding € 10 million, involving more than forty partners including firms large and small. In the two largest SHOK centres, annual project volume exceeds € 150 million and even in the smallest one, it reaches € 30 million. Typical SHOK projects are granted for 4-5 years although subject to annual reviews. From a technical perspective, they are aimed at a 5 to 15 year time horizon and thus typically attract long-term co-investment of participating firms. On average, 40% of a SHOK project's funding stems from private sector sources.

Different from many other initiatives, the SHOK programme does not take a particular position on the regionalisation of localisation of the supported activities. As there is no requirement that joint facilities should be used, the extent of localised cooperation depends on the individual centres orientation. While ICT oriented centres tend to favour virtual collaboration, one engineering centre has set up so called "factories", dedicated working environments in which partners can come together and work jointly for certain time periods. Some larger programmes under the SHOK umbrella have thus involved the creation of sizeable and high-quality facilities. As most of the money invested in these projects stems from industrial partners, such "factories" equipment and facilities will in the end mostly owned be owned by specific companies.

In 2013, international evaluation of SHOK activities found that the objectives pursued by the programme were still valid while, at the same time, most centres have not produced technologically transformative outcomes, the involvement of SME in many projects was insufficient as was the commitment of the public research sector to the initiatives (TEM 2013). Against that background, several changes were introduced to the programmes, not least to the evaluation system itself that had been underdeveloped (TEM 2014). In 2015, finally, the programme came to an abrupt end, when requirements of fiscal austerity, going along with substantial cuts in the TEKES budget, led to an outright termination of the programme. As a result of this, some centres are likely going to terminate operations in the coming months whereas the leading ones remain confident that they can sustain their activities based on industrial and other private sources.

In summary, the Finnish SHOK programme is particular in its attempt to cover next to all of its home nations industries, yet without taking a particular position on localisation. In terms of its approach, therefore, it is arguably the most uniform of the initiatives presented, i.e. the least regionalised and the least selective at the same time. In practice, however, the resulting centres are far from uniform, both with a view to reach and performance. When TEKES funding will soon be terminated, a selection may set in retroactively, with some centres surviving, even thriving, on other sources of funding and others phasing out for a lack of better options.

4.7 Norwegian National and Global Centres of Expertise (NCE/GCE)

From the mid 1990s, the Norwegian government has put a focus on collaborative innovation projects that, in 2002 led to the introduction of the Arena Programme the country's first cluster programme that has since supported over 70 projects. For more ambitious projects, the Norwegian Centres of Expertise (NCE) Programme was introduced in 2006 and today supports 14 clusters. In mid 2013, finally, a new, third support line was introduced for clusters with a global position: Global Centres of Expertise (GCE) that currently supports three clusters. In this cases study the two latter support lines will stand in the focus of interest as they in an interesting manner support "new strategic projects" which have grown out of smaller projects of the more traditional cluster-type.

With their cluster programmes Innovation Norway, the Industrial Development Corporation of Norway and the Research Council of Norway aim to strengthen firms' innovativeness and regional innovation milieus' capacity for renewal. According to specifications, the programme will support collaboration-based projects with clear "cluster properties", i.e. the potential to trigger possible synergies that can form the basis for innovation collaboration (Econ Pöyry and DAMVAD 2011). Beyond direct funding, the programmes' intention to link the owners' networks, expertise and policy instruments to create a more forceful support effort. Firstly, resources shall be administered on the basis of an overall strategy and across programme levels and, secondly, collaboration with related support programmes shall be nurtured to leverage synergies between different agencies' resources.

In 2014, € 4m were spent on Arena projects, € 7.6m on NCE projects and € 2.4m on GCE projects. Recently, allocations to the GCE programme were increased by a further € 1.2m. In 2014 the cluster programme's total budget thus amounted to € 18.1m. In the national budget, part of it is earmarked as R&D support, another part as regional development funding. In line with this, the national initiative works closely with regional organisations and authorities on the identification, development and follow-up of regional cluster initiatives. In a similar way as in France, therefore, the overall programme is thus put as a mediator between two, in part competing political objectives.

The individual sub-programmes select initiatives based on regular open calls for applications, clearly specified selection criteria and external project assessment. Calls for the Arena sub-programme are launched annually since 2002. Calls for the NCE sub-programme were launched in 2006, 2007, 2009, 2014 and 2015. For the new GCE sub-programme, two calls have been launched since 2013. As a tendency, the calls for tenders have been oversubscribed and thus been selective, even in the small country context of Norway. The first NCE call, announced in December 2005, resulted in 24 applications for 6 opportunities for support, far exceeding expectations. Likewise, later NCE calls in 2007 and 2009 prompted ten and eight proposals for only three opportunities for support respectively. In 2014, finally, of a total of 51 draft applications 33 were developed into full proposals (among them 7 NCE, 8 GCE) of which only eight could finally be approved (among them 2 NCE, 2 GCE), a chance of about 25% for both higher level programmes.

