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Service stations along global knowledge pipelines

*On innovation intermediaries' function in
fostering globalized innovation processes*



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by

Emily Wise

DOCTORAL DISSERTATION

By due permission of the Faculty of Economics and Management,
Lund University, Sweden.

To be defended in room EC3:207, Holger Crafoords Ekonomisentrum,
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Title and subtitle: Service stations along global knowledge pipelines - on innovation intermediaries' function in fostering globalized innovation processes		
<p>Abstract</p> <p>Innovation is an interactive learning process that is facilitated naturally by geographic proximity. Innovation intermediaries can serve as an extra catalyst to and facilitator of interaction and collaboration. With today's more globalized knowledge and innovation landscape, companies and research organizations seek complementary competencies and partners with whom they can collaborate on a much broader geographical scale. Although linkages with other actors internationally can offer related knowledge to help secure continuous dynamism and long-term competitiveness, engaging in internationally-collaborative innovation processes requires conscious efforts and capabilities. Innovation actors – particularly small companies – may lack the internal capacity or network connections to pursue international innovation activities. Such barriers may prevent or limit the effectiveness of their engagement in international innovation processes.</p> <p>Within the field of innovation policy, one of the current issues is how policymakers can address actors' barriers to the internationalization of innovation – helping to catalyze increased (and more efficient) international knowledge sourcing and collaboration. If innovation processes are increasingly transnational, how are public policies designed to facilitate cross-border interaction? Could innovation intermediaries be leveraged in this regard?</p> <p>Existing literature focuses on the role that innovation intermediaries (cluster organizations or similar) have in facilitating interactive learning and knowledge creation within a particular local innovation node or national geography. There is relatively less written about innovation intermediaries' role in facilitating <i>international</i> interactive learning processes. This thesis aims to improve understanding of how innovation intermediaries foster firms' and research organizations' transnational innovation processes – facilitating learning and serving as an input for future policy development in this area.</p> <p>This thesis uses a case study approach to investigate factors driving innovation actors' need for intermediary support, and support functions innovation intermediaries fulfill in relation to these needs. 59 innovation actors (i.e. research organizations, large/medium companies, and small companies) and 14 innovation intermediaries – grouped in five transnational innovation networks – were the objects of study in the StarDust project case. Data was collected through interviews, surveys and participant observation over the course of the three-year project.</p> <p>Results highlight three key conclusions. First, transnational innovation processes drive a relatively stronger demand for external support to bringing dispersed knowledge sources together in collaborative development of innovative solutions. Second, innovation actors' differentiated interests in external support imply a need for tailored support functions, and highlight the possibilities for leveraging the system in support delivery. Third, research results point to the expanding role that innovation intermediaries take on to foster globalized innovation processes – without necessarily having corresponding mandates or skills.</p> <p>These findings contribute to the research field by providing more detailed insights on the type of intermediary support functions that may be useful in internationally-interdependent innovation processes, and by providing a comparative perspective of different innovation actors' support needs in relation to the services provided by innovation intermediaries. The research helps take a first step to substantiating the role that innovation intermediaries could play in strengthening international linkages in research and innovation activities – contributing to ongoing policy development in this area.</p>		
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Date 25 March 2014

Service stations along global knowledge pipelines

*On innovation intermediaries' function in
fostering globalized innovation processes*

Emily Wise

Research Policy Institute

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Lomma, 7 March 2014

Emily

List of Abbreviations and Glossary

BSR – Baltic Sea Region

Cluster actors – firms, research organizations and other related organizations that interact/collaborate in knowledge development, transfer and commercialization activities

Cluster initiative – an organized effort to increase the growth and competitiveness of a cluster within a region, involving cluster firms, government and/or the research community (Sölvell *et al.* 2003)

Cluster organization – specialized institutions (that manage cluster initiatives) which take various forms, ranging from non-profit associations, through public agencies to companies (Commission of the European Communities 2008a: 8); one type of innovation intermediary (see definition below)

CO – cluster organization

Globalization – increasing interdependence between internationally dispersed economic activities (Cantwell and Janne 2000)

Innovation – the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations (OECD 2005)

Innovation actors – in this thesis, innovation actors are defined as research organizations and companies

Innovation intermediary – an organization or body that acts as an agent or broker in any aspect of the innovation process between two or more parties (Howells 2006)

Innovation node – localized grouping of innovation actors; in this thesis, an innovation node can be a research milieu, cluster initiative, or group of SMEs

Internationalization – the process of increasing involvement in international operations across borders (Welch and Luostarinen 1988)

Transnational innovation network – knowledge transfer and other links between firms and other actors in a local/regional innovation system, with other actors embedded in regional innovation systems in other countries (Coe and Bunnell 2003)

1. Introduction

1.1. Setting the Scene

Studies of innovation and innovation systems have highlighted the importance of networking, cooperation and learning by interaction as necessary elements of successful innovation strategies (Freeman 1991, Lundvall 2001, Prahalad and Krishnan 2008). Interaction between various actor groups (e.g. firms, research organizations and users) is naturally enabled by geographic proximity. Geographical proximity provides exposure and ease of communication – enabling exchange of tacit knowledge and development of absorptive capacity. Geographical proximity also provides opportunities for social interaction – strengthening collaboration between dispersed specialized entities. While geographic proximity provides a natural counterforce to the complexities of the innovation process, proactive facilitation of interaction – through various types of innovation intermediaries – can enable stronger collaboration and catalyze innovation processes (see, for example, Edquist and Johnson 1992, Bessant and Rush 1995, Howells 2006, and Stewart and Hyysalo 2008). In this thesis, innovation intermediaries are defined as organizations or bodies that act as an agent in any aspect of the innovation process between two or more parties (Howells 2006).

The last decades have been characterized by an increasingly *globalized*¹ landscape for knowledge and innovation. Factors such as increased international mobility of individuals, more efficient and easier access to communication platforms, a geographic shift in the center of gravity of knowledge and innovation resources, new forms of collaboration and firm strategies for competitive advantage, and

¹ Globalization is defined as the increasing interdependence between internationally dispersed economic activities (Cantwell and Janne 2000).

the global nature of societal challenges have all contributed to this. The internationalization² of innovation is viewed as important not only for exploiting knowledge in new markets through e.g. exports, but also for accessing international sources of knowledge and developing interactive learning processes with international partners. International knowledge sourcing and collaboration contribute to strengthened innovation processes (Amin and Cohendet 1999, Asheim *et al.* 2011, Fitjar and Rodríguez-Pose 2011), and more attractive and competitive international positions (Chen and Chen 1998, Wilkinson *et al.* 2000).

In transnational innovation networks³, firms and other innovation actors have strengthened opportunities to access complementary knowledge located elsewhere and to respond to new market needs through collaboration with international partners. This helps to enrich their own capacities and inspire new ideas, ensure continuous dynamism (and avoid path dependencies), and enable the development of more differentiated and competitive solutions – which can strengthen performance and support longer-term competitive advantage. Despite the many potential benefits of linking local innovation nodes to global knowledge pipelines (Bathelt *et al.* 2004), the geographic dispersion of knowledge sources and collaboration partners makes the interactive learning process increasingly complex. Innovation actors need capabilities for identifying relevant international opportunities, accessing complementary knowledge located elsewhere, melding dispersed knowledge sources into collaborative innovation processes, and developing and operationalizing integrated solutions (Doz *et al.* 2001). Innovation actors – particularly small companies – may lack the internal capacity or network connections to pursue international innovation activities (OECD 2009a). Such barriers may prevent or limit the effectiveness of innovation actors' engagement in international innovation processes. The limited effectiveness of and low engagement in international innovation activities are among the problems that are addressed by innovation policy.

² Internationalization is defined as the process of increasing involvement in international operations across borders (Welch and Luostarinen 1988). The terms globalization and internationalization are used somewhat interchangeably throughout the thesis.

³ “Transnational innovation networks” refers to knowledge transfer and other links between firms and other actors in a local/regional innovation system, with other actors embedded in regional innovation systems in other countries (Coe and Bunnell 2003).

Innovation policy aims at enhancing actors' competencies as well as fostering interactions between them, in order to strengthen the development, transformation and use of knowledge. Just as the innovation process is complex (relying on the capacities of and interactions between different actors), the design and execution of innovation policy is challenging. The policy objectives are complex – often intersecting with other policy areas. The instruments target multiple actor groups (individuals, companies, research organizations, etc.) – often in interaction with each other. And the indicators of success can be quite vague – often using case “stories” and other qualitative measures to provide evidence of progress, as statistics and composite scoreboards do not tell the whole story.

