

# **Connecting SMEs of Low and Medium Innovation Capability to Research Base: Challenges, Enablers and Supporting Policies**

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## 1 Introduction

The story of technology transfer from universities and Research and Technology Organisations to small enterprises has been a significant item in the innovation debate for some time. The success of regions like Silicon Valley and the following upsurge of the IT-related sectors has captured the imagination of several policy-makers who sought to create similar economic advantages for their regions. While this has been successful in several other regions (e.g. Cambridge biotechnology cluster in UK), it has been equally been a disappointment for several regions which do not possess necessarily the range (or the strength) of science competencies to create similar effects. Most recent approaches (Foray et al, 2012) accept that the best way to promote innovation and economic development is to build the next stage up, from the existing strengths and competencies rather than try to 'leapfrog' into the highest forms of innovation and economic activity. Innovation support should target to enhance the existing industrial and economic capabilities, rather than try to push an unrealistic agenda of 'leapfrogging' to new technologies and new sectors.

The implicit assumption of the literature so far has been that there is little point to discuss about knowledge and technology transfer, other than the case of high-tech SMEs or the very least medium-sized SMEs. However the share of these SMEs do not exceed the 13% of total population – with a more likely figure around 5-7%. More recent contributions have stressed the need to understand better the businesses that develop “hidden innovations” (NESTA, 2007). Arundel et al. (2008) referred to the concept of “neglected innovators”, suggesting that research has developed limited understanding of innovation activities that do not involve processes of formal R&D. Hervas-Oliver et al (2011) emphasises the need to analyse non-R&D innovators in low-technology context while Hervas-Oliver et al (2012) discusses the challenges of the firms' access to scientific institutes in low-medium tech context. In similar vein Robertson et al (2009) present very thoroughly the case for Low and Medium Technology (LMT) firms, namely the firms that spend less than 5% of their turnover in R&D. They point out that “the importance of LMT sectors is not based on a simple (and simple-minded) assertion that they always have been and, in all likelihood will remain, statistically dominant”. Sandven et al. (2005) calculated that LMT sectors were responsible for 34.8% of all manufacturing growth in contrast with 32.7% of high-technology sectors.

With these thoughts in mind we decided to explore in a three year research project policies and instruments that support SMEs of lower or medium innovation capabilities. These tend to be SMEs with little previous history of knowledge and technology transfer and/or little track record in innovation. Despite the current stance of the academic literature, a significant stream of policy practice has been found in different European countries with some of them being support schemes with a significant track record. These policies and support instruments are investigated in this paper, examining the different types of instruments, the kinds of SMEs that participated in these schemes, their common trends and the strategic crossroads they are facing.

Differentiating between alternative policy initiatives on the basis of whether they are designed to assist SMEs of higher or lower innovation capability should be an important and distinctive feature of the innovation support of SMEs. One of the key assumptions was that SMEs with lower levels of innovation capability are likely to require different kinds of policy interventions and services than those with high levels of capability.

## **2 Literature Review**

### **2.1 SMEs and Knowledge and Technology Transfer**

Work Regulations of the United Nations, define technology transfer as the transfer of systematic knowledge for the manufacture of a product or provision of service (Yu, 1991), while Abbott (1985) describes it as the movement of science and technology from one group to another, such movement involving their use. Initially the policy focus was on technology transfer, where the public research organisation was primarily responsible for 'diffusing' its technologies into the economic base, either through the support of spin-off companies or through the active pursuit of technology licensing to the private sector. However this approach has shown clear limits. According to the Association of University Technology Managers in the USA out of 21,000 active technology licenses held by universities in 2001, only 125 (or 0.6%) produce value more than \$1 million (Lester, 2005, p. 11). Moreover out of the total number of new business formations in the USA, only 2-3% sprung out of a university (ibid., p.11).

Bessant and Rush (1995) provided a critique of 'traditional' technology transfer policies by referring to twelve critical points and pointing out to an equivalent number of policy revisions needed in order to ensure an efficient process of technology transfer. The realisation of the limitations of 'traditional' schemes has led to a number of reconsiderations and new perspectives which can be clustered in a set of three 'aggregate' trends.

#### **2.1.1 Innovation is more than R&D: programmes should include both knowledge and technology transfer activities**

Knowledge and technology transfer is closely linked with innovation and their definitions often intertwine. Bozeman (2000) states that innovation and knowledge and technology transfer are closely interlinked but still very complex systems The UK BIS (2010) – merger of the Department for Business, Enterprise and Regulatory Reform and the Department for Innovation, Universities and Skills- state that

*Within a modern, knowledge driven economy, knowledge transfer is about transferring good ideas, research results and skills between universities, other research organisations, firm and the wider community to enable innovative new products and services to be developed*

The Oslo Manual (OECD, 2005), which has defined innovation, made clear that innovation is clearly wider than R&D, defined in the Frascati Manual (OECD,

2002). In line with these approaches Bessant and Rush (1995) explain the multi-dimensional character of the transfer phenomenon:

*For the outset we should be clear that what is transferred may take one of many forms ... It could equally be in the form of knowledge, codified via a patent license or a set of design specifications ... Technological knowledge may be ... held in a tacit mode, part of the informal knowledge derived from experience with particular activities ... yet many formal processes and policies for technology transfer make narrow assumptions about the nature of what is being transferred (pp. 97-98)*

Both scholars and practitioners have moved away from a tendency to focus exclusively on the technology itself. It has been acknowledged that without knowledge transfer, technology transfer does not take place as knowledge is the key to identifying, acquiring, developing, and using technology. Without knowledge there is no technology. Therefore, knowledge transfer is crucial in the process of technology transfer (Odigie and Li-Hua, 2008). The IRE Knowledge Transfer Working Group (2008) has expressed the new approach in clear terms:

*Under “**knowledge transfer**” we understand capturing and transmitting research findings, skills and competence from those who generate them to those who transform them into economic outcomes - either explicitly (patents) or tacitly (know-how). It includes both commercial and non-commercial activities such as research collaborations, consultancy work, training, licensing, the creation of spin-offs, mobility of researchers and the publication of scientific articles. The term of knowledge transfer is much more extensive compared to the “**technological transfer**” defining the process of developing practical applications from scientific research. (p.6, their emphasis)*

### **2.1.2 Policies have started considering SME of lower and medium innovation capability**

Cohen et al (2002) claimed that public research “importantly affects industrial R&D across much of the manufacturing sector” but it is “critical to industrial R&D for a small number of industries” (p. 1). Laursen and Salter (2004) looked at the CIS (Community Innovation Survey) data to find out that:

*the direct contribution of universities to industrial practice is likely to be concentrated in a small number of industrial sectors, among those firms who have an existing capability in R&D and among those firms who have adopted an ‘open’ approach to innovative search. (p. 1212)*

In similar spirit a recent report (Fisher et al, 2009) on the impact of EU funded research on innovation has put the case very emphatically:

*A most important message for policy decision-makers is the reconfirmation in this study of a finding that has stood repeatedly in evaluations of the Research Framework Programme: the Programmes attract the ‘elite’ of private sector innovators in Europe. (p. 80)*

The same study found two types of SMEs that have managed to reap the largest innovation benefits from these projects. The medium-sized companies which “*can achieve critical mass for R&D in a focused area ... often take a leading role in projects, and are most frequently found as coordinators*” (p. 10) and the firms with a strong innovation history such as firms with experience in both intramural and extramural R&D or a relatively high number of new products introduced the last 3 years (p. 50).

Partly responsible is the tendency of academics and policy-makers alike to concentrate traditionally on ‘science-pushed’ knowledge transfer (e.g. university spin-offs) and SMEs in the higher end of the innovation spectrum (e.g. New Technology Based Firms). However, in the best case scenario, these SMEs do not exceed the 10% of the total population (EURAB 2004). More recent contributions have stressed the need to understand better the businesses that develop “hidden innovations” (NESTA, 2007). Arundel et al. (2008) referred to the concept of “neglected innovators”, suggesting that research has developed limited understanding of innovation activities that do not involve processes of formal R&D. Hervas-Oliver et al (2011) emphasises the need to analyse non-R&D innovators in low-technology context while Hervas-Oliver et al (2012) discusses the challenges of low-medium tech firms’ to access scientific institutes.

Robertson et al (2009) present very thoroughly the case for Low and Medium Technology (LMT) firms, namely the firms that spend less than 5% of their turnover in R&D. They point out “the importance of LMT sectors is not based on a simple (and simple-minded) assertion that they always have been and, in all likelihood will remain, statistically dominant”. They articulate the significance of LMT by quoting a study of several OECD economies (Sandven et al., 2005) which calculated that LMT sectors were responsible for 34.8% of all manufacturing growth in contrast with 32.7% of high-technology sectors. To their opinion “if innovation by-passes older industries, this will stifle the demand for high-tech products and reduce incentives for R&D activities” (p. 441).

The topic of non-research intensive firms is a recent addition in the academic debate with the literature being in a rather embryonic state. An increasing number of authors argue that being low or medium-technology firm does not necessarily mean a firm with little innovation potential. In fact Robertson et al (2009) argue that the innovation potential of LMT firms has been concealed in official statistics since their unique contributions come in the form of formal or informal inputs to high-tech companies (e.g. in the form of lead-users):

*these sorts of ad hoc changes, while essential for innovation, may not fit the definition of R&D that has been formulated for statistical purposes and thus will not always contribute to indices of ‘research intensity’*

Stiglitz and Wallsten (1999) even go beyond the need of public research organizations to acknowledge the varied innovation needs of their industrial partners. They suggest that industrial R&D projects that have a good chance to be privately profitable should not be supported or subsidised by any form of public policy.