In principle, the programme is based on the assumption that clusters need time to unfold, and that, accordingly, funding should be awarded with a reliable long-term perspective. Arena offers three-year contracts to projects which can on request be extended by two years. NCE offers five-year contracts to projects which can on request be extended by another five years. GCE finally offers contracts for up to ten years (IN/SIVA/FR 2015). Also, it is possible, even desired that a cluster moves up to a higher level of support as long as the maximum timeframe for state aid to corporate project is not exceeded.

The Norwegian clusters have in most instances (been) developed on the basis of spatial proximity between related enterprises, a geographical concentration of experience-based competence or regionally-specific, customer-driven applications of knowledge. This requirement of a 'localised core' is taken relatively seriously. At the same time, analyses have documented that in Norway, innovation is thus mostly driven by market pull- rather than technology push-mechanisms which the cluster programme reflects in terms of admitting a more limited inclusion of public R&D-activities than would be the case in other countries. Typically, they build on collaboration of locally clustered companies with the nation's leading research organisations outside of the region. In principle, cluster members can leave the partnership at any time or at least cease to co-invest in the projects. Since the activities financed through the cluster programmes are mostly facilitation-oriented, fluctuation does not induce legal complications (DAMVAD 2012).

The size of the annual grants is rather limited in comparison and determined on the basis of the project's format. For Arena projects it ranges between about € 170-340,000 per year, for NCE projects between about € 460-690,000 per year, for GCE projects between about € 910-1,140,000 per year (IN/SIVA/FR 2015). With limited exceptions, public money can be invested into facilitation only, whereas all concrete innovation projects have to be financed by the clusters' member organisations themselves. All clusters are headed by a cluster manager who runs the daily affairs of the organisation. The more larger-scale NCE and GCE clusters employ 2-4 additional staff for administrative tasks. In addition to their fixed budget, many clusters make use of specific funds to take specific investment in connection with extra efforts in strategic focus areas or new pilot projects.

Notably, this effect is not only a sideline option, but arguably one of the most relevant lessons learnt from the Norwegian programme. In recent years, an increasing amount of activities have grown around clusters and in particular NCE and GCE projects have spurred the creation of a sizeable number of joint facilities, laboratories and demonstrators which, in practice, render their activities quite equivalent to that of Research Campus, Catapult Centres or other centres that receive block funding from public programmes with more generous budget. Interestingly, Norway's close to purely facilitation-oriented approach has thus not inhibited the emergence of "new strategic partnerships". Overall, there are indications that in the larger clusters, commitment increases rather than decreases over time and that many enterprises become more and more keen to cooperate in projects besides the core publicly sponsored activities (DAMVAD 2012).

Against this background, it is likely that the first batch of NCE clusters, whose lifespan as publicly supported entities is coming to an end, will find ways to organisationally survive when funding has to cease next year. For the three recently selected GCE clusters, it is too early to tell precisely. In principle, they are the clusters that can most strongly rely on parallel private investment as well as public investment from additional sources. Consequently, they are most likely to have a prosperous long-term perspective be-yond the immediate period of funding from the programme.

In summary, Norway's cluster programme is interesting in particular as it demonstrates how a programme that, at its basis is not primarily aimed at the creation of "new strategic partnerships" can nonetheless have that effect factually and, over time, also adapt its political orientation accordingly.

5 Summary Results

With reference to the research questions outlined above, this comparative study's central findings can be summarised as follows.

With regard to the first research question, concerning common characteristics and lessons despite different contexts, the comparative analysis finds that most "new strategic partnerships" are not only characterised by the long-term, pre-competitive perspective that defines them, but, in the majority of cases, a joint vision and mutual commitment of actors from science and industry. Thus, this study demonstrates that a need for such partnerships is latent in various contexts and that, intrinsically motivated, they can come to fruition under different framework conditions. As a result of this, different approaches have been sought and diverse forms have been found to substantiate and sustain long-term collaborations between science and industry. While localised cooperation facilities are a core element in many, they are always constitutive and structured virtual collaboration has come to play an important complementary role. At the most generic level, therefore, new strategic partnerships emerge when public and private actors share a joint perception of future challenges and opportunities, combined with a sense of urgency leading to a joint readiness to invest.

With regard to the second research question, concerning the suitable relation between specific challenges and more generic political objectives, the comparative analysis finds that both the general state of national economies' as much as countries' overall culture in economic policy play a key role for the thrust of support programmes, most importantly with regard to the budget invested, the degree of excellence orientation and their sectoral focus. In the light of the particular framework conditions, many policy makers have been quite adept in tailoring support programmes to both their political options and pressing socio-economic challenges. As a result, a large number of formerly latent partnerships have been successfully set into motion. At the same time, programmes with an overly complex and in part conflicting set of targets have led to responses from a heterogeneous set of actors beyond those able to activate latent partnerships. More or less irrespective of the concrete national framework, the factual development of initiatives under a specific support programme depends on the degree of clarity with which its objectives are articulated and translated into terms and conditions relevant for business and science.