With a more globalized innovation landscape, policymakers place increasing attention on implementing measures to ensure domestic players are attractive partners for international collaboration, support domestic enterprises' ability to take part in international collaborations (particularly small and medium enterprises), and establish relevant infrastructures and institutions to facilitate linkages “at home” and with others internationally (see, for example, Archibugi and Iammarino 1999, Lundvall 2001, and Borrás *et al.* 2009). In addition to the existing challenges of the policy area, the design and execution of instruments to foster interactive learning processes across geographical boundaries and multiple levels of governance certainly adds increased complexity.

Compared to experience with policies to support international trade and investment or international research cooperation, there is relatively less experience with policies to foster new linkages and collaborative innovation processes across borders (INSEAD and WIPO 2012: v). Policy instruments to foster international innovation collaboration can target research organizations and companies directly – through e.g. joint research projects, mobility programmes, and specific collaboration programmes (Boekholt *et al.* 2009). Policy support can also be provided indirectly – using innovation intermediaries to provide e.g. information and brokerage services abroad, access to external infrastructure, and international visibility.

As discussed above, existing literature has established the role of intermediaries in e.g. scanning opportunities and providing intelligence, building network linkages and facilitating interaction, and supporting commercialization activities – all contributing to more effective innovation processes (Howells 2006, Batterink *et al.* 2010). And there are a number of examples of innovation policy programmes (particularly in the area of cluster development) that leverage

intermediaries as an instrument to foster innovation processes and strengthen the effectiveness of (regional) innovation systems (see, for example, Nooteboom 2004, OECD 2009b, OECD 2010, Lindqvist *et al.* 2013). The bulk of existing literature focuses on the role that innovation intermediaries (cluster organizations or similar⁴) have in facilitating interactive learning and knowledge creation *within* a particular cluster/local innovation node or national geography. There is relatively less written about innovation intermediaries' role in facilitating *international* interactive learning processes.

The issue in question is how policymakers can address actors' barriers to the internationalization of innovation – helping to catalyze increased (and more efficient) international knowledge sourcing and collaboration. If innovation processes are increasingly transnational, how are public policies designed to facilitate cross-border interaction? Could innovation intermediaries be leveraged in this regard? If so, what type of intermediary functions best address innovation actors' barriers and support needs?

1.2. Aim and Research Questions

Innovation intermediaries have an established (and academically documented) role in innovation systems – helping companies and research organizations to identify new opportunities, serving as a bridge (and interpreter) between actor groups (including the public sector), as well as brokering and facilitating new collaborative activities. Innovation intermediaries constitute a part of “support infrastructure” within (regional and national) innovation systems.

The changing element is the nature of innovation processes. With a more globalized knowledge and innovation landscape, innovation actors seek complementary competencies and partners with whom they can collaborate in order to develop a stronger “constructed advantage” (Asheim *et al.* 2011) on a much broader geographical scale. Innovation processes have become more open, dispersed and internationally-interdependent – which contributes to additional

⁴ For a more detailed description of cluster organizations, see Sölvell *et al.* (2003), Ketels *et al.* (2006) and Commission of the European Communities (2008a)

complexity. For some innovation actors, the level of complexity can be a barrier – either decreasing their effectiveness, or preventing their engagement altogether. Companies and research organizations may need support.

Given the benefits that international knowledge sourcing and collaboration has been shown to provide, innovation policymakers have an interest in finding ways to decrease the barriers to and increase the effectiveness of international innovation processes. As introduced above, policy support can target a range of objectives. Most examples of policy instruments target universities, research organizations or companies directly. Although “establishing relevant infrastructures and institutions to facilitate linkages” are mentioned as a role for public policy (Archibugi and Iammarino 1999), innovation intermediaries are rarely mentioned. In the discussions on connecting local nodes to global knowledge pipelines, one has to wonder if there is a role for “service stations” ...and if so, what is the purpose of the person at the pump?

The use of innovation intermediaries as an enabler and facilitator of globalized innovation processes is a noticeable trend. It is not clear, however, what role innovation intermediaries play – what functions they fulfill – in these internationally-interdependent innovation processes, nor how they may be leveraged as an instrument of policy.

This thesis aims to improve understanding of how innovation intermediaries foster firms’ and research organizations’ transnational innovation processes. The analytical framework used in this thesis builds on existing theoretical models of metanational capabilities (Doz *et al.* 2001, Doz and Wilson 2012) and innovation intermediary functions (Howells 2006) to answer two research questions:

1. What factors drive companies’ and research actors’ interest in intermediary support to their transnational innovation processes?
2. What functions do innovation intermediaries fulfill to support transnational innovation processes for different actor groups (e.g. small companies, medium/large companies, or research organizations)?

1.3. Research Design and Empirical Object

In this thesis, a case study approach has been used to explore how innovation intermediaries foster firms' and research organizations' transnational innovation processes.

The case study investigates both innovation actors' needs for external support, and the support functions that innovation intermediaries fulfill in relation to these needs. Thus, the case study has two embedded units of analysis: innovation actors and innovation intermediaries.

The case provided the opportunity to study a number of innovation intermediaries who worked actively to support international innovation processes for particular groups of innovation actors (including companies and research organizations). The intermediaries were grouped in five transnational innovation networks, representing different business sectors. Each network was comprised of intermediaries (and their related actors) from several different countries. Although the intermediaries (and their related actors) came from different business sectors and geographies, they were all part of one single (project-constructed) context.

The StarDust project⁵ is the object of this case study. The project aims at strengthening transnational linkages between specialized research and innovation nodes in the Baltic Sea Region. The project is comprised of five transnational innovation networks operating in the fields of well-being and health, clean water, design of living spaces, sustainable transport, and digital business and services. Each of the five networks is made up of a number of local innovation nodes (either clusters or research institutions) with complementary competencies – working together to address a common challenge and shared strategic vision.

The five networks all have an innovation focus. In other words, the aim of each innovation network is to develop a longer-term collaborative partnership that – by combining complementary areas of expertise located in different regional nodes around the Baltic Sea Region – can develop new products, services or

⁵ StarDust was a strategic project (running for three years – 2011-2013) financed within the EU's BSR Programme. In this thesis, references to the case are all in present tense (even though the project has ended).

business models that contribute to addressing societal challenges (with commercial potential). By operating within a “transnationally-interdependent” structure, individual innovation nodes are able to act on opportunities that may otherwise have been “out of reach” if acting alone.

The StarDust case was chosen for several reasons. First, the embedded innovation intermediaries and actors provided an example of the typical goals and internationally-interdependent structures of transnational innovation networks – comparable to global techno-scientific collaborations (Archibugi and Iammarino 1999). It is this type of “globalization of innovation” (where interdependent linkages between actors are key), where there is least policy experience – and thus an area where additional exploration can help advance knowledge and draw lessons for policy development.

Second, the case provided the chance to examine both innovation actors’ support interests and innovation intermediaries’ support responses at the same time. Existing literature typically focuses on either the actors’ barriers to internationalization and support needs, or the role of intermediaries in this process. This case study has enabled a comparative analysis of what needs and support interests innovation actors have, relative to the support functions that innovation intermediaries provide. This provides a new contribution to research in this field.

Finally, the case provided the opportunity to group the embedded units in different constellations (allowing some comparison of support needs and support functions across business sectors).

As an “insider researcher” within the StarDust project, the case also provided me with good access to the two embedded objects of the study (both the innovation intermediaries, and the innovation actors – i.e. companies and research organizations) over the course of the three years. The case study includes data from 14 innovation intermediaries, and 59 innovation actors (11 research organizations, 18 large/medium companies, and 30 small companies).

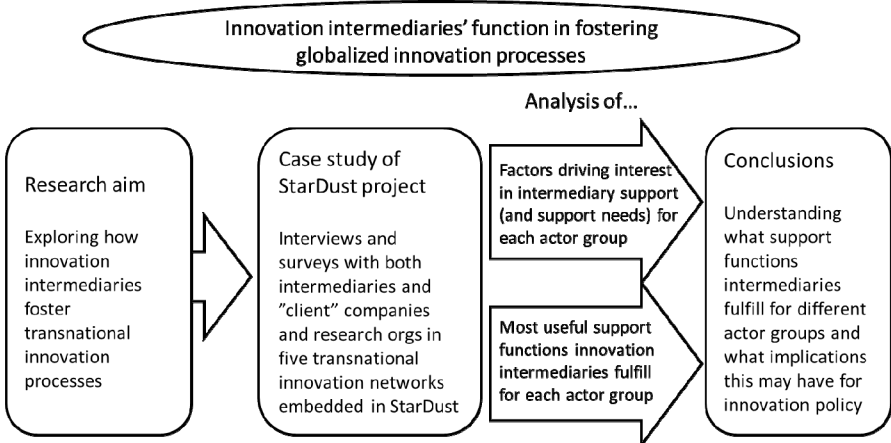
Data on drivers of support needs (of companies and research organizations), and support functions (of innovation intermediaries) was collected through interviews, surveys and participant observation in two main phases. The research involved an iterative analysis of the data collected in both the initial and follow-up phases. The data on innovation actors’ support needs was structured according to three innovation actor groups (i.e. research organizations, large/medium companies, and small companies) and compared to data on the

support functions that innovation intermediaries provided. The analysis of results provides a number of insights on the support interests in most demand across actor groups, on the actor group that has the most need for external support, and on the expanding role that intermediaries take on in relation to international innovation processes.