*Program managers who make funding decisions must reject not only projects of dubious scientific and technical merit, but also reject scientifically sound proposals that are very likely to yield commercial successes and therefore could be funded elsewhere (p. 60)*

The projects that should be prioritised are the projects that are likely to be socially beneficial and there are doubts whether they can be privately profitable.

### **2.1.3 Growing significance of intermediaries to improve the quality of interconnections in the knowledge and technology transfer process**

Dougherty (1999) argued that knowledge transfer is about connection and not collection. This argument signals the fact that several processes occur between actors involved in the “transaction”. To improve these interaction processes, intermediaries are involved either by direct inputs such as “offering transfer of specific technological competence” or through “a wider and more flexible interaction in the process by providing a number of information and related services which help to bridge the gap between technological opportunity and (often poorly articulated) user needs” (Bessant and Rush, 1995, p. 101).

Bessant and Rush (1995) argue that the need for such intermediation stems from the “managerial gap” that firms face when it comes to technology transfer. The managerial gap, which is a reduced capability to manage “a complex process that requires high levels of managerial skills and innovative capabilities”, results in “a high incident of failures or partial success in technology transfer, particularly amongst the SME population” (p. 100). They go on to suggest:

*Policies should thus focus on closing the managerial gap through mechanisms which encourage the development of, or compensate for the lack of, relevant innovative capabilities, especially in smaller and less experienced firms (p.100)*

The same paper proposes to build bridges between the suppliers of technology and the potential users through the deployment of consultants who can play four roles. Asheim and Isaksen (2000) analyse the experience of technology attachés in the Norwegian TEFT programme. Technology attachés were called to play the role of brokers, organizers, animators and coach in the SME innovation process. Despite the overall success, they also faced significant challenges.

## **2.2 Innovation policy trends in KTT for SMEs**

Nauwelaers and Wintjes (2003) reviewed 40 policy tools focusing on SMEs in 11 European regions. They present the main lessons of their research as

- Linear tools are dominating the policies but a clear trend towards more interactive support is “clearly visible” (p. 200)
- Lack of co-ordination and synergies among tools is in general the rule

- Few instruments are designed and implemented in a user-oriented mode: “the majority of tools are developed in a reactive, top-down fashion and at best consider firms’ needs expressed (but not latent)” (p. 201)
- Policy learning is rare; whenever it appears is at the level of the delivery organization
- A clear tendency emerges to develop “overall schemes” (p. 202) which gather into a single programme, instrument or organization a set of tools that were traditionally offered separately to companies
- The mainstream instruments target the improvement or facilitation of existing innovation projects, rather than the development of new innovation practices
- In several cases, the system endures from boundaries that have been set up in administrative terms (e.g. the region boundaries)
- Overall policy tools suffer lack of market orientation with the “lack of focus on the commercialization aspects of innovation, ... particularly evident” (p. 203).

The same authors draw a distinction between two kinds of policies:

- The *input resources* policies and programmes which aim “to raise the endowment, the stock of given resources” (p. 210) rather in a reactive way;
- The *behavioural value-added* instruments which are more proactive and “focus on learning, trying to change behavioural aspects [of the firm] like the organizational culture, innovation strategy, management, mentality or the level of awareness” (p. 211).

The former are suitable for high-tech or higher absorptive capacity SMEs since they are the firms which know what they want. In the authors’ words these schemes are “particularly relevant for New Technology-Based Firms and spin-offs” (p. 214). They tend to be the most ‘traditional’ schemes in the sense of dominating the technology transfer policy scene.

The latter are better for SMEs of lower capability, which can “learn by doing, by using and by interacting” (p. 211). In their words, “if a region does not have a lot of innovative SMEs, providing even more resources to the same group of firms seems less appropriate than extending the number of innovators by approaching non-innovating SMEs” (p. 215). According to Nauwelaers and Wintjes (2003) the “behavioural” schemes are the most innovative ones, in the sense of having arrived in the policy scene only recently. Behavioural schemes “could be used for less innovation-aware firms” (p. 214).

Despite the undoubted value of these contributions, they stop short of providing sufficient insights into the how and why of these behavioural-added instruments. Research is needed to help us understand the main features of these instruments as well as the main strategic crossroads they are facing when deployed in real circumstances. This is the very discussion this paper is set to contribute, investigating various ‘ingredients’ of these instruments from the type of SMEs they address to the mechanics they use, the different types of such instruments existing etc.

## 3 Methodology

### 3.1 Methodology Overview

The research project has developed and deployed a 'funnel' methodology strategy to identify good practice KTT programmes for SMEs. The methodology contained a multilevel selection process (**Error! Reference source not found.**). The project has looked into a total of 339 national and regional programmes across Europe, including 289 (national or regional) programmes supporting SMEs to connect with Public Sector Research organisations. The methodology has enabled the identification of 7 good practice schemes out of the originally identified 289 programmes.

The research started with the consideration of over 900 programmes from the ProInno and ERAWATCH databases, out of which 422 were considered "potentially relevant". Access was secured in 289 of these programmes and an Expert Judgement Survey (EJS) took place with their programme managers. Once the EJS was completed, five stages of selection were carried out:

- (i) *Preliminary selection* where a group of experts looked at the investigated programmes to select programmes that are *relevant to KTT and SMEs* on the basis of 8 definition criteria;
- (ii) *First level selection* to select the most 'functional' programmes in terms of focus on knowledge and technology transfer for SMEs and based on the evidence acquired in the previous stage;
- (iii) *Second level selection* to select the programmes with the highest consistency between design and implementation ("Strategic fit") and between management and measurement ("Operational fit") following the evidence from a real-life implementation of the programme;
- (iv) *Third level selection* to select the programmes with the highest learning potential, assisted by the peer review of the programmes by independent experts and the prioritisation they produce;
- (v) *An in-depth case study* of the programme involving the collection of evidence from several programme stakeholders such as participating SMEs, Knowledge providers and Linkages enablers.

The research also included 445 participants, five types of programme stakeholders in three rounds of fieldwork (**Error! Reference source not found.**). The initial survey involved 289 (national or regional) programme managers who participated in an Expert Judgement Survey. This was followed by a semi-structured interview and a closed-questionnaire survey of people who are in charge of implementing (a selected set of) these programmes on the ground -with a focus on strong implementations of the selected programmes. The third round of fieldwork, consisted of the in-depth case studies, which included 39 managers from beneficiary SMEs, 37 researchers from involved PSR organisations and 30 KTT enablers (like agents working for the programmes and network brokers or co-ordinators). All interviews lasted around 60 mins

Throughout the selection process, the methodology has followed a stratified sample strategy, making sure that programmes of various EU regions were identified on the basis of relatively similar context characteristics (Table 1). The main factors considered were the degree of economic development, the size of the country (population) and their innovation performance<sup>1</sup>. Historical or cultural connections were also taken into account (e.g. UK and Ireland placed together because of the obvious connections).

<i>Geographical Region</i>	<i>Included countries</i>
<b>British Isles</b>	UK and Ireland
<b>Scandinavian countries</b>	Sweden, Finland, Norway, Denmark
<b>Big European countries</b>	France and Germany
<b>Small Developed European countries</b>	Austria, Belgium, Netherlands, Switzerland
<b>Eastern European countries</b>	Baltic countries, Czech Republic, Hungary, Poland, Slovakia, Balkan countries
<b>Southern European countries &amp; Israel</b>	Cyprus, Greece, Spain, Portugal, Israel, Malta

**Table 1: European regions identified in the RAPPORT research**

Next sections describe in more detail these selection rounds, providing some insights to the relevant research. Deliverables 3.3, 4.1 and 5.1 give a more detailed account of these selection rounds and the conducted research.

### 3.2 Identify KTT programmes for SMEs and Preliminary Selection

The research in this phase followed four different steps (Table 1). It started with the identification of over 900 programmes from the ProInno and ERAWATCH databases with 422 of them considered as “potentially KTT programmes”.

Access was secured in 289 programmes of these programmes. An Expert Judgement Survey (EJS) was carried out with the programme manager of each of the 289 programmes. The survey examined the main objectives of the programme, its ‘mechanics’ i.e. offered services and engagement strategies) as well as the innovation characteristics of the participating SMEs. Based on the information collected in the previous phase, a ‘Sanity Check’ test was implemented to all considered programmes to ensure that they are compatible with the objectives of this research, namely looking at programmes that support KTT for SMEs (Table 2). After considering the feasibility of further research (some programme managers refused any further access) 146 programmes were selected for further investigation.

Programme is recent, mature, or established. If the programme is functioning before 2009, it is to be included, but if it was initiated in 2010, it is considered as too recent to be included.

<sup>1</sup> See the latest report published by the European Union “Innovation Union Scoreboard 2011”.

In actual reality are SME's being engaged? If yes, the percentage should exceed 10%.
If KTT is taking place between PSR and business, it should be a usual story (rather than an atypical practise).
If the programme leads towards KTT (i.e. proper awareness generation with active attempts in leading the SMEs to KTT), it can be included. However if it is merely information spreading programme then it should be excluded.
If it is a European wide programme with national implementations, it should be included. If the European programme doesn't have a national implementation then it should be excluded.
If the programme support spin offs but it also has complementary KTT activities then it should be included. However if the scheme merely supports spin offs but has no KTT component then it should be excluded.
If the programme supports incubators and also has KTT activities then it should be included. However it supports incubators without any KTT activities then it should be excluded.

**Table 2: Selection criteria for including programmes in further research**

### 3.3 First Level Selection

Based on the collected information, two fundamental aspects of the 66 programmes were identified: (i) the level of innovation capability of the participating SMEs (ii) the main engagement strategy used by the programme. Two different 'categories' of beneficiary SMEs were distinguished:

- SMEs with high innovation capability;
- SMEs with low innovation capability.