With regard to the third research question, concerning lessons for technical realisation, competitive calls were found more suitable to elicit relevant initiatives than programmes aiming at coverage or even distribution. Apparently, even a clear political perspective of "blind spots" in the innovation system cannot easily help generate strategic partnerships "on demand". All-encompassing programmes thus tend to perform less effectively for additional reasons than their lack of political focus. Most competitions, to the contrary, have been oversubscribed, even if intentionally promoted as high-threshold. Furthermore, indications have been found that while a strong core of long-term committed partners is needed, openness to the (regional) environment and SME does not negatively affect the efficacy of partnerships. To the contrary, different, place-based models have been found to connect partnerships to their respective environments. Finally, the study could not identify general rules for a "best" legal or organisational set-up across national frameworks other than that their organisational model should be independent enough to endow them with own strategic capacities, and that funding should not be allocated once and for all, but rather in a stepwise approach including either probation or gradual upgrading.

In synthesis, Table 1 brings together these findings in a final, synoptic overview. The first section on 'environment' takes up the general selection criteria known from the coordinate system of Figure 2 and specifies them based on the more detailed analysis The second section on 'structure' illustrates commonalities in approach, as relevant for research question one. The third section on 'political orientation', in contrast, illustrates their diversity in orientation as a result of different framework conditions. Finally, the section on 'process' provides a insights with regard to commonalities and differences in the process of project selection, in light of research question three.

Table 1: Characteristics and Context of Different Strategic Models of Science-industry Collaboration

	Research Campus	**ERC / NNMI**	**Catapult**	**Pôles / (plateforms)**	**SHOK Centres**	**GCE Clusters**
ENVIRONMENT						
overall political environment	conducive	averse	ambivalent	conducive	conducive	ambivalent
state of economy at inception	excellent	losing momen-tum	losing momen-tum	reasonable	fairly good	fairly good
current science-industry relations	very good	diverse	below average	diverse	good	average
RQ 1: STRUCTURE						
driven by	public research & enterprises	public research & enterprises	policy & public research	policy	policy & enter-prises	enterprises & public research
role of small firms	mixed	limited	limited	high	limited-low	notable
openness to external parties	mid-range	limited	high	high	limited	limited
integrated vs. composite approach	both	integrated	integrated	composite	integrated	composite
budget (annually)	~ € 4-5 m up to ~ € 15-20 m	$ 3-4 m / $ 10-50 m	£ 25-50 m	€ 1.5 m / up to € 50 m	€ 30 m / € 150 m	€ 0.9 m - € 1.1 m
RQ 2: POLITICAL ORIENTATION						
sectoral focus on manufacturing	no	yes	yes	no	no	no
focus on excellence	very strong	notable	notable	partial	partial	notable
type of research supported	strategic/ precompetitive	strategic/ precompetitive	strategic/ appl. oriented	diverse	strategic/ appl. oriented	strategic/ appl. oriented
role of territorial dimension	occasional, not required	required yet varying	occasional, not required	strong to domi-nant	very limited	strong

	Research Campus	**ERC / NNMI**	**Catapult**	**Pôles / (plateforms)**	**SHOK Centres**	**GCE Clusters**
RQ 3: PROCESS						
selection	bottom-up, competitive	bottom-up, competitive	policy driven	policy driven / (bottom-up)	policy driven	bottom-up, competitive
selectivity	very high	very high	mid-range	low	low	high
involvement of regional policy	partial	notable	limited	high	low	high
max. period of support	3 x 5 years	2 x 5 years	5 years	*not determined*	*project based*	10 years
probation period	yes	yes	no	no / (yes)	no	implicit
need for ex-ante private commitment	high	limited	limited	low	limited	limited

Source: Own analysis

6 Conclusions

In light of this, the following three final conclusions can be drawn.

Firstly, there seems to be a widespread need for "new strategic partnerships" in the field of pre-competitive yet application-oriented research and development. In next to all leading economies such models tend to de facto emerge, driven by their key stakeholders, irrespective of the general political culture and the concrete ambition of the related support programmes. Apparently, there are numerous latent interests in this area which not always come to fruition on their own that policy can help leverage on a broader basis.

Secondly, it seems clear that the blank spot in the innovation system can best be addressed through clearly delineated programmes whose key thrust can be easily identified by relevant stakeholders and which are not burdened with additional political expectations. While the study suggests that policy makers may not be too adept in defining areas of intervention or specific institutional model, they should clearly define the programmes specific thrust, based on a clear definition of the role and purpose of "new strategic partnerships". Consequently, regional governments should better be engaged as enablers for individual proposals, rather than as co-designers at the programme level.

Thirdly, and consequently, policy programmes should be designed in such a way to mobilise key stakeholders, i.e. through competitive selection governed by high-level juries. Beyond its mobilising dimension, this approach has the merit that it allows for diversity in proposals that thanks to the jury member's experience can be assessed case-by-case based on generic specifications regarding professionalism and excellence rather than standardised criteria. Still, long-term funding should not be allocated once and for all but only after the submitted concept has proven itself as a viable business model, supported by industry.

Certainly, further research is needed to determine the exact implications, advantages and disadvantages of particular models' set-ups and internal organisation. The overall findings of this study, however, suggest that this be done for a particular national context, as generalisable conclusions do not seem possible in this regard.

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