With a role as an “inside researcher”, the analytical results have not only helped me draw some insights (and new questions) relevant to my personal research interests, but have also been fed into an ongoing policy dialogue (across 10 countries) about alternative approaches and policy instruments to support innovation collaboration across borders.

Figure 1 below provides a summary view of the logic of this thesis.

Figure 1: Scope of the Thesis



1.4. Contribution and Limitations

Within the field of innovation policy in recent years, significant attention has been given to the globalization of research and innovation activities (generally)⁶,

⁶ See, for example: Commission of the European Communities (2007, 2012b and 2012c) and OECD (2008c).

and the benefits of establishing international linkages between clusters (and other specialized research and innovation environments) more specifically.⁷ Clusters and other types collaborative innovation environments can be viewed as “systemic instruments” (Smits and Kuhlmann 2004) – serving as platforms for learning and experimentation, managing interfaces between various actors, and stimulating new forms of interaction (including international linkages). In addition to a prominent position in the innovation policy discourse, the topics of internationalization of research and innovation, and international linkages between clusters and regional innovation systems also figure prominently on the management and academic front.⁸

A common thread in all the policy, management and academic discourse is the benefit of and need for strengthening international linkages in research and innovation activities. Coupled to this, many issues are raised regarding the complexity of managing such interdependent international processes (Doz *et al.* 2001, Doz and Wilson 2012), and the lack of experience/good practice on effective policy instruments for catalyzing and strengthening such globalized innovation processes (Archibugi and Iammarino 1999, Boekholt *et al.* 2009, INSEAD and WIPO 2012).

Current management and academic literature has documented the role that innovation intermediaries play within a regional or national innovation system by providing information, brokering transactions, facilitating collaboration, and helping to find funding for the innovation outcomes of such collaborations (Howells 2006, Kleinbaum and Tushman 2007, Kirkels and Duysters 2010). Yet there is relatively little written on the role that innovation intermediaries play in facilitating international linkages and fostering globalized innovation processes. This thesis contributes to existing theory on functions of innovation intermediaries (Howells 2006) by exploring aspects related to internationalization and network orchestration and outlining a number of specific activities that intermediaries perform to foster globalized innovation processes.

⁷ See, for example: Commission of the European Communities (2008a and 2012a) and Borrás and Haakonsson (2012).

⁸ See, for example: Archibugi and Iammarino (1999), Borrás *et al.* (2009), Carlsson (2006), Doz and Wilson (2012), Edler and Boekholt (2001), Fitjar and Rodríguez-Pose (2011), Howells (1999) and INSEAD and WIPO (2012).

Existing reports on the role that cluster organizations⁹ have in supporting international innovation activities focus primarily on the perspective of the cluster organization – not comparing usefulness of support functions to the needs/demands of the companies and research organizations that they support. This thesis provides a contribution to this type of analysis by presenting a more complete picture – exploring both the support interests and priorities companies and research organizations have for external support, as well as their perspectives on the usefulness of support functions that innovation intermediaries deliver.

By exploring how innovation intermediaries are currently being used to foster international innovation processes in five transnational networks, this thesis aims to provide some new insights on particular support needs of different actor groups, as well as a deeper understanding of the functions that innovation intermediaries fulfil to address these needs. The research results help take a first step to substantiating the role that innovation intermediaries could play in strengthening international linkages in research and innovation activities – contributing to ongoing policy development in this area.

Given the scope of the case study, the research results do not provide insights on the relative success or impact of innovation intermediaries' support, nor does the research provide insights on whether or when innovation intermediaries should be leveraged to support globalized innovation processes. Rather, the main contribution of this thesis is to position innovation intermediaries as an institution or infrastructure that could be leveraged in policy support to globalized innovation processes – a possible way of addressing the “systemic problems” (Chaminade and Edquist 2006) that exist.

1.5. Structure of the Thesis

Following this introductory chapter, chapter two provides an overview of the theoretical points of departure. The chapter is divided into five sections, discussing: innovation, collaboration and the role of intermediaries; globalization and implications on innovation processes; innovating in

⁹ one example of an innovation intermediary

transnational innovation networks; and public policy in relation to international innovation processes. The chapter's final section presents the analytical framework.

Chapter three on research design and methods presents the overall research approach, describes the object of research and the research design, and discusses how the work has been operationalized and how limitations and challenges have been addressed. Chapter four presents the empirical context, including an overview of historical, political and economic linkages in the Baltic Sea Region, an introduction to the EU Strategy for the Baltic Sea Region and the BSR Stars flagship programme, and an overview of the five transnational innovation networks embedded in the StarDust case. Chapter five presents an analysis of the data following the structure of the analytical framework: an analysis of the drivers of innovation actors' external support needs and an analysis of the functions that innovation intermediaries fulfil in relation to these needs. Finally, chapter six concludes with a discussion of the overall findings, their possible implications for innovation policy, and areas for future research.

2. Theoretical Building Blocks and Analytical Framework

The aim of this thesis is to explore how innovation intermediaries foster firms' and research organizations' transnational innovation processes – providing insights on how they may be leveraged in policies aimed at strengthening interaction and innovation linkages internationally.

The thesis draws from theoretical work in a number of areas (innovation systems and innovation management, economic geography, internationalization strategy and business management, and innovation policy) forming five main theoretical propositions. First, innovation intermediaries are a part of the “support infrastructure” of innovation systems – supporting innovation processes by providing information, brokering transactions, and facilitating collaboration. Second, internationalization of innovation (i.e. accessing international sources of knowledge and developing interactive learning processes with international partners) is growing in practice and policy attention as it has been shown to be conducive to more (and more radical) innovation. Third, despite an understanding of the benefits and capabilities needed for globalizing innovation activities, some companies and research organizations experience barriers or challenges that limit their internationalization activities. Fourth, innovation policy plays a role in addressing systemic problems such as a lack of linkages and interactive learning between actors – and may implement measures that strengthen linkages and foster interactive learning processes between actors and between internationally-dispersed innovation nodes. Finally, compared to experience with policies to support exploitation of nationally-produced knowledge or to generate new knowledge in international collaboration, there is relatively less experience with policies to foster transnational innovation processes (i.e. interactive learning processes in geographically-dispersed, internationally-interdependent structures).

This thesis focuses on two main issues that are not explored in detail in existing theory: why innovation actors may need intermediary support for transnational innovation processes, and what functions innovation intermediaries have in transnational innovation processes. Existing theory documents the challenges to and capabilities needed for internationally-interdependent innovation processes – highlighting the importance of strong network linkages. Much existing literature discusses the role that subsidiaries, trade networks, and global value chains play in fostering and making use of these international network linkages. Although empirical observations provide evidence that intermediaries are involved in supporting innovation processes (including international knowledge sourcing and collaborative innovation activities), there is little theoretical debate or empirical studies of the possible need for or use of innovation intermediaries in transnational innovation processes. This thesis explores this topic.

Related to this first issue on why companies and research organizations may have an interest in intermediary support to their transnational innovation processes, is the issue of what functions companies and research organizations may need intermediaries to fulfill. Existing theory (Howells 2006) establishes a general set of functions that innovation intermediaries fulfill to support any aspect of the innovation process. This set of functions was developed based on the context of innovation processes in the United Kingdom. This thesis explores what functions innovation intermediaries fulfill in transnational innovation processes – investigating which functions are most useful (in relation to innovation actors' needs) and further developing the existing theoretical frame.

The discussion of the theoretical building blocks and presentation of the analytical framework is structured in five sections. The first section draws key messages from innovation management and innovation systems theory, describing the complexities of the innovation process, highlighting the role that geographical proximity plays in enabling exchange of tacit knowledge and collaboration, and explaining the role of innovation intermediaries within innovation systems. The second section reviews a number of characteristics of the increased globalization of innovation processes and the resulting changes in strategic approaches and structures for organizing international innovation activities. The third section elaborates on the opportunities and challenges associated with transnational innovation networks, and the capabilities innovation actors need to operate within such internationally-interdependent structures. The fourth section discusses the role of public policy in relation to transnational innovation processes. In the final section of this chapter, the

analytical framework – operationalizing the two main issues introduced above – is presented.