The *first level selection process* shortlisted 22 out of 66 programmes. The assessment process was based on a set of qualitative indicators (Table 3). The programmes were assessed by the team researchers according to these indicators. In fact the responsible researcher gave a score to each of these criteria which was then aggregated to a score for each programme. The individual scores and the overall score were then discussed with another member of the team to check against any bias of the responsible researcher. The researcher pairs had to agree on the final score of each programme.

KTT programmes Selection Criteria	
1	The programme provides support throughout the innovation journey, taking into account the differing needs of SMEs?
2	The programme addresses management challenges that are complimentary to KTT?
3	The programme adopts a proactive role for addressing and engaging with SMEs?
4	The programme supports the development of partnerships that are complementary to KTT?
5	The procedure to access and implement the scheme, is easy and user-friendly from the SME perspective?

**Table 3: Criteria To Assess Programmes Functionality**

The *second level selection* process aimed to shortlist 29 out of the 50 PSR programmes, followed a comprehensive methodology with four components:

1. The programme managers of the 50 KTT programmes (identified by the first level selection) were asked for referrals to very effective implementations of these programmes (programmes-in-practice) with a track record of successes;
2. A semi-structured interview with the managers being responsible for the selected implementations, what was termed as “programme implementors”;
3. The evaluation of the programmes by the programme implementors on two sets of indicators, one measuring the design orientation of the programme and one measuring the implementation orientation of the programme;
4. The assessment of the programme by the project researchers on two sets of indicators which measured the management capability of the programme and the evaluation capability of the programme.

The indicators selected to carry out the third component of assessment were drawn from the evidence-based criteria, as developed in a publication by OECD (OECD, 2011). This round of assessment relied on two sets of indicators addressed the following aspects of the programme:

- I. *Design related principles*: innovation focus, proximity to SMEs, service portfolio and programme focus and the extent to which these are oriented towards HAC or LAC SMEs.
- II. *Implementation related principles*: nature of services, diversity of cooperation partnerships, size and technological intensity of engaging SMEs – revealing the actual reality of the programmes and what kind of SMEs are reached and supported.

The fourth round of assessment focused on the following aspects of the programmes:

- III. *Management related principles*: target groups, service offering and delivery, delivery challenges, pricing model, resource strategy and governance;
- IV. *Evaluation related principles*: external evaluation, monitoring system, impact measurement and other evidence.

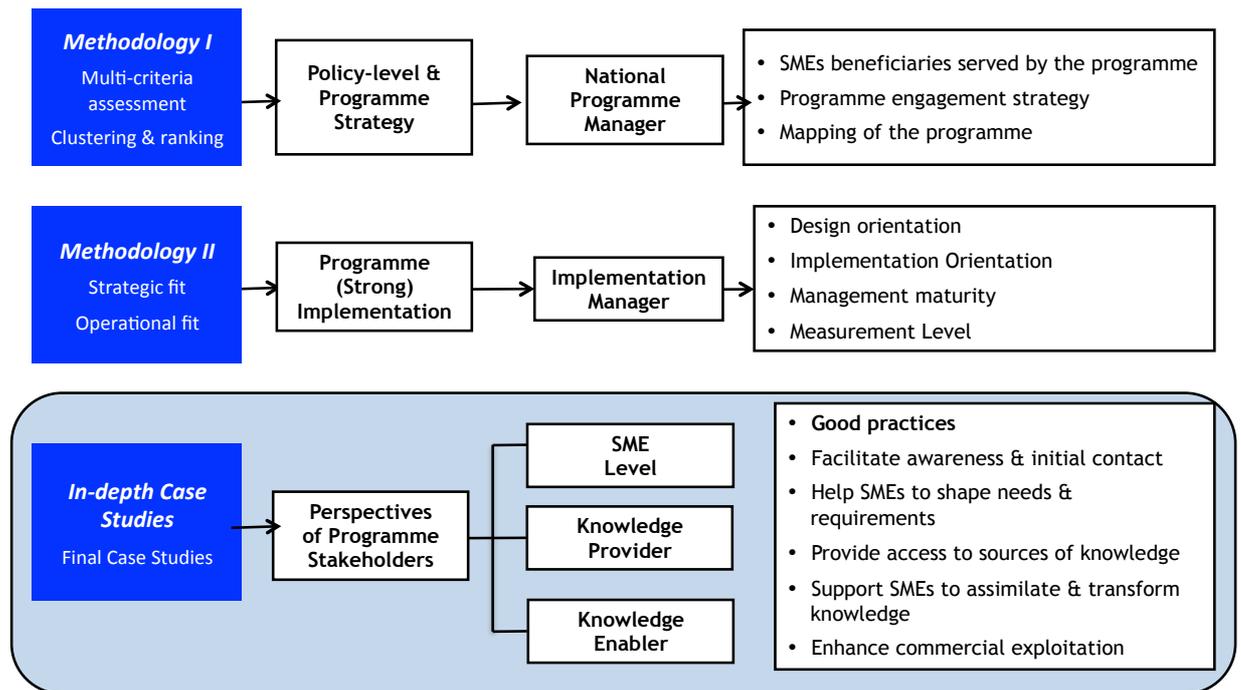
The *third level selection* took place with a significant contribution from the Advisory Board. Each expert was given the programmes of one geographical region and asked to assess each programme (on a scale from 1 to 5) on four dimensions:

- Originality/uniqueness of the KTT process;
- Management of the programme;
- Impact on SMEs;
- Learning potential of the programme.

Members were also requested to provide the rationale behind the selected scores. Once this assessment has been carried out, the Advisory Board met to discuss the programmes of each region, engage in a discussion with the

researchers who carried out the relevant research and produced their priority list for each region.

The final round of research was to get an in-depth understanding of the programmes activities on the ‘ground level’ (Table 4). The research turned into the perspectives of the ultimate beneficiaries, namely the participating SMEs as well as the views of the other involved actors like the researcher who was involved in the KTT and the KTT enabler who had the responsibility to facilitate the contact between the two parties.



**Table 4: The programme actors interviewed by the RAPPORT team**

Research at this stage included three steps: (i) the identification of segments/groupings of participating SMEs, following the recent track record of the programme (ii) the use of a purposive sampling technique to choose a project within each segment where the programme has exemplarily engaged, impacted or benefited the SME<sup>2</sup> (iii) the investigation of the ‘exemplary’ project activities through the interview of the focal SME and the knowledge providers (PSR) and the knowledge enablers who were involved in the process, along the full innovation journey of the SME (from the pre-project stage to the capture of the final outcome/benefit).

## 4 Tentative Typology of Programmes

*Agent-Supported*

*Network-Based*

<sup>2</sup> Since the focus was on the identification of good practices, the sample was biased towards the successful cases (rather than selecting a representing sample).

LMT SMEs	≤ 75%	PlatInn (CH)	IPC (NL) Innovation Networks (DK)
	76%-90%	RIS (BE)	Vinnväxt (SE)
	> 90%	RTD (FR)	Profitnet (UK)

**Table 5: Identified Good Practice Programmes Supporting KTT for SMEs of Low or Medium Innovation Capability**

Two generic engagement strategies were identified through this research (). Firstly the *agent-supported programmes* are characterised by the fact that an integral part of the support they offer to their SMEs is the presence of an agent, who becomes a champion for the KTT process. Agent-supported programmes usually have special training programmes in place to develop the skills and the competencies of their agents. The agent is supposed to act as an impartial intermediary, providing momentum to the process but also resolving critical issues in the interaction between the SME and the PSR. The agent's role varies in the different phases of the KTT process.

Secondly the *network-based programmes* function on the basis of a network where participants are given several opportunities to connect with the most suitable partner, either for the research or the industry world. Networks include both active and dormant members: if opportunities emerge dormant members can become more active while in absence of opportunities active members can adopt a more passive (dormant) position. Usually the network include a brokering organisation which makes sure that the network continue to operate and tries to create connection opportunities for all members. The broker's role varies in the different phases of KTT process.

As for the participating beneficiary SMEs, they range between different shares of high-tech and low and medium-tech SMEs, micro, small and medium sized companies ()

<i>Programme</i>	<i>Share of high-tech beneficiary SMEs</i>	<i>Share of medium-tech and low-tech beneficiary SMEs</i>
IPC (NL)	34%	66%
Innovation Networks (DK)	33%	67%
PlatInn (CH)	25%	75%
Vinnväxt (SE)	10%	90%
RIS (BE)	10%	90%
RTD (FR)	0%	100%
Profitnet (UK)	5%	95%
<i>Programme</i>	<i>Share of beneficiary SMEs that are medium-sized (&gt; 50 employees)</i>	<i>Share of beneficiary SMEs that are micro or small (≤ 50 employees)</i>
IPC (NL)	55%	45%
Innovation Networks (DK)	40%	60%
PlatInn (CH)	13%	87%
Vinnväxt (SE)	20%	80%
RIS (BE)	19%	81%
RTD (FR)	9%	91%
Profitnet (UK)	13%	87%

**Table 6: Types of SMEs involved in the process**

<i>Programme</i>	<i>Share of beneficiary SMEs using services focused specifically on KTT without other complementary activities<sup>3</sup></i>	<i>Share of beneficiary SMEs using a portfolio of services including a range of complementary services<sup>4</sup></i>
IPC (NL)	100%	0%
Innovation Networks (DK)	80%	20%
PlatInn (CH)	0%	100%
Vinnväxt (SE)	40%	60%
RIS (BE)	20%	80%
RTD (FR)	67%	33%
Profitnet (UK)	0%	100%
<i>Programme</i>	<i>Share of beneficiary SMEs forming one-to-one partnerships with PSR institutions</i>	<i>Share of beneficiary SMEs engaging in diverse partnerships with a range of stakeholders<sup>5</sup></i>
IPC (NL)	0%	100%
Innovation Networks (DK)	50%	50%
PlatInn (CH)	20%	80%
Vinnväxt (SE)	10%	90%
RIS (BE)	80%	20%
RTD (FR)	70%	30%
Profitnet (UK)	10%	90%

**Table 7: KTT services and partnerships formed by participating SMEs**

<sup>3</sup> e.g. access to expert knowledge, basic research, collaborative research

<sup>4</sup> e.g. advice on marketing, organisational development, commercialisation

<sup>5</sup> e.g. intermediaries, other companies

## 5 Common Trends

### 5.1 Regional embeddedness

The programmes have developed a ***thorough embeddedness in the regional structures***. For instance, the RIS programme was established by employers' federations and business associations in the region while today, less than half of the members in the programme board are from the founding organisations while the rest are from regional businesses. The RTD programme is managed by dedicated associations (including some pre-existing structures in the region) while it is supervised by a steering committee composed of various regional actors like the Regional Delegation of Research and Technology (DRRT) and Regional Directorate for Industry, Research and Environment (DRIRE) etc. Moreover the organisation running the RDT programme has developed a dense network of 60 regional key players (associated members). The starting point of the intervention is the regional challenges; for instance, the RDT programme was established in a region with an “underprivileged economy”, in a former mining area with a predominant agricultural sector and many traditional small or micro companies.

Proximity and accessibility inherently facilitate awareness among SMEs and contact with them. Two types of administrative responsibility have been identified in the reviewed programmes. First a group of programmes have been running so far *only at a regional basis* (RIS and PlatInn). The regional programmes started as a result of local or regional initiative or they grew in the context of delegation of power from the national to the regional government (e.g. the RIS programme in Belgium). Second, there are national programmes (RTD) which have passed the *implementation responsibility to a regional authority*.

It is extremely difficult to generate a robust network out of thin air. Most of the network examples build on existing connections between industry, universities, government, and other institutions. These are often organised around *sector-based or technological areas of interest, as well as geographically specialised fields of activity*. The rationale is to take these existing landscapes and promote even greater interaction between the established participants at the same time as drawing in new members to the network. This means that there is a critical role to be played by network facilitators who are able to work on connecting potential collaborators without necessarily specifying precisely the nature of their collaboration. A key concept here is the *triple helix* which refers to building strong three-way relationships between government, industry and the research base.

The language of triple helix is explicitly used by initiatives under the VINNVÄXT programme. Indeed, the implementation that we studied, Peak Innovation, had extended the idea to include a fourth actor in the partnership, making this a *4-Helix agreement* (in the terminology of the programme implementation). The four signatories are as follows: Mid-Sweden University; the Jämtland-Härjedalen Sports Association; the municipalities of Östersund, Krokum, and Åre and the Jämtland regional council; and the region's industry (represented by the

business platform Peak Business and Sports AB). Together these parties are shareholders in a joint venture called Mid Sweden Science Park AB (MSSP AB).

The roots of the implementation go back to 2000 when the Executive Board of the Östersund Municipality set up a taskforce comprising different players in the region to create a development plan for Östersund. This resulted in a strategy called 'Peak of Tech Adventure 2000' which envisioned the future of the region being based on events and experience-based business and technology. In 2003 and 2004, applications were made to the first two rounds of the VINNVÄXT competition. Both were unsuccessful, rejected on the grounds that the proposed initiative included too little participation from the business community. In 2005, Mid Sweden University established the ETOUR tourism research centre, with a much stronger focus on engaging with industry. There was a favourable response from business and on the back of this a collaborative business platform called Peak of Tech Adventure AB was established. In 2007, the main actors in the regional innovation system decided to apply to the third round of the VINNVÄXT programme. In preparation for this, they signed a partnership agreement. This time the application was successful and the initiative formally began in 2008. The following year the original name was changed to Peak Innovation, followed by the rebranding of Peak of Tech Innovation AB as Peak Business and Sports AB.

**Table 8: Building a Vinnväxt network out of existing relationships in Östersund**

All of these regional actors were already in existence. The goal of Peak Innovation is to *act as a catalyst* to build even more effective connections between the different players in the regional innovation system. Winning funding from VINNVÄXT for the network was the culmination of a historical trajectory where significant effort had already been expended in developing productive interactions between the main actors in the area. The Jämtland region already had a strong concentration of activity in the areas of tourism, winter sports, and outdoor pursuits. These provided the basis from which to build the network. However, there also needed to be a shift of focus, especially from the research community at Mid-Sweden University, before the network could really take off.

In networks targeting SMEs of low or medium innovation capability, the relationships with stronger players (e.g. Multinationals) are used to *create dynamics that can draw these SMEs* into it. A critical condition of this approach is the variety of participants which should come from all quarters of industry, all the way from start-ups to large corporations. For instance in the Innovation Networks in Denmark one third of the participating companies are high-tech companies, one third are medium-tech companies while 25% are large firms and 30% are medium-sized firms (Table 9). This mix creates the conditions for attracting SMEs of lower absorptive capacity and start interacting with them.

<i>Number of currently participating companies</i>	240
<i>Duration of programme in the specific implementation</i>	8 years
<i>Number of firms participated historically in this part of the programme</i>	1000
<i>Proportion of participating companies according to size (Q9)</i>	

Micro	Small	Medium	Large
15%	30%	30%	25%
<i>Proportion of participating SMEs that are start-ups:</i>			15%
<i>Proportion of participating SMEs that are</i>			
High Tech	Medium tech	Low tech	
33.3%	33.3%	33.3%	

**Table 9: Participating companies in the Offshore Centre Innovation Network**

## 5.2 Understanding and defining the target group of SME

The first insight gained by the identified programmes is the need for *segmenting the targeted market* (SMEs), especially according to a set of critical dimensions. PlatInn keeps extensive records of the serviced SMEs along their size and their sector. From time to time it engages in evaluation exercises to understand in detail the innovation priorities of the different groups of SMEs. RIS has developed a detailed innovation classification for its targeted audience, so they can classify each of the approached SMEs and direct them appropriately (Table 10). Similarly to PlatInn, they measure regularly the kind of SMEs they support to have a good overview of the changing market and their customer base. A recent exercise has shown that only 10% of client companies are high-tech ('technology pioneers' or 'leading technology users'), 65% are 'technology adopting enterprises' that adapt or just use existing technologies and 25% are low-tech (mainly service companies).

Probably the most characteristic case was the PlatInn programme where the programme has invested significant resources to develop an extended definition of innovation the so called "business innovation" which is "the creation of substantial new value for the firm's customers and the firm itself, which is not necessarily based on R&D".

Two groups of companies are targeted:

- firstly companies with limited in-house innovation capabilities, which have the potential for innovation activities to develop value-added;
- secondly companies that own a substantial innovation capacity, but need an additional incentive or support.

A more detailed classification of SME has been developed in order to deliver services according to the specific needs of these SMEs. Four groups are identified:

- Latent innovators have the capacity to innovate, but are not doing this yet;
- Starting innovators started to innovate;
- Systematic innovators innovate regularly and most of the time they are running at least one innovative project;
- Strategic innovators have innovation in their business strategy.

Groups of SMEs that will not be served by RIS are SMEs that are not interested in innovation or have no potential for economic growth

**Table 10: Segmentation of Potential Beneficiaries in RIS**

### 5.3 Reach-out strategy

Probably the most challenging task of a **reach-out strategy** is faced by programmes which face SMEs of LAC. SMEs of LAC have limited understanding of the innovation process and very little appreciation of the KTT process. This creates an important problem for the programmes because they try to communicate to them the value of a process they do not know. In the words of the RTD programme implementor:

*Many enterprises do not know anything about the process of innovation and their possibilities to be supported. Although the publicity of RDT Lorraine is good (websites, information events, agents etc.), much of this work grasps at nothing since firms are not ready for it.*

In similar vein, both companies and agents in RIS noted that the programme should improve the value proposition part of their communication.

There are two underlying problems here that contribute to the problem. Firstly, programmes targeting SMEs of LAC must convince SMEs which do not know that they do not know; the RTD manager refer to “SMEs who are not even aware of the concept of innovation”. Secondly SMEs of LAC usually suffer from lack of confidence where a lot of potential avenues of support (especially those involving university researchers) are perceived as unbearably superior and with potential risks for the company. These fundamental characteristics of SMEs of LAC combined with the fact that universities offer “limited help” in reaching-out SMEs and that some programmes discourage the participation of the same SME twice in the same programme<sup>6</sup> create a very challenging environment. This what led one of the RTD managers to refer to “the high investment of time and competences needed to support LAC innovation-starter companies”. Three strategies were identified to help with these challenges:

- a. Alliance and common communication strategy an with established organisation with a strong brand (e.g. the case of RIS with a reputable organisation called IWT) or secure public mandate to give credibility and authority to the programme (e.g. the case of RDT)
- b. Proactive approach of potential beneficiaries such a proactive onsite visit (proactive site visits to companies are responsible for mobilising about 50% of the LAC SMEs in RDT)
- c. Develop a range of activities to attract SMEs through different avenues (Table 11).

- (i) Innovation breakfast - a short overview of what innovation is and how innovation centres can assist;
- (ii) Research meetings introduces to a researcher or knowledge that can be useful to companies which can find partners for innovation projects;

<sup>6</sup> For instance RTD requires a minimum period of 2 years between two projects of the same enterprise.

- (iii) Seminars provide insights into specific aspects of technological innovation or innovation strategy;
- (iv) Readings give overview of innovation and inspires with examples of local and international players;
- (v) Business visits.

**Table 11: Typical awareness raising activities in the RIS programme**

Other activities like the regular training of agents involved in proactive visits and the exchange of experiences with similar programmes in other regions have also been found useful.

The *entry to a process* that can lead to a connection with the research base starts from a business issue (like the need to discuss the business model of a specific product or service, the lack of sales, the concerning of too much dependency on one customer etc. This leads to a wider discussion which gradually can make obvious the need for linking-up with a research organisation. In other words discussing concrete business issues is a very efficient strategy of making these SMEs aware of the need for Knowledge and Technology Transfer.