2.1. Innovation, Collaboration and the Role of Intermediaries

Innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations (OECD 2005). The innovation process is based on knowledge that is embodied in people and transformed through interaction and learning – embedded in various systems of innovation. Interaction between various actor groups is naturally enabled by geographic proximity. Proactive facilitation of interaction – through various types of intermediaries – can also enable stronger collaboration and catalyze innovation processes. The following section draws on relevant literature in the areas of evolutionary economics, innovation and knowledge management, innovation systems and economic geography.

2.1.1. Innovation and Systems of Interactive Learning

Schumpeter used the term ‘creative destruction’ to describe the process of innovation, and highlighted that economic growth is driven by continually evolving institutions, entrepreneurs and technological change (Schumpeter 1934, 1942). Studies of the process of technological advancement (i.e. innovation) expanded over time, emphasizing the role that investments in R&D, education and learning processes played on economic growth (see, for example: Arrow 1962; Kuznets 1973; Romer 1986).¹⁰ Innovation has been described as both an evolutionary and socially interdependent process which is built on the transformation of information into knowledge – which, through continuous learning processes within firms and other organizations, later evolve

¹⁰ See Sena 2004 for a useful overview

into goods or services which can be commercialized (see, for example: Nelson and Winter 1982; Lundvall 1985, 1988, 1992; Nelson and Romer 1996).

Various descriptions of the innovation process highlight feedback loops both between firms and other organizations, as well as between different activities (or sub-processes): sensing market opportunities; developing research, scientific and technological knowledge; applying knowledge through invention, development and production processes; and matching the transformed knowledge to market needs through commercialization (see, for example: Kline and Rosenberg 1986; Pavitt 2005; Tidd *et al.* 2005). The continuous and interdependent process of blending knowledge and skills, embodied in a variety of individuals and organizations, makes innovation a complex process. A number of aspects contribute to the complexity. For this dissertation, four overall aspects are highlighted: the type of knowledge involved, the level of specialization of knowledge and economic activities, the absorptive capacity of actors seeking knowledge (e.g. individual entrepreneurs, firms and other organizations), and the nature of interactions between involved actors.

First, the type of knowledge involved can influence the complexity of the innovation process. Knowledge is often described as being one of two different types: codified or tacit. Codified (or explicit) knowledge is possible to articulate (in writing or orally), store and transfer easily. Examples of codified knowledge include dates of historical events, measurements or distances. Tacit knowledge, on the other hand, has been described as “things that we know but cannot tell” (Polanyi 1962, 1966). Tacit knowledge is not easily shared, but is rather learned through experience. These experiences are person-embodied, and are not easily codifiable. Examples of tacit knowledge include the ability to ride a bike or speak a language, as well as the ability to operate complex systems or manage an organization. The degree of tacitness can vary (Howells 1996), affecting learning processes. “The less explicit and codified the tacit know-how is, the more difficult it is for individuals and firms to assimilate it (*ibid.*: 93).”

The second aspect contributing to the complexity of learning and innovation processes is the level of specialization of knowledge and economic activities. Early economists stressed the benefits of specialization through division of labor (Smith 1776) and trade based on the principles of comparative advantage (i.e. producing and exporting those goods for which you have a relatively lower cost of production) (Ricardo 1817). More recent economists have proven the economic benefits of specialization – not based on the principles of comparative advantage from certain given natural advantages, but rather based on the

principle of increasing rates of return associated with the strategic investment in and accumulation of knowledge (Romer 1986). As individuals, firms, and countries make intentional choices to invest in developing certain fields of expertise (through e.g. education and research), this leads to increased capabilities and efficiency in these fields. Such intentional and strategic choices of specialization, taking advantage of unique competencies and strengths in the business environment, have been coined “competitive advantage” (Porter 1990, 1998a). Increasing specialization of knowledge – embodied in both individuals and organizations – leads to more dispersed nodes of knowledge, which firms need to access and integrate in their innovation processes. The management (or guidance) of this process requires a high degree of social interaction, as well as the ability to communicate and work across organizational, disciplinary and professional boundaries (Doz *et al.* 2001, Archibugi and Pietrobelli 2003, Gertler 2003).

The third aspect contributing to the complexity of learning and innovation processes is the absorptive capacity of actors seeking knowledge (e.g. individual entrepreneurs, firms and other organizations). Absorptive capacity has been defined as “the ability to recognize the value of new (external) information, assimilate it, and apply it to commercial ends” (Cohen and Levinthal 1990: 128). Success in absorbing and using new knowledge is based on prior related knowledge and expertise. Prior related knowledge and expertise includes a range of things – from shared language and context, to knowledge of the most recent scientific or technological developments in a field. Thus, actors who have been educated, worked or developed specific competencies within a particular field are well-positioned to take in and use new knowledge from external sources. And, in fact, prior possession of relevant knowledge gives rise to creativity – permitting new associations and linkages that may not have been considered before. On the other hand, those who have little or no prior knowledge are less likely or unable to understand the benefits of and apply external knowledge inputs. Effective communication – both between individuals and within and between firms – also strengthens absorptive capacity. At a minimum, effective communication includes a shared language and symbols. On an organizational level, the importance of individuals who can stand at the interface of either the organization and the outside, or between units within the organization are critical. These “boundary spanners” (Tushman, 1977) are important interpreters of “external” information into forms that are useful.

The fourth aspect contributing to the complexity of learning and innovation processes is the nature of interactions between involved actors. Here, one can distinguish between two extremes: interactions that are more short-term, transactional, driven by contractual arrangements, and those that are more long-term, relational, driven by trust in the mutual gains from collaboration. Longer-term interactive learning processes among different actors (including users, firms, research actors, etc.) are those that have been shown to be more successful and productive (Rothwell 1977). Collaboration with potential users at early stages in the innovation process can provide insights both on user needs and conditions of usability (Lundvall 1985, 1988 and von Hippel 1988). Collaboration within the firm (across different functional departments), and inter-firm collaboration (with suppliers, customers and firms in related industries) also provides access to insights that are important inputs to innovation processes (Porter 1998a, Nooteboom 1999). Interactions with actors who have complementary competencies help firms explore and ‘stretch’ their own knowledge base, as well as expose firms to situations where their own knowledge could be exploited in new ways (Nonaka and Takeuchi 1995, Lundvall and Borrás 1998). Collaboration with universities and other research actors provides firms with access to newest findings and cutting-edge knowledge – and universities with the opportunity to better understand industry needs and help them shape research to be more relevant. The public sector also has a role in providing, for example, infrastructure and supportive institutional frameworks. Government – at sub-national, national and supra-national levels – is an important part of innovation systems (see for example: Lundvall 1992, Nelson 1993, Edquist 1997, and Etzkowitz and Leydesdorff, 2000).

The definition of innovation systems used in this thesis is Lundvall’s (1992: 2) broad definition of innovation systems: “...a system of innovation is constituted by elements and relationships which interact in the production, diffusion and use of new and economically useful, knowledge.” This definition includes all parts and aspects of the economic structure and the institutional set-up that affect learning, and highlights the function of relationships and interaction between actors in the system. The boundaries of systems of innovation – the distinction of what is inside and outside a system – can be viewed spatially/geographically, sectorally¹¹, or in terms of technology¹² or activities¹³. In

¹¹ see e.g. Breschi and Malerba (1997)

terms of spatial/geographic boundaries, two concepts are predominant: national and regional innovation systems.

A national innovation system (NIS) encompasses elements and relationships either located within or rooted inside the borders of a nation state. Lundvall (1992) explains that national economies differ regarding the structure of the production system and the general institutional set-up. These differences will be reflected in: internal organization of firms; inter-firm relationships; role of the public sector; institutional set-up of the financial sector; R&D intensity and R&D organization (*ibid.*: 14). Building from the work of regional science and economic geography (including Camagni 1991 and Braczyk et al. (eds.) 1998), Cooke (1996 and 2001) and others highlighted that similar distinctions in infrastructure, institutions, organization of firms and governance of the innovation system could be made at regional level – regional innovation systems (RIS). These regional characteristics together define the degree of embeddedness of the region, i.e. the extent to which a social community operates in terms of shared norms of cooperation, trustful interaction and untraded interdependencies (Cooke 1996 and 2001). Such inter-firm networking, inter-personal connections, and local learning processes lead to unique regional capabilities – “sticky” knowledge – that cannot easily be transferred to other places (Malmberg 1997, Asheim and Isaksen 2002) – see next sub-section.