Developing a strategic view of the developing innovation is crucial because it can determine the success of the KTT venture. However, SMEs tend to perceive this part of the process as *relatively unimportant and attempt to hurry it*. The RTD implementation manager claimed:

*The whole development process from project concept to the selection for a PSR ... highly depends on the enterprise and the clarity and accuracy of the concept. In most cases, enterprises try to go through this phase too fast and need to be stopped by us or another actor involved.*

Programme name	Formal application process	Assistance with application	Brief description
IPC	Yes	Yes	Application process completed by the knowledge provider with help from programme secretary
RIS	No	Yes	No formal application process, although programme helps SMEs to source other funding, e.g. under IWT programme.
Platinn	No	Yes	No specific application process although coach works closely with SME to assess needs and plan intervention.
Innovation Networks	No	N/A	N/A
RDT	Yes	Yes	Simple application process. SME receives help in identifying needs and developing the project proposal.
Profinet			
VINNVÄXT	No	N/A	No formal application for most activities. Detailed evaluation process for 'Öppen Dörr' initiative.

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### Table 12: Comparison of programme application procedures

Of course, creating awareness among the population of potential participants is only the first step in linking SMEs with the support provided by a network. Firms also need to have the motivation to join the programme, as well as the ability to navigate their way through the membership process. Although LAC SMEs with little previous experience of KTT are likely to need as much help as possible in facilitating their access to the network.

The IPC programme tries to *ease the administrative burden* on the companies as far as possible. This is achieved by assigning a programme secretary to each project who is responsible for helping the SMEs to apply for IPC funding and support.

Many of the SMEs had previously had experience either with the same programme or an associated initiative. In these instances, the role of the implementing organisation is not so much to encourage the firms to participate in the first place, since they are already sensitised to the benefits of involvement, but rather to ease the pathway to receiving support. However, for many *SMEs, particularly those with little previous experience of KTT*, there may need to be more direct activities encouraging them to take part in a programme and preparing them for participation. For example, one strand of the Peak Innovation programme is called Öppen Dörr. This is a business development initiative that seeks to identify and support promising business ideas and connect entrepreneurs with other parties who can help them develop and commercialise their ideas. According to Peak Innovation (2011: 5), "A lot of effort has been put into encouraging the research environments to focus on commercialisation and to motivate the small companies, with little research experience, to join this cooperation." The initiative involves actively searching for ideas from a range of sources, including researchers, laboratory staff, and students, R&D and business development staff in companies, entrepreneurs, and other 'idea donors'. Such prospecting activities are about locating and engaging potential entrepreneurs who may not even have reached the stage of establishing a business.

For SMEs to be encouraged to join a network programme it is important that the benefits of the network are clearly communicated. Although awareness of a programme can be high, if the message being communicated is not straightforward this can create confusion among prospective beneficiaries. The Offshore Centre Denmark (OCD) implementation of the Innovation Networks programme, for example, has a clear communication plan designed to engage SMEs. As the director of OCD commented: "I would say that for the small companies the first step is to recognise that innovation is important and also for them to recognise *what is innovation, why it should be for them strategic* and why should they be part of networks and this kind of thing. And we should give them adequate time to do this. So the first, I would say, three years, we had to reach a common concept; that's very much about knowledge sharing."

## 5.4 The critical role of agent services

An agent supports the company throughout its journey within the programme, all the way from the initial contact, to shape its needs and requirements, handle the application process and facilitate the communication with the knowledge provider. Although the support throughout this journey is important, the agent's contribution in shaping the needs, the requirements and the motivations of the company is the most crucial one. This is the phase where the main responsibility falls in the shoulders of the agent who has to help the company to realise its needs, develop a strategic view on the developing innovation and therefore set the ground for a constructive interaction with the knowledge provider.

The collected evidence from the beneficiaries SME confirms *the value of the agent* for this phase of KTT. For instance, the interviewed SMEs in the RIS programme suggest that they perceived the agent as “an external, impartial expert”. In the RTD programme, the agent has the responsibility to ensure that the proposed concept is innovative, clear and sound and might call for another round of refinement if needed; in the interviewed SMEs, this iteration process was an essential element of concept maturation.

As far as *the roles and responsibilities of these agents* are concerned, two models have been identified. Programmes like RIS and PlatInn are clear that their mandate does not include the development of the actual application for securing funding for KTT. Once the agents advise the company on the project concept and how it relates on its strategy, they can signpost the SME to a private consultancy who can help them with putting the application together. On the contrary, agents in RTD and play a more active role in supporting the SME to put the application together. The engagement of an agent is compulsory for RIS, PlatInn while it is optional in RTD.

The vast majority of the respondents have pointed out the critical role *the quality of the agent* plays for the success of the process. In the words of the programme implementor in RTD:

*The greatest strength of the programme is also its biggest challenge: the quality of the personal support delivered by the network agent. While competences and personal motivation of agents is crucial for success, it does vary from person to person and can be found lacking at times.*

The significance of this challenge becomes bigger, given that in most programmes, the recruited agents come from external (to the programme) organisations and offer their services on a part-time basis. For instance the RTD programme employs agents from 26 different organisations. A number of strategies and good practices have been identified to underpin the competencies of the employed agents:

- The standardisation of services and tools (RIS and PlatInn) to allow quality assurance, which is less dependent on the qualities of the specific agent;

- The development of “a rigorous but customized accreditation procedure, corresponding to the needs of SMEs and to the mission of the programme” (PlatInn) together with their periodic evaluation (PlatInn);
- The delivery of regular training (every 2 months) to the agents to enhance their professionalization and increase their compliance with the programme directions, as exercised in RDT;
- The allocation of agents to SMEs according to the background of the agent and the nature and the strategy of the company such as the RIS policy to allow agents to specialise in sectors (each advisor covers several sectors).

In addition to these strategies there were a few practices that found particularly interesting. The RDT programme employs two sets of agents: (i) the “generalist” with more generic business skills like marketing, project management etc. and (ii) those with a more “scientific specialisation” in the sense of having a relatively good understanding of the technologies and the knowledge for transfer.

Finally an issue raised by the managers with the programme implementation responsibility is the value of *continuity of agents’ employment*. The RIS implementor pointed out

*the four year programme cycle limits effects of learning as experienced personnel leave because there is no certainty about the future of the programme. Every 4 years the programme presents a challenge since in transition many agents leave and competences and trust relationships are lost.*

This position was corroborated by the RDT manager who pointed to the value of agents staying in their position for many years, giving them the chance of developing their “connecting abilities” which “get better and better” over time. This position was confirmed by all interviewed actors in RDT (beneficiary SMEs, PSR institutions and knowledge enablers) who argued that the communication in the project development stage was “trouble-free”.

Nearly all of the studied network-based programmes involve some element of agent support, although there are variations in the number and type of activities undertaken by the agent. For the IPC programme, the agents, in the form of programme secretaries, play an important role in *guiding firms through the support process*. A key aspect of this is to help the companies identify and shape their innovation needs. Acknowledging the importance of developing a clear innovation plan, a pre-IPC stage was developed (Table 13). One element of this involves conducting an innovation study where the secretary works with the firm to identify innovation opportunities, formulate objectives, and target specific collaborations to help meet these needs.

<p><b><i>Information provision related to the IPC scheme</i></b>  <i>Many participants (including some secretaries) are new to the project and need getting familiar with it. It was one of the reasons for introducing the pre-IPC stage.</i></p>
<p><b><i>Conducting innovation study (IPS)</i></b>  <i>This activity serves gaining knowledge about innovation opportunities, formulating innovation objectives and designing future collaboration.</i></p>
<p><b><i>Building a coalition (IPC group)</i></b></p>

*The applicant (organisation) facilitation role is very important in bringing together the IPC group, albeit the process may be very different from one case to another.*

**Table 13: Pre-IPC services offered to SMEs to shape needs and requirements**

Obviously it is important that innovation audits and planning are conducted in a rigorous and systematic way. There are a number of methodologies available to assist with this. The Peak Innovation programme uses an *evaluation methodology* called TEMPOR to consider which innovation projects to support. This is structured under the headings of technology, economy, market, product, organisation, and research. These are further considered in the light of selection criteria such as export potential, development potential, novelty or uniqueness of contribution, infrastructural and strategic significance for the region, links with research, and the competence and motivation of the entrepreneur or idea developer. This process of evaluation and selection is carried out by a programme board largely made up of industrial representatives with extensive business experience.

### 5.5 From informal to ‘managed’ networks

Even with strong existing foundations it is by no means clear that all networks reach a stage where they are entirely self-sustaining. Usually there is a lot of effort required in the early stages of network building to raise its profile and establish a core membership. Once a network has reached a sufficient size and density it is more likely that it will draw in further participants through word-of-mouth and other informal interactions. However, this is not necessarily the case. As network relations between existing participants are strengthened it is equally possible for the network to become more internally-focused, neglecting, or even positively avoiding, interactions with external parties. For this reason it is important to have a *network managing organisation and a governance structure* rather than relying entirely on informal interactions. One of the roles of these bodies is to monitor the functioning of the network and take the necessary steps to keep up the momentum. This includes continuing to communicate the benefits and successes of the network and raising awareness among potential new members (Table 14).

Sustainable financing of the management organization and appropriate staffing of the organization;
The provision of professional services that address the needs of the members through a one-to-one support system for all SMEs;
Follow a bottom-up approach to accommodate the development needs of the industry;
The successful implementation of the role of an “integrator” championed by the OCD management;
The existence and implementation of a strategy for the further continuous development of the network and the industry

**Table 14: The qualities of a network management organization according to Offshore Centre Innovation Network organiser in Denmark**

It is important for the programme to take explicit steps to raise awareness among the business community and communicate the potential benefits and services that are available. For the IPC programme an important role is played by sector organisations that signpost their members in the direction of the programme. Nearly half of the SMEs participating in IPC have arrived through this route. The Peak Innovation implementation of VINNVÄXT takes a more direct approach. Considerable effort has been expended in communicating the benefits of the network. During the last three years around 500 presentations, seminars, and individual meetings were held to raise awareness of the initiative and attract support. The programme also works hard to maintain a high profile media and web presence. These types of activities are important for drawing new players into the network, without which there is the danger of stagnation.

There are two important lessons from this. Firstly, the more *SMEs feel that they have a stake* in the project and a sense that they are able to shape their destiny, the more the programme is likely to be adapted to their needs. However, it is not always possible for SMEs to be in the driving seat for network-based projects, particularly where there are large and complex consortia. The second lesson is therefore to ensure that *SMEs have sufficient voice* so that they can at least have some influence over the support process. The difference between the projects driven by the PSR and large enterprise is that in the case of the former the SME was largely disengaged from the consortium, while in the latter there were regular interactions between all the partners that allowed for the different interests and priorities to be negotiated. The network coordinator has an important role to play here in ensuring that such dialogue takes place.

There are, of course, major challenges for SMEs to get their voice heard in KTT networks. Compared to larger players, such as PSR or large enterprises, SMEs tend to have much lower levels of individual influence because of their size and more limited resources. One way of counteracting this is to provide SMEs with *a collective voice*, either through industry organisations and similar institutions, or through a *designated champion*. The Peak Innovation programme provides SMEs with a coordinated collective voice in the form of Peak Business and Sports AB which has influence on the governance of the network. Meanwhile, in the OCD implementation of the Industrial Networks programme, SMEs definitely has a strong champion in the director of the network who is able to ensure that their needs are not ignored.

Negotiating needs and priorities is crucial in this respect. Network participants, such as SMEs, large firms, PSR, and government have different cultures, needs, and priorities. These need to be acknowledged and taken into account in any collaboration. For this to be successful agreements need to be negotiated between the partners about roles and responsibilities and how costs and benefits are shared. Here network coordinators are able to serve an important function as neutral arbitrators, helping the different parties to come to an agreement and find common ground.

## 6 Strategic Crossroads

### 6.1 Business or Technological Strategic View?

Nevertheless programmes emphasise the value of developing a strategic view of the developing innovation. In particular, two patterns have been identified to support the development of a strategic view:

- i. help the company to develop a *business strategic view of the innovation*
- ii. help the company to develop a *technological strategic view of the innovation*

RIS and PlatInn have developed a multiple-services package to help SMEs develop a business strategic view (Table 15). RIS has developed a special package of services to help SMEs to develop a business strategic view (Table 16).

<i>Focus</i>	<i>Description</i>
Strategy	Building Innovation Capacity: Strategy Workshops. The service consists of a series of workshops. However, it is upon the company to decide which routes take and how fast to proceed.
New Ideas	Creativity sessions use proven methodology that helps enterprises to generate new ideas around existing or new products, processes or markets. The methodology helps to look at business organization from a point of current or future business trends.
Evaluation of New Ideas	The "opener" is a questionnaire by which the quality of an idea for innovation is improved by pre-assessing on four axes.
Process Innovation	The Innovation Audit measures the innovation capability of production-oriented SMEs. It is based on an interview that takes 2 hours, and uses 49 innovation management best practices help define possible routes for improvement. Innovation advisers in the later stages of innovation audit help company to develop innovation plans for change.

**Table 15: RIS supporting SME to develop a business strategic view**

<i>Focus</i>	<i>Description</i>
Service Strategy Development	The business strategy in relation to the considering innovation
Service Context Analysis	Business model, service ecology
Service Idea Generation	Product / service life cycle analysis, stakeholder value map, customer activity chain / job mapping
Service Design	Service blueprint, business model, customer journey mapping
Service Development	Implementation of developed service innovation

**Table 16: RIS Services on the opportunities of innovation in services**

RTD focuses more on the strategic view from a technological perspective, offering services towards the identification of the strategic technological needs and a preliminary feasibility and testing study (Table 17). RTD involves the targeted PSR institution at this stage, encouraging both parties to describe objectives, expected results and planned activities as clearly as possible.

<i>Focus</i>	<i>Description</i>
Identify Technological Innovation Needs	At the early stages of innovation projects, RDT raises awareness about different subjects, such as introduction of new technologies, information management, etc. If a company shows interest in engaging in RDT, a technological consultant visits the entrepreneur on-site in order to support and stimulate the company free of charge to identify, formalise, validate and prioritise its technological innovation needs.
Technology Network Service	A service prescribed to a company by a network agent to be used for technical pre-studies, feasibility studies, testing, modelling, product specification, state-of-the-art research, market analysis or for consultancy on IPR issues.

**Table 17: RTD supporting SME to develop a technological strategic view**

In network-based programmes the majority of firms draw to some extent on a combination of both specialised technical knowledge and business support. SMEs in network-based programmes take advantage of a mixture of technical and business support, and this is reflected in the type of innovation outcomes they achieved. Nevertheless, the emphasis between the two broad types of support does vary between the programmes broadly. Thus, VINNVÄXT, whose beneficiaries are typically LAC SMEs, has a relatively stronger emphasis on business support than technical input, although the latter is by no means absent.

An interesting point worth noting is that despite the mixed nature of support received, the competence and role of PSR in these programmes is predominantly technically-focused. However, this does not necessarily mean there is a mismatch between the capabilities of the knowledge provider and the needs of the SMEs. One of the strengths of the network programmes we investigated is that they have the potential to allow for knowledge to come from a range of providers, which may or may not be PSRs. This in turn means that there is scope for a division of labour whereby different knowledge providers are able to offer specialist input depending on their expertise. By configuring the combinations of knowledge that they draw on, firms are therefore potentially able to shape their network to meet their needs. PSRs may not be the most appropriate source of support for business, market, or organisational innovation. Indeed, in our examples, this type of support is generally provided by other firms (e.g. Innovation Networks), or by dedicated agents, such as the network coordinators and Öppen Dörr consultants in VINNVÄXT or the programme secretaries in IPC. Nevertheless, there were suggestions from many of the firms participating across all of the network programmes that PSR could do more to increase their awareness of business and commercial issues and challenges instead of concentrating purely on their own scientific and technical agendas.

Table 18 provides further detail on the types of knowledge and activities drawn upon by the case study SMEs. It also outlines the extent to which these knowledge types and activities are customised or modified according to the specific needs of the companies and, related to this, the degree to which the knowledge is co-produced by the firm in interaction with the knowledge providers. At one end of the spectrum the PSR provides ready-packaged technical data and information that the firm is able to use to support its innovation activities without extensive modification. This also means that the

SME and the knowledge provider do not need to enter into extensive ongoing interaction in order to shape and refine the knowledge according to the firm's needs. One of the SME case studies in the Innovation Networks programme were closer to this position, essentially drawing on established knowledge provided by PSRs. However, in the case of the former, the SME did complain that the level of interaction with other consortium members was not as high as it had hoped, suggesting that the scope for co-production in this instance was much greater. At the other end of the spectrum are co-development projects where the PSR and SME work together to develop innovations, each contributing to the knowledge produced.

This often takes place either through transfer of personnel or through the creation of joint development teams. Two of the SME cases from the IPC programme fell into this category, both of which were involved in joint software development projects with universities. Overall, the majority of examples involved either medium or high levels of customisation and co-production. An important implication of this is that in order to support the intensive and ongoing interactions needed to sustain the joint production of knowledge network-based programmes need to have a time horizon that is long enough to allow such relationships to mature and reap benefits. There are doubts in the case of IPC that this is fully the case and an argument to be made that the two examples of joint software development emerged in spite of rather than because of the programme. This is because the level of funding and rules of participation actually favour short-term interactions where the PSR is expected to transfer already developed knowledge or technology instead of entering into longer term co-development relationships.

Programme	SME	Focus of KTT	Knowledge types and activities	Level of customisation	Level of co-production
<i>IPC</i>	1	Process innovation, organisational innovation	Process technology, testing, business planning	Low/medium	Low
	2	Product innovation	Software development, specialist medical knowledge, personnel transfer	High	High
	3	Product innovation	Software development, testing-validation, training	High	High
<i>Innovation Networks</i>	4	Market development, product innovation, process innovation	Experience sharing, network contacts, access to external research	Low	Low
	5	Market innovation	Experience sharing, project management systems and approaches, specialist knowledge on oil and gas sector, personnel placement	Low/medium	Low/medium
	6	Market development, process innovation	Experience sharing, technical development projects	Medium	Medium
<i>VINNVÄXT</i>	7	Product innovation, market innovation	Product testing, access to technical personnel, strategy development	Medium	Medium
	8	Product, market & organisational innovation	Product testing, access to technical personnel, network contacts, market knowledge	Medium/high	High
	9	Product innovation, market innovation	Product development, market testing	Medium	Medium

**Table 18: The influence of knowledge types and activities**

## 6.2 Knowledge providers: Strategic alliances, Matchmaking or Open access?

Some programmes form a *strategic alliance with a network of knowledge providers* in order to provide to the agents an infrastructure for easing the access to sources of knowledge (or technology). The search is much easier because it takes place within the pre-defined boundaries of the selected alliance. Moreover the agent has the opportunity to deepen over time the understanding of the competencies of various knowledge providers, so identifying the right research partner becomes a much more efficient process. In fact the identification of a knowledge provider becomes so much easier if the infrastructure is already there that some beneficiary SMEs (in RIS) had identified the knowledge provider before they started engaging with the programme.