In addition to national and regional systems of innovation, various academic and policy papers have introduced the concept of innovation activities at supra-national level (including mega regions and macro regions). Florida (2008) builds on a premise presented by Ohmae (1991) that globalization has made national boundaries relatively less important for economic activities. The economic unit that makes most sense – he argues – is not the city, region or nation-state, but rather mega-regions that mass together talent, productive capability, innovation and markets on a large scale. Mega-regions are contiguous (or nearly contiguous) geographic spaces (ranging in size from 5 to more than 100 million people) that have been identified by lighted areas as seen from space at night, combined with other economic measures (Florida et al. 2008). A macro region, on the other

¹² see e.g. Carlsson and Stankiewicz (1991)

¹³ see e.g. Edquist (1997 and 2005)

hand, is not an empirically, but rather a politically-defined concept that has been introduced by the European Commission (Commission of European Communities 2009a). A macro region is defined as an area including territory from a number of different countries or regions associated with one or more common features or challenges. Macro regions are considered as a new cooperative framework to address shared challenges – aimed both at strengthening international competitiveness and achieving territorial cohesion. Both mega-regions and macro regions are conceived as parallel structures to national and regional innovation systems – aimed at mobilizing the capacity of the people and businesses located in a particular territory, and building links with other territories to ensure that common assets are used in a coordinated and sustainable way. The importance of linkages between these different geographical spaces and “systems” of innovation (on local/regional, national and supranational/global levels) has been increasingly highlighted in academic literature (Bunnell and Coe 2001, Freeman 2002, Asheim and Isaksen 2002, Bathelt et al. 2004, Amin and Cohendet 2005, Cooke 2005).

Linkages within and between different geographical spaces and systems of innovation are important because they increase knowledge spillovers and learning, strengthen absorptive capacity, and provide companies with helpful input from related actors (e.g. users, customers, suppliers, companies in related industries, research organizations). All of this serves to stretch an existing knowledge base, inspire new ideas, and spawn continuous renewal. These related actors with specialized and “sticky” knowledge can be located within the same geographical area, or they can be embedded in another innovation system elsewhere. Whereas linkages and interactive learning processes are enabled by geographic proximity (see next sub-section), innovation policy may play a role in strengthening linkages and fostering learning processes between actors and between (potentially spatially-dispersed) specialized nodes. This reasoning lies at the core of the concepts of “constructed regional advantage” (Commission of the European Communities 2006; Asheim, Boschma and Cooke 2011) and “smart specialization” (Foray and Van Ark 2007; Foray 2009; Foray, David and Hall 2009 and 2011). Alternative policy approaches for strengthening linkages and interactive learning processes is a topic on which I will elaborate further in later sections.

2.1.2. Geographical Proximity and Clusters – the natural enabler of interaction

The increasing specialization of knowledge production leads to a need for connecting different (but related) knowledge bases through interaction (Frenken *et al.* 2007, Asheim *et al.* 2011). Interaction can occur between individuals, but also between firms and other actors (in the same or different sector). Broader interaction and networks with other related actors strengthen absorptive capacity and learning (see, for example, Nooteboom 2000, Cohendet and Llerena 2003). Interaction, learning and collaboration are facilitated by geographical proximity. Economists and economic geographers have established a number of benefits (or positive externalities) of the spatial concentration (or agglomeration) of people and economic activities. Agglomeration economies are typically divided into two types: urbanization economies and localization economies. “Urbanization economies” refers to the co-location of unrelated economic activities in cities or industrial core regions, and the benefits derived from diversification (Jacobs 1969, 1984). “Localization economies” refers to the co-location of the same or closely-related economic activities, and the benefits derived from pools of specialized labor, economies of scale in specialized inputs, and knowledge spillovers¹⁴.

Simply put, when firms (and other organizations) in related industries cluster together, pools of specialized human resources and other specialized inputs (e.g. components, machinery, research and design) develop over time. Firms in the cluster benefit from being able to draw from larger pools of labor with relevant skills and experience, and individuals benefit from the range of employment possibilities. The concentration of other inputs helps firms to decrease costs (as firms have multiple competing suppliers), while keeping quality high. And (as discussed in the previous section), the regular interaction between the various actors supports a quicker diffusion and absorption of knowledge. Marshall (1890) describes this eloquently:

¹⁴ See Marshall (1890) for a discussion of these positive externalities

“Good work is rightly appreciated, inventions and improvements in machinery, in processes and the general organization of the business have their merits promptly discussed: if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further new ideas (*ibid.*, Book IV, Chapter X, Section 3).”

Academic discourse over the last 20 years has drawn a number of links between the concept of localization economies (or spatial clustering) and innovation processes – focusing on knowledge spillovers and dynamic relations between actors, as well as the role of the business environment in supporting innovation and ensuring sustainable competitive advantages for an economy. For example, Howells (2002) expands on the mutual influencing relation between geography and knowledge. He argues that geography has a profound influence on knowledge and learning processes by shaping individuals’ self-knowledge and interpretation frames, by influencing human interactions and learning processes undertaken with others, and by constraining access to externally acquired information (in terms of scanning costs and acquisition barriers). Although other types of proximity (e.g. cognitive, relational, institutional) matter in learning processes, geographical proximity has an indirect influence on everything else. This point is also made by e.g. Sabel 1989, Porter 1990, and Storper 1992, who have highlighted the role of the local business environment and production system in determining the innovative capacity of firms and maintaining global competitiveness.

Localization economies have been described using a number of different concepts including: industrial districts (Brusco 1982, Becattini 1990), innovative milieux (Aydalot 1986, Camagni 1995), and clusters (Porter 1990). Among these, the concept of “clusters” has become the predominant term used by researchers and policymakers. Porter (1998b) describes clusters as “geographic concentrations of interconnected companies and institutions in a particular field” and summarizes a number of reasons why clusters allow companies to operate more productively and innovate. These include: better access to employees and suppliers; access to specialized information; complementarities with other actors in the cluster; continual interactions and mutual learning among actors in the cluster; access to institutions and public goods; better motivation and measurement; and the capacity and flexibility to experiment at lower cost and act rapidly.

A number of empirical studies (Glaeser *et al.* 1992; Audretsch and Feldman 1996; Porter 2003; Delgado, Porter and Stern 2011) have described how specialized clusters of related economic activities yield growth of employment, wages, number of new company establishments and patents – and thus strong international competitiveness. Other studies (DASTI 2011) provide evidence that participation in organized efforts to increase cluster competitiveness – referred to as cluster initiatives (see Sölvell *et al.* 2003) – result in increased R&D collaboration, probability to innovate, and better use of other (public) R&D and innovation financing. Many of the positive results that clusters bring are derived from spillovers across firms, industries and institutions of various sorts – making clusters a system of inter-connected firms and institutions whose whole is more than the sum of its parts. As discussed above, spillovers within clusters depend, to some extent, on personal relationships and interactions between networks of individuals and institutions. Although the existence of a cluster makes such relationships more likely to develop and become effective, they are far from automatic. Formal and informal organizing mechanisms play a role (Porter 2003). Cluster organizations are such a formal organizing mechanism – or institution for collaboration. Cluster organizations have the role of providing services to various participating actors (firms, research providers and others) and orchestrating collaboration activities that foster growth and development (Porter and Emmons 2003, Sölvell *et al.* 2003, Wallin 2006). Institutions in the cluster define how learning takes place (Lundvall and Maskell 2000) and help make firms of the cluster attractive for outsiders to interact with (Malmberg and Maskell 2002).

On other hand – clusters or networks that foster interactions and relationships that are too close (cognitively and relationally) may yield obstacles for novel combinations of knowledge and radical innovation. Critics of clusters argue that there is a lack of clarity in the concept – both the geographical scale and the composition of cluster, and discuss the potential disadvantages of clusters. Among the disadvantages, authors highlight that over-specialization in clusters may result in a lack of broader interaction and dynamism, institutional and industrial path dependencies or lock-in (Martin and Sunley 2003). On this topic, Jacobs (1984: 224) draws comparisons between natural ecologies and economies: “...*economies producing diversely and amply for their own people and producers, as well as for others, are better off than specialized economies...the more diversity there is, the more flexibility, too...*” To guard against such risks for lock-in, clusters need to continuously diversify their exposure to new knowledge. A recent empirical study of firms in Norway has highlighted that the most

innovative firms are those that rely more on global – rather than local or national – sources of knowledge. In fact, the study provides evidence that firms with a greater diversity of international partners tend to innovate more and introduce more radical innovations than firms focused on local interactions for new knowledge (Fitjar and Rodríguez-Pose 2011).

The geographic proximity that naturally exists in clusters addresses the complexities of the innovation process. Proximity provides exposure and ease of communication – enabling exchange of tacit knowledge and development of absorptive capacity. Proximity also provides opportunities for social interaction – strengthening collaboration between dispersed specialized entities.

Even though geographic proximity provides a natural counterforce to the complexities of the innovation process, many innovation systems include intermediary institutions as an extra catalyst to and facilitator of collaboration (see, for example, Edquist and Johnson 1992, Bessant and Rush 1995, Howells 2006, and Stewart and Hyysalo 2008). These intermediary institutions may originate as a policy response to a lack of linkages and interactive learning between actors, or an effort to catalyze stronger linkages and interactive learning processes (addressing what Chaminade and Edquist 2006 term a “systemic problem”). As such, innovation intermediaries can be considered to be a part of the “learning system” or “innovation support system” (see e.g. Cooke *et al.* 1997, Doloreux 2002) – focused on fostering flows of knowledge and information, and enabling social interaction that are key for the learning process. This positions innovation intermediaries as one of the alternative policy mechanisms that can be used to strengthen linkages and interactive learning processes.

2.1.3. Innovation Intermediaries – the construct for collaboration

Building on literature on dynamic capabilities (Teece *et al.* 1997), knowledge management and organizational learning (including Lam 2000, Lam and Lundvall 2000), and the function of the “supporting space” in innovation networks (Ratti 1991), a broad range of authors have investigated the role of boundary spanners (Tushman 1977, Tushman and Scanlan 1981, Williams 2002, Kleinbaum and Tushman 2007), brokers (Provan and Human 1999, Klerkx and Leeuwis 2009, Kirkels and Duysters 2010) and other third-party actors who facilitate knowledge exchange and collaboration in open and distributed innovation processes.

These authors highlight the role that boundary spanners, brokers and other organizations have in supporting innovation processes and more effective innovation systems by e.g. linking actors (e.g. companies, research organizations, users, etc.) together, mediating and helping to coordinate the use of knowledge, and facilitating interactive learning processes between different actors. As introduced above, these intermediaries can be considered part of the innovation support system, as they provide structured activities that are targeted at strengthening innovation and the competitiveness of firms.

Howells (2006) provides a synthesis of the literature and develops the “catch-all” concept of innovation intermediaries. Innovation intermediaries are defined as “an organization or body that acts as an agent or broker in any aspect of the innovation process between two or more parties. Such intermediary activities include: helping to provide information about potential collaborators; brokering a transaction between two or more parties; acting as a mediator, or go-between, bodies or organizations that are already collaborating; and helping find advice, funding and support for the innovation outcomes of such collaborations (*ibid.*: 720).” Based on a case study of intermediaries operating within the UK system of innovation, Howells summarizes a list of 10 different roles and functions of the intermediation process within innovation (see Table 1 below).

Table 1: Innovation intermediation functions

1. Foresight and diagnostics
2. Scanning and information processing
3. Knowledge processing and combination/recombination
4. Gatekeeping and brokering
5. Testing and validation
6. Accreditation
7. Validation and regulation
8. Protecting the results
9. Commercialisation
10. Evaluation of outcomes

Source: Howells (2006: 720)

For each function, examples of activities or services that intermediaries provide will be briefly presented. The *foresight and diagnostics* function encompasses technology foresight and forecasting, and articulation of needs and requirements. Intermediaries may support innovation actors with technology roadmapping and strategic planning. The *scanning and information processing* function encompasses information scanning, and scoping or filtering activities.

Intermediaries may support innovation actors with access to new market or technology intelligence, or prioritization of identified market opportunities. The *knowledge processing and combination/recombination* function encompasses combining knowledge from two or more partners, as well as generating new knowledge to combine with partner knowledge. Intermediaries may support innovation actors by facilitating collaborative research or development – within the “node” or with external partners. The *gatekeeping and brokering* function encompasses matchmaking and brokering, and contractual advice. Intermediaries may support innovation actors by negotiating new alliances or business models.

Innovation intermediaries are engaged in later phases of innovation processes as well. The *testing, validation and training* function encompasses testing, diagnostics, analysis and inspection; prototyping and pilot facilities; as well as scale-up, validation and training. Intermediaries may support innovation actors by providing neutral prototyping or demonstration facilities (e.g. living labs), or enabling tests or validation activities in other markets. The *accreditation and standards* function encompasses providing standards advice, setting and validating standards. The *regulation and arbitration* function encompasses regulation and arbitration. The *intellectual property: protecting the results* function encompasses protecting the outcomes of collaboration. In these three functions, intermediaries may support innovation actors either by directly setting standards or regulation, or by engaging indirectly through lobbying, mediation, or professional advice. The *commercialization: exploiting the outcomes* function encompasses marketing, sales, and provision of capital. Intermediaries may support innovation actors with market research and business planning, promotion activities, and accessing seed or venture capital. The *assessment and evaluation* function encompasses technology assessment and evaluation. Intermediaries may support innovation actors with performance assessments (of a specific product or technology, or of a collaborative process).

Building from Howells’ own description of “phases” of intermediary support and inspired by the network orchestration functions of “innovation initiation, network composition, and innovation process management” presented in Batterink *et al.* 2010, these 10 functions can be placed into three groups: intelligence and innovation initiation (functions 1 and 2), network composition and knowledge transformation (functions 3 and 4), and innovation process management and commercialization (functions 5-10). A range of institutions and organizations exist that fulfill these functions in different innovation

systems. Within clusters (or other types of specialized innovation nodes), cluster organizations¹⁵ fulfill a number of innovation intermediary functions – highlighting innovation opportunities, bringing innovation actors together and matchmaking, catalyzing knowledge exchange and collaborative experimentation, and facilitating different parts of the innovation process.

Existing literature focuses on the role that innovation intermediaries (cluster organizations or similar¹⁶) have in facilitating interactive learning and knowledge creation *within* a particular cluster/local innovation node or national geography. There is also a need for innovation intermediaries to help “their” local nodes to reach out and interact with other actors that can offer related knowledge in order to secure continuous dynamism and long-term competitiveness. This encompasses interaction not only with actors outside their particular cluster and local geography, but also with actors in specialized innovation nodes in other geographies. It seems that the overall rationale and role of innovation intermediaries (i.e. to foster flows of knowledge and information, and enable interactive learning processes between various actors) should be the same regardless of the level of geographic dispersion of the actors, yet one can wonder if the specific activities – or functions – of innovation intermediaries are the same. Given that the list of intermediary functions was developed based on the context of a national innovation system (the UK), it can be questioned whether the same functions are relevant for supporting transnational innovation processes – i.e. fostering linkages and interactive learning processes between actors located in different geographical systems of innovation. This is one of the main issues addressed in this thesis. The operationalization of this question will be elaborated in Section 2.5.

But first, the trend toward and importance of linkages between different geographical spaces and systems of innovation is explored in the next section.

¹⁵ specialized institutions (that manage cluster initiatives) which take various forms, ranging from non-profit associations, through public agencies to companies (Commission of the European Communities 2008a: 8); for a more detailed description of cluster organizations, see Sölvell *et al.* (2003) and Ketels *et al.* (2006)

¹⁶ For a more detailed description of cluster organizations, see Sölvell *et al.* (2003), Ketels *et al.* (2006) and Commission of the European Communities (2008a)

2.2. Globalization and Impacts on Innovation Processes

Over the last decades, various authors (Ohmae 1995 and 2005; Doz et al. 2001; Chesbrough 2003; Prahalad et al. 2004 and 2008; Friedman 2007) have highlighted features of globalization that have led to a “flattened world” (Friedman 2007). This flattened world is characterized by (among other things) increased interdependence between nation-states, new means of social interaction and accessing outside knowledge, more empowered individuals, and a resulting change in the ways that companies and countries compete. These (and other) features have contributed to the development of a *global* knowledge and innovation landscape, which has led to more internationally-interdependent innovation processes. This has created new opportunities and challenges for firms and other actors involved. The following section draws on relevant literature in the areas of economic geography, internationalization strategy and business management.

2.2.1. The Global Knowledge and Innovation Landscape¹⁷

In the context of this thesis, globalization is defined as the increasing interdependence between internationally dispersed economic activities (Cantwell and Janne 2000). For the purposes of this dissertation, the reference to the ‘new global knowledge and innovation landscape’ is defined as referring to five somewhat inter-related aspects: increased international mobility of individuals; more efficient and easier access to communication platforms; a geographic shift in the center of gravity of knowledge and innovation resources; new forms of collaboration and competitive advantage; and the global nature of societal challenges. A more detailed description of each aspect follows.

¹⁷ This section is developed from a conference paper co-authored with Sylvia Schwaag Serger: “Internationalization of Research and Innovation – new policy developments”, presented at the CONCORD 2010 Conference on Corporate R&D: an engine for growth, a challenge for European policy.