Two patterns were identified on the basis of *the research capability of the organisations or networks* that form the strategic alliance with the programme. In the case of the RDT programme, it has formed a strategic alliance with a network of organisations called CRITT (Regional Centres for Innovation and Transfer of Technology) which were established in France in 1980s. Although officially these centres are research establishments, in reality they act more as research results disseminators rather than centres with a high-level scientific capability (Table 19). Obviously the underpinning rationale is that the dissemination of research results is good enough for SME of LAC. To avoid 'deadlock' situations, where the CRITT in a particular region do not have the required competences, a database has been developed to enable RDT implementors to access the whole network of CRITT across the country.

In the case of RDT, a formal agreement was not signed and the alliance took place on a basis of verbal commitment and enacted engagement. The collaboration between the RTD programme and the CRITT, an informal type of agreement, works well because it is based on the convergence of their strategic objectives. RTD gets an effective and quick access to knowledge sources while CRITT get an opportunity to valorise their research products; both have the opportunity to justify the public funding as a result of this alliance.

CRITT were created in the eighties by the French Ministry of Higher Education and Research. These structures are dedicated to the regional transfer and diffusion of technologies to traditional SMEs, which are rather unfamiliar with R&D, in order to enable them to develop their innovation potential. Approximately 200 CRITT exist today in France. In 2007, three new official labels introduced for the CRITTs: CRT = Centres of Technological Resources, CDT = Centres of Technological Dissemination and PFT = Technology Platforms. While universities concentrate on research, CRITTs are designed to promote their research results by collaborating with industry.

CRITT organisations are specific to France, and are not directly related to the RDT programme, but they are essential for the SME support and KTT activities in the framework of RDT. The CRITT offer technological expertise while they can also act as innovation consultants and programme interface at the same time. The research partner of an SME in RDT does not have to be a CRITT – it can be any PSR institution, in France or abroad. However, the latter is rather rare. CRITT are far more often the knowledge

provider partners than universities: from all projects where the knowledge provider was a PSR, 72% were CRITT in contrast to 28% which were public universities.

There are some areas where the agent immediately knows which CRITT organisation has the necessary technical competence to respond to the firm's needs. If the agent does not know an appropriate CRITT partner, the database of all CRITTs and other knowledge providers is addressed.

### **Table 19: The strategic alliance of the RDT programme with CRITT**

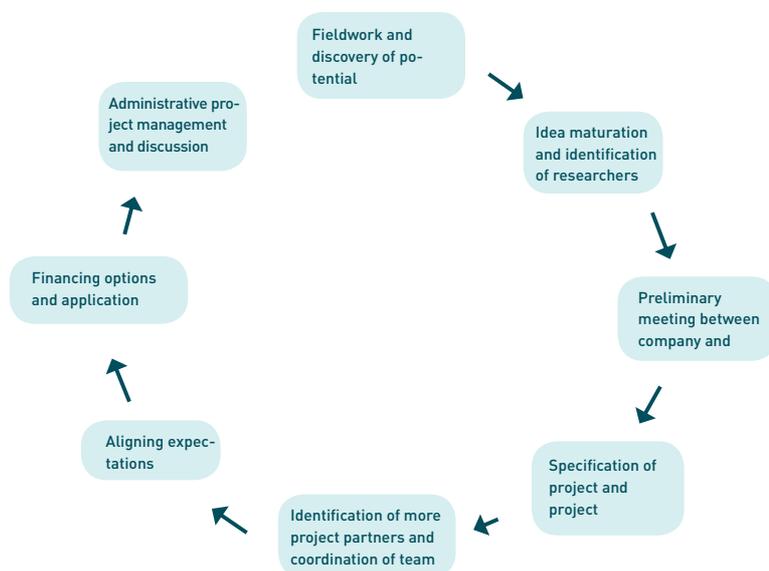
Overall forming a strategic alliance of knowledge providers makes the process much more convenient for the involved agents while the overheads of searching are minimised for programme (the cost of searching becomes lower as the search is repeated within the same network). However this requires the existence of a fund to support the knowledge provider for these activities (national government in the case of RDT). A potential limitation of this strategy is the (natural) tendency of agents to find a knowledge provider within the network of the strategic alliance, even if the search outside the network is allowed.

Left to their own devices, SMEs that have reached the point where they are motivated to participate in a KTT network are not necessarily going to have the time, resources, or knowledge to connect with a knowledge provider that is able to satisfy their innovation needs. Unless they have extensive experience of cooperating with universities they are unlikely to have a well-developed network of contacts in the world of research. This is where network intermediaries who span the boundaries between business and PSR have a crucial role to play. Having knowledge both of the specific needs of SMEs and the landscape of research expertise means that they are able to find and connect appropriate partners from both sides. How effective this matchmaking is depends on the depth of knowledge and experience of the network intermediary.

In the IPC programme, the role of matchmaker is undertaken by the programme secretaries. These are usually *people with extensive industry and technical knowledge, as well as contacts with knowledge providers*. The degree to which they are able to match the needs of firms with appropriate sources of knowledge thus depends to a large extent on the individual characteristics of each secretary. This means that the recruitment and selection of high quality secretaries is of crucial importance. Some of the secretaries complained that they received little systematic support and were largely on their own.

The OCD implementation of the Innovation Networks programme has developed a range of *matchmaking services* (Table 20) including an international directory of research expertise. This functions as a tool both for network employees and for companies and researchers requiring access to information about suitable partners. The searchable database contains information about researchers, expertise, skills and equipment at universities and other knowledge institutions as well as the same kind of information for all the companies that are part of their network. However, it is obviously a challenge to maintain such a database so that it is up-to-date. It is also needs to be considered as complementary to,

rather than a replacement for, personal contacts. It can signpost companies in the right direction for appropriate research that meets their technical requirements, but it is difficult to include information in such databases about the social dimensions upon which a productive collaboration needs to be built.



**Table 20: Matchmaking services in OCD Innovation Network in Denmark**

An important topic in the relevant agenda is the opportunity for matchmakers to meet and exchange knowledge in order to enhance their own skills and create more connection opportunities for the SEMs they support. In IPC, it was acknowledged that there is *clear scope for more knowledge exchange between secretaries* to expand the pool of available expertise and ensure that the system is not entirely dependent on the personal knowledge of individuals.

A good example of this is the start-up firm Marsblade AB established in the latter part of 2010. It was founded by Per Mårs and Hans Victor. Per Mårs is a former professional ice hockey player who played for Brynäs IF in Sweden and was recruited by the Columbus Blue Jackets in the National Hockey League in the USA. The company is in the process of developing a new technology for summer training skates. The concept is to adapt the design of inline skates or rollerblades to make them closer in feel to that of ice skates. However, having come up with the idea, Per Mårs did not know how to develop it further. Hans Victor provided the necessary business expertise to begin commercialising the concept. He has a background as a business angel and company founder for a number of sports-related ventures. The company turned to Peak Innovation for support in the following areas:

- Access to research expertise – the company has benefited from being put in contact with researchers at Mid Sweden University. In particular, it has worked with Sportstech on developing and testing working prototypes of the technology.

- Access to research personnel – Peak Innovation has funded a half time research technician to conduct durability testing on the product. The other half of his time is spent working on university activities.
- Access to funding – Marsblade has received assistance from Soft Financing AB in writing applications for funding from non-private equity sources. Hans Victor has a lot of experience in securing private venture capital, but less knowledge of how to apply for soft finance. Peak Innovation fills this gap in the company's expertise.
- Access to business networks – as a shareholder of Peak Business and Sports AB, the company has access to a network that can help them connect with other people in the industry.
- Access to public relations and marketing resources – Peak Innovation has an effective public relations operation and Marsblade has benefited from being mentioned in publications and by Peak Innovation personnel in the numerous meetings and seminars. The programme has also helped the company to prepare press releases. These activities have contributed to building brand awareness for Marsblade produce range.

Together these activities have helped to move the company from a start-up with a promising product idea to a potentially viable company with a fully developed product on the verge of commercialisation. The programme has supported the company through the different stages of this process, adapting the support offered according to its evolving needs.

Instead of the strategic alliance or matchmaking with knowledge providers, some programmes have chosen more open access arrangements where the engaging SME is allowed more freedom to identify the right knowledge provider. In this case the strategy is to provide some support during the process of searching for a research partner, rather than a pre-prepared infrastructure of knowledge providers.

PlatInn has adopted a more *arm length's approach in terms of finding the right research partner* for the engaging SME. The PlatInn programme does not try in an active way to identify the right research partner. Instead the programme agents deliver to beneficiary SMEs, a coaching service to help them identify the appropriate profile of a partner, 'train' them on the principles of partnerships and collaborations and enable them to develop a research partnership themselves (Table 21).

*Coaching service Cooperation - Development of partnerships and collaborations*

1. Business innovation: Analyzing business innovation potential
2. Strategic partnering: Defining partnering strategy, identifying strategic partners and funding sources
3. Project design: Developing collaboration projects (structure, governance, IP, financing, risk)
4. Contract: Negotiating partnership contracts

## Table 21: PlatInn's Coaching Service on Partnerships and Collaborations

The RIS model gives more responsibility to the agent for the identification of a research partner compared to PlatInn where the main responsibility lies with the SME. In the RIS model, the agent is set to function as “navigator” of the regional, national and international system of innovation. In contrast in the PlatInn model the agent aspires to become *an enabler of the SME partnerships* development without any active support to the task of identifying the right research partner.

This strategy allows the beneficiary SME to explore a much wider range of possibilities for engaging with a PSR organisation. The strength of this strategy is that it allows a lot of freedom to the SME without burdening the programme with the overhead of identifying a research partner (searching comes at a much lower cost compared to the identification of a research partner). However this strategy comes with some limitations. According to the evidence acquired in the RIS programme, the freedom to choose a research partner may end up with a research centre which is very strong but very expensive (contract research organisations tend to belong to this category). Moreover, especially for the programmes that encourage the SMEs to be in the driving seat, the search may suffer a reduced quality since SMEs have the tendency to define their search in very broad terms. A potential risk of this strategy is that the SME gives up on the search because it is unable to find the right research partner in a relative efficient way.