Increased international mobility of individuals has impacted the way companies innovate. AnnaLee Saxenian (2006) discusses how skilled “technology entrepreneurs” lever their experience and relationships to operate in several countries simultaneously – identifying market opportunities, locating partners and managing cross-border business. Such circulation of human resources and the development of “knowledge diasporas” contribute to a country’s talent pool, strengthen interactive learning across borders, and help ensure longer-term competitive strength (World Bank Institute 2006, Tung 2008). Increasingly, innovation processes are embedded in distinct local/regional environments, linked internationally. Bathelt *et al.* (2004) highlight the importance of linking the strengths of “local buzz” with “global pipelines” of knowledge in order to enhance interactive learning. As argued by Breschi and Malerba (2001) and confirmed in a recent OECD study (2008a), the international mobility of labor is a crucial means for local (cluster) environments to establish these external linkages.

More efficient and easier access to communication platforms is the second aspect of the global knowledge and innovation landscape. The rise of personal computing, the world wide web, internet search tools, and social networking applications – combined with the increased efficiency and decreased cost of codifying and sharing different types of data (written, audio, video, etc.) – has enabled not only a broader spread of knowledge, but also new platforms and methods for global collaboration (including open source software, mass customization toolkits, co-creation platforms, etc.) (see Castells 1996). The “democratization” of knowledge enabled by the internet has made consumers more aware of “what’s out there” and, more importantly, given them the means to communicate their demands and actually take part in development processes. This has catalyzed companies to include users in the innovation process – gaining insight on what to produce, and developing new innovations together with users (see Prahalad *et al.* 2004, 2008 and von Hippel 2005, among others). These new technology-enabled methods have helped to internationalize innovation processes. According to Archibugi and Iammarino (2002:100), technological change and globalization are mutually reinforcing phenomena, with technological change acting as a “lubricant” for globalization, and globalization, in turn (by “facilitating the circulation of people, goods, capital and, above all, ideas and knowledge”) accelerating the rate of technological change.

The third aspect is a shift in the geographic center of gravity of knowledge and innovation resources (see, for example, OECD 2008b, OECD and The World Bank 2009, Battelle 2009, and Glänzel *et al.* 2007). Industrialized countries (North America, Europe and Japan) have for a long time dominated the global R&D landscape, accounting for the majority of global knowledge resources both in terms of R&D investments and human resources for science and technology. This dominance is increasingly being challenged as growth and transition economies increase both their supply and demand for knowledge and innovation. China, Brazil and India are perhaps the most prominent examples of countries where domestic investments in R&D and the number of students, engineers and researchers are growing dramatically at the same time as large domestic markets are attracting R&D investments of foreign companies. In particular, we see a growing number of European, Japanese and US companies setting up R&D activities in China and India (see, for example, Schwaag Serger 2009). In the most striking example, China's share of global R&D expenditure (in purchasing power parity terms) is projected to increase from 9.5% in 2007 to 12.5% in 2009, at the same time as the shares of the US, Japan and Europe are all projected to decrease (Battelle 2009). These patterns explain the increasing interest of slower-growing (primarily Western) countries in identifying and tapping into innovation hot spots in new/different geographies (Kao 2009, TAFTIE 2011). The Economist's special report on innovation in emerging markets (Wooldridge, 2010) summarizes a number of ways that the nature of innovation has to be re-thought in light of this shift in the center of gravity of knowledge and innovation resources: the revitalized importance of mass market appeal and increased charm of frugal innovation¹⁸; the new geographic locations of skilled resources and consumer markets; and the challenges (for Western firms) associated with operating in these markets.

The fourth aspect of the new knowledge and innovation landscape – new forms of collaboration and competitive advantage – is a product of the first three aspects. Whereas increased international mobility and easier access to communication platforms have made new forms of global collaboration possible, the increased competitive pressure from the rise of new sources of knowledge

¹⁸ Frugal innovation refers to new low-cost products and services (such as the \$2200 car produced by Tata Motors) that target the needs of poor consumers. These “frugal innovations” are being produced both by Fortune 500 companies, and new companies in transition economies.

and innovation has made new forms of collaboration and competitive advantage an imperative. Over the past 10-15 years, there has been a noticeable trend in multinationals spending an increasing portion of their R&D investments outside the countries in which they are headquartered (see, for example, Booz Allen Hamilton and INSEAD 2006; OECD 2008b; OECD 2009c; OECD and The World Bank 2009; UNCTAD 2005; and Karlsson, ed., 2006). Whereas previously, corporate off-shoring of R&D was focused mainly on product adaptation to new markets, evidence now shows that corporations establish R&D facilities abroad to decrease costs and access attractive pools of talent as well (see, for example, OECD 2008c and Moncada-Paternò-Castello *et al.* 2011). As a consequence of this, the value chain is broken up, and research, innovation, production and value creation no longer necessarily occur in the same geographic location – creating new challenges both for firms and policymakers.

This makes it increasingly important for companies to develop new ways of doing business – accessing external sources of knowledge and managing globally-distributed innovation processes. Chesbrough (2003) refers to this as a paradigm shift from closed to open Innovation. Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. Open innovation differs from prior theories of innovation by, among other things: giving equal importance to external knowledge in comparison to internal knowledge, making purposive outbound flows of knowledge and technology, the proactive and nuanced role of IP management, and the rise of innovation intermediaries (Chesbrough *et al.* 2006).

Finally, the global nature of societal challenges (such as climate change, environmental degradation, epidemics, etc.) has prompted change. These challenges extend far beyond the borders of a single country or region and thus require that countries and regions work together to find solutions. In this new global knowledge and innovation geography, the competitiveness and prosperity of countries and regions are increasingly dependent on their ability to harness the forces of globalization, science, technology and innovation to generate economic and social value. According to Auerswald and Branscomb (2008:339), the challenge of globalization is that “...unless an economy enjoys success at every stage of the process – from invention, through innovation and economic disruption, to growth – it may lead the world in research but the final economic returns will flow to others”. This has prompted governments in Europe to

mobilize research, development and innovation (RDI) financing targeting such “grand challenges”,¹⁹ and develop new ways to manage research and innovation activities and relationships that are inclusive and cross-boundary in their character (see, for example, Cagnin *et al.* 2012).

2.2.2. Implications of the Global Landscape – Internationalization of Innovation Processes

Together, the five aspects of the global knowledge and innovation landscape have an impact on innovation processes. The sources of knowledge are broadening to include new geographies and new actor groups (e.g. the growing importance of users). The methods of accessing knowledge – through both digital and human/embodied means – are multiplying, enabling more efficient access to international knowledge sources and enhance the generation of knowledge externalities (see, for example, Cohendet and July 2001). The need to access and mobilize dispersed knowledge is increasing with the emergence of new knowledge and innovation hotspots around the world, and with the increased prioritization of addressing “grand challenges”. And the approaches for transferring and transforming knowledge are evolving to be more open, collaborative, and network-oriented.

In contrast to knowledge transfer and transformation processes in one’s local environment – access to non-local knowledge sources is not automatic. “Tapping into an external pool of knowledge and establishing new relations with distant firms requires conscious efforts...to successfully establish a global pipeline therefore requires the development of a shared institutional context which enables joint problem-solving, learning and knowledge creation (Bathelt *et al.* 2004: 43).” Firms (and other innovation actors) adopt different strategic approaches for developing such a shared context, as well as different structures for organizing international innovation processes.

¹⁹ See also: The Lund Declaration
(http://www.se2009.eu/polopoly_fs/1.8460!menu/standard/file/lund_declaration_final_version_9_july.pdf)

Strategic Approaches for International Innovation Processes

Internationalization is the process of increasing involvement in international operations across borders (Welch and Luostarinen 1988). Internationalization can be driven by a desire for increased global efficiency, an ambition to respond to local needs, or an ambition to spread innovation internationally (Bartlett and Ghoshal 1998), as well as by a desire to seek new knowledge. Prange and Verdier (2011) distinguish between two over-arching objectives for internationalization: exploitation (asset- or knowledge-exploiting activities such as technology transfer or foreign direct investment) and exploration (asset- or knowledge-seeking activities where firms develop new forms of organization and coordination to source and manage dispersed knowledge).

Two overall strategic approaches to internationalization are presented in the literature: incremental internationalization strategies and accelerated internationalization strategies (including the *international entrepreneurship model*). Although these models describe firm's internationalization processes generally, the models can be applied to international innovation processes as well.

Firms with incremental internationalization strategies increase their international activities over time. This “staged approach” to internationalization can be driven by export and foreign direct investment patterns over a product's life cycle (the *product (life) cycle model*, Vernon 1966 and 1979), or by successively increasing acquisition, integration and use of knowledge about foreign markets and operations over time (the (Uppsala) *internationalization process model*, Johanson and Vahlne 1977). Firms with incremental approaches to internationalization generally initiate activities in markets where there is a lower perception of ‘psychic distance’ (i.e. differences between countries in terms of language, culture, education, level, business practice and legislation) – often with neighboring countries – and expand their geographical involvement with increasing experiential knowledge about foreign markets (Melin 1992). In a ‘revisited’ view of the internationalization process model, “insidership in relevant networks” is highlighted as a condition of successful internationalization (Johansson and Vahlne 2009).²⁰ These “network relationships offer potential for

²⁰ The revised model is called the “business network internationalization process”, where a firm's internationalization process begins with an existing knowledge base, network position, and

learning and for building trust and commitment, both of which are preconditions for internationalization” (*ibid.*: 1411-1412).