### 6.3 Active Intermediation or Project Management?

A range of different intermediation strategies has been identified, ranging from more active intermediation to no intermediation at all. Firstly in the RIS programme, the agents make an *active contribution* in “finding an equilibrium between the interests of the PSR and SME”. According to the programme implementor such equilibrium is “difficult and necessary” while he accepts that the agent has a “small but critical” role to play. The agents undertake the role of mediator in the communication between the beneficiaries SME and the PSR, especially in issues where there is a rising tension between the two parties. This practice is supported by the recruitment of agents who have some specialisation in the fields of the transferred knowledge or technology (e.g. ICT focused agents or agents with some knowledge of biotechnology). Agents make very valuable contributions to the communication channel between the beneficiary SME and the PSR. The challenge these programmes face is “balancing the quest for impact with the broad coverage of clients (10,000 clients)”.

A second intermediation strategy for agents focuses on providing primarily a *project management service* to the interacting parties, enriched with a little amount of intermediation. The programme implementor in RTD goes as far to claim that

*Interestingly, even SMEs that are clearly not in for the money, profit ... through the structure and the milestones it provides.*

Beyond providing structure and milestones for the project, the agent is also responsible for “bringing together the SME with the knowledge provider”<sup>7</sup>, supplying a *little amount of intermediation*. For instance the agent in RTD is in charge of the project, staying in contact with the firm and the knowledge provider, having common meetings with them and making sure that everything runs smoothly.

Finally, a third pattern of intermediation is provided by the PlatInn programme where the company becomes in charge of the communication with the PSR with the agent making *minimal intervention* (if any) to the process of communication.

#### 6.4 Commercial Exploitation: Moral support or active introductions?

The predominant model in LAC programmes is to provide limited support to SMEs once they enter the commercialisation phase. In the RIS programme, the agents visit the SME which had been receiving support from the programme to see if further support is needed. Depending on the needs, the agent has been instructed to *refer to other parts* of the Innovation Network, government agencies such as Enterprise Agency and FIT. Similarly the RTD is clear that the “the cost for following-up activities are covered by the company and not by the project”. For instance, for IPR issues the enterprises are directed to INPI.

##### *Coaching service 4: Research of Financing (fund raising support)*

- Elaboration of financing strategy
- Preparation of documents and presentations for investors
- Access to a large network of investors and private and public sources of financing
- Negotiation with investors for fund raising

#### **Table 22: A new PlatInn service for commercial fund raising**

The contribution of the programmes at this stage is centred more on *moral support and “listening and understanding”*<sup>8</sup>. In some cases, the programme may refer the SME to business partners or (other) funders but this tends to be an *ad hoc* service, taking place rather irregularly. There was evidence from one SME in the RIS programme that the agent accepted to “play a role of “devils’ advocate” in this phase, helping the SME to “identify the ‘you don’t know what you don’t know’ and risks in the plans”<sup>9</sup>, an ad hoc service offered by the programme.

#### 6.5 Regional specialisation or International expertise?

In the RIS programme, once the agent exhausts the possibilities of finding a research partner within the region, he/she starts looking for a research partner outside the region. In fact the programme has made an *agreement with two organisations which are specialising on search* of research partners. One of these organisations is responsible for search within the national boundaries while the

<sup>7</sup> Interview information with programme implementor

<sup>8</sup> Interview information from SMEs in the RIS programme.

<sup>9</sup> Interview information from SMEs in the RIS programme.

other is providing a search service for research partners abroad. This practice is closer to the latest trend of the open innovation paradigm and the search and match intermediaries that have emerged in the commercial world.

All of the network-based programmes investigated are organised around some form of specialisation in terms of regional clustering, industry sector, or technological focus. This specific focus provides the network with the foundation for building long-term synergies between the different participants (industry, universities, government and other institutions). Having a strong and clear focus for the network means that those taking part are predisposed to have certain interests in common. As such there is already likely to be some degree of fit between the different participants. In the case of Peak Innovation, for example, the concentration of outdoor and sporting activities in the region was already reflected in the types of specialist research that had grown up at Mid-Sweden University (Table 23).

A shared focus for the network also has the potential to create a *collective learning environment* where the various collaborating parties are able to *tailor their resources, activities, and behaviours* to align them more closely with those of their partners. Similar to the situation for agent-supported programmes, strategic alliances between the members of the network not only simplify the process of searching for suitable partners, they also provide a longer time horizon that allows for reciprocal adjustment between those involved. Thus, although it is advantageous for knowledge providers to have the necessary subject expertise to meet the SMEs' specific innovation needs from the outset, it is also important that what they have to offer is continuously refined and renewed as they develop their capabilities of working with industry.

<b>ETOUR</b>
This centre is involved in research and teaching in the area of tourism and destination management. This centred around a model for needs-driven research which seeks to engage businesses, customers and other stakeholders. A good example is the Peak Experiences project: the idea has been to build up a more detailed understanding of the different needs of visitors to the region and to use this to help focus business development activities.
<b>Swedish Winter Sports Research Centre (SWSRC)</b>
This centre engages in research and development relating to elite sports, physical activity and health. It is internationally recognised for its role in ski research and has close links with the Swedish Olympic Committee. Its involvement in Peak Innovation covers three main priority areas: 1) establishment of a laboratory for product development and manufacturing of prototypes; 2) building closer links between academia, business, the public sector, and the sports movement, which in practice means being flexible in responding to the variety of requests for collaboration that have come from sports and industry; and 3) the Swedish Winter Sports Centre Åre, an alpine research and testing centre focusing on field based analysis of biomechanical movement and the optimisation of sporting techniques and training.
<b>Sportstech</b>
Established in 2004, this centre focuses on research and education in technology related to sports and outdoor recreation. It collaborates closely with companies in the

sports and outdoor industries, both through R&D projects and through student placements and dissertations.

### **Table 23: Research centres closely involved in Peak Innovation**

Some of the most important barriers we identified in the case studies are about differences in perspectives and priorities between different participants in the network. In particular, *differences in culture and time-scales* between business and PSR were explicitly mentioned as problems by interview respondents for Innovation Networks, IPC, and VINNVÄXT. One of the SME managers interviewed for the Peak Innovation/VINNVÄXT case study suggested that universities run at a different pace and with different priorities. The researchers are interested in writing articles, not developing products, he suggested. He went on to argue that for the company's purposes it is usually adequate to have the 90% results that take 10% of effort to achieve. The university, in contrast, typically continues to spend another 90% of effort to make the results really rigorous, but only contributing another 10% to their usefulness for the company. This was seen as source of some conflict.

However, the SME in this case still felt that they benefited from the relationship, not least because both parties maintained a continuous dialogue that allowed their differences to be surfaced and addressed. Providing the *environment for a longer term set of interactions* between universities and firms thus offers the potential to reach some sort of accommodation between them where these competing priorities can be tackled. This is not to say that competing priorities disappear because the driving forces for firms and PSR are clearly not the same. However, it does mean that the different activities and interests can be aligned more closely so that at least it is possible for the partners to work together.

The issues covered so far are mostly about the *internal focus of the network*. Specialisation provides the glue that binds each network together. It generates shared interests and activities that encourage participants to collaborate. This is important because it provides the motivation for members to interact and learn from each other. However, there is an extensive body of research that cautions against an excessive emphasis on inward-focused activities (Solvell, 2009). While there are clear advantages to building upon existing network relationships in terms of reciprocal learning and trust, there are also downsides to such continuity. In particular, the closer the network the more likely those involved will ignore potentially useful knowledge and interactions from outside the sphere of normal interactions. Consequently, there is an important role for those managing KTT networks in encouraging *new connections beyond the usual horizon of the network*.

The risk of being too inward looking was raised during the mid-term evaluation of the Peak Innovation network. In response to this the network implementers have attempted to reorient their strategy to encompass more outward-facing activities. For example, there have been purposeful attempts to promote *contacts with other similar sporting or 'experience-based' regions* such as Chamonix in France, Veneto in Italy, Lillehammer in Norway, Ruhpolding in

Germany, and Manchester in the UK. It has also invested a lot of effort in enhancing its external profile, partly through the help of brand consultants. There have also been attempts to *connect with other PSR institutions outside the region*, both within Sweden and elsewhere. This is based on the recognition that even though the research centres at Mid-Sweden University are international centres of excellence in their fields, the most appropriate knowledge may not always be available locally.

## 7 Conclusions

Firstly the KTT analysis and practice should open up their horizons to extend beyond the usual themes and stakeholders. For a start, in addition to high-tech and high absorptive capacity SMEs, the *KTT policy needs to support SMEs of lower capabilities which may have an innovation potential*. In fact the policy practice was found more advanced in this area than the academic discussion and research. A number of KTT programmes have been developed the last years in different European countries to address the SMEs of lower absorptive capacity and help them to raise their innovation game.

Secondly KTT analysis and practice should also adopt a *more comprehensive approach*, addressing thoroughly not only the formal objectives and the design of a support programme but also the *actual reality of these programmes* in terms of the activities taking place on the ground, the actual participants etc. The orientation of their design should be in congruence with the orientation of the implementation while the management and evaluation aspects must be thoroughly addressed.

Thirdly the KTT analysis and practice need to look widely into *various models and strategies of KTT*, the pros and cons of each model and more profoundly the circumstances that each model is appropriate for. Agent-supported and network-based programmes were found more helpful with SMEs of LAC: The agent-supported and network-based programmes have the greatest potential for behaviour change and innovation in SMEs.

## 8 References

EURAB (2004). "Small and medium enterprises and the European research area, European Research Advisory Board."