On the other hand, firms with accelerated internationalization strategies are “business organizations that from inception, seek to derive significant competitive advantages from the use of resources and the sale of outputs in multiple countries” (the *international entrepreneurship model*, Oviatt and McDougall 1994: 49). In this approach, as well, the speed, geographical scope and depth of commitment to firms’ international activities is influenced by the enabling force of ICT, the motivating force of competition, the mediating force of entrepreneurial actors (that discover an opportunity), and moderating forces of knowledge and network relationships (Oviatt and McDougall 2005).

In most recent years, other models have proposed an integration of the concepts presented in both the incremental and accelerated models of internationalization (see, for example: Casillas *et al.* 2009; Schweizer *et al.* 2010; Prange and Verdier 2011). These models combine the aspects of entrepreneurial opportunity identification and exploitation capabilities, together with aspects of incrementally building on existing knowledge and networks in order to develop trust, create new knowledge (by integrating new and existing knowledge), and strengthen the international network position over time.

Structures for International Innovation Processes

Depending on the objectives of internationalization (exploitative, explorative, or both – see above), activities can be organized in different ways. International management literature suggests three types of structures that can be used to organize international activities: global (or center-for-global), multinational (or local-for-local/global), and transnational (or global-for-global) (see, for example, Harzing 2000; Dunning and Lundan 2009).

Global structures are characterized by a centralized hub, where the focus is on building cost advantages through realization of economies of scale, and where most assets and decisions are made by the parent company. *Multinational*

recognition of opportunities. Firms pursue international activities in order to learn, create new knowledge, and build relationships and trust with new partners.

structures are characterized by decentralized and nationally self-sufficient units that can identify and respond to local opportunities, as well as develop and retain knowledge within national units. *Transnational* structures are integrated and interdependent networks where decisions on centralization or decentralization of tasks are based on the differentiated and specialized competencies of the subsidiaries (or other members in the network) in order to respond simultaneously to strategic needs for global efficiency and national responsiveness to local demands. Expertise is spread throughout the network, and development is dependent on a continuous flow of people, products and knowledge. This dispersed structure is viewed as highly complex to coordinate and control, yet can be managed if built on a shared vision and individual commitment.

The driving characteristic of transnational network structures is collaborative action for mutual benefit of the network members. Yet in these structures, it takes time for members to develop attachments within networks, to find out what actual benefits can be derived, and to reap benefits (e.g. reputation, legitimacy, status, increased business opportunities and market share, etc.) from such networks. Leung (2013) uses the metaphor of a sponge to refer to these flexible, interdependent network structures for international collaboration.

This thesis focuses on developing a better understanding of the role of intermediaries in transnational or “global-for-global innovations” – innovation processes that aim at pooling resources across spatial scales to address a common problem, and which are conducted in internationally-interdependent network structures (see Table 2 below).

Table 2: Overview of International Structures and Strategies

Types of Structures	Organizational/Decision-making structure	Strategic Purpose
Global	Center-for-global Centralized decisions	Cost advantages Economies of scale Focus on exploitation
Multinational	Local-for-local/global Decentralized decisions	Identify and respond to local opportunities Develop knowledge in local hub Focus on exploration
Transnational	Global-for-global Internationally-interdependent management and decisions	Leverage differentiated and specialized competencies in local hubs Pool resources to address a common problem or opportunity Global efficiency and responsiveness to local demands Focus on both exploration and exploitation

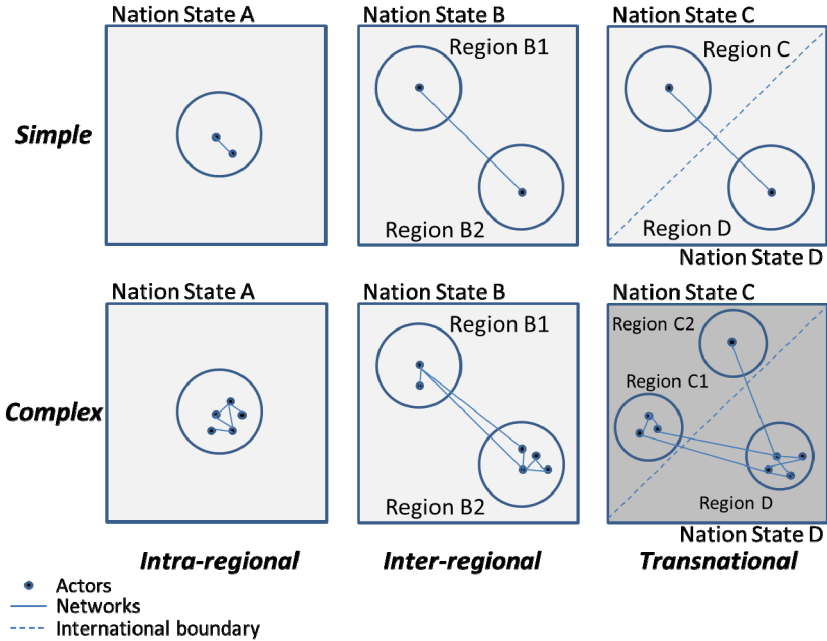
Source: Bartlett and Ghoshal (1998), Harzing (2000), author's synthesis

Various concepts to describe the relationship between and across different spatial scales and systems of innovation have been used, including: innovation networks (Camagni ed. 1991), communities of practice (Wenger 1998; Breschi and Lissoni 2001; Gertler 2003), knowledge communities (Henry and Pinch 2000; Oinas 1999), and transnational communities/diaspora (Morgan 1999; Saxenian 1999). A synthesis of these various concepts is embodied in the concept of “transnational innovation networks” (Coe and Bunnell 2003).

Transnational innovation networks (illustrated in Figure 2 below – in the bottom right) are defined as interdependent network relations between actors that are embedded in particular regional innovation systems that are located in different nation-states. The concept of transnational innovation networks encompasses three overlapping domains of network linkages: corporate-institutional (intra- and extra-firm knowledge transfers), social networks (knowledge transfers embodied in migrants, bridging organizations, transnational enterprises and governmental organizations), and hegemonic-discursive (transfers of dominant knowledge about innovation embodied in e.g. academic literature, media, policymakers, etc.).

The concept of transnational innovation networks introduced by Coe and Bunnell also suggested a new perspective on innovation systems and studies of innovation processes. They suggest that innovation systems are a combination of intra-local, extra-local and transnational network connections, and that research should move beyond understanding innovation in the context of particular spatial scales to research that puts the focus on the network linkages and social relations between various types of actors that are embedded in particular places. In brief, they suggest putting increased focus within innovation studies on the *different kinds of network interaction and flows* that operate across spatial scales – between firms, but also between research organizations, individuals, bridging organizations, media and governmental organizations.

Figure 2: Configurations of innovation networks



Source: Coe and Bunnell (2003: 441)

More recently, the concept of global innovation networks – a globally organized web of complex interactions between firms and non-firm organizations engaged in knowledge production related to and resulting in innovation – has been

introduced (Chaminade 2009). The two concepts of transnational innovation networks and global innovation networks both share the meaning of complex/interdependent interactions between groups of actors embedded in different countries with the aim of knowledge production and innovation. The two concepts seem to diverge a bit in a few respects. First, the concept of global innovation networks makes distinctions in “degrees of globalness, innovativeness and networkedness” – presenting a measurable typology of global innovation networks (Barnard and Chaminade 2011). The concept of transnational innovation networks is more descriptive. Second, the concept of global innovation networks seems to imply a broader geographical spread of activities (global vs. transnational). And third, the concept of global innovation networks looks at “networkedness” as a function of span and depth of a particular actor’s networks – compared to the concept of transnational innovation networks which seems to put relatively more emphasis on different kinds of network interaction and flows across spatial scales (i.e. networkedness of the whole innovation system).

Although the two concepts are similar in many respects, I have chosen to use the concept of transnational innovation networks as defined by Coe and Bunnell (2003) in this thesis because of its emphasis on the networkedness of the whole innovation system.

2.3. Innovating in Transnational Networks

Friedman’s postulation about the world being flat kicked off a number of articles about the “death of geography” and “the fading luster of clusters”...which were met with counter-arguments about the world being spiky (Florida 2005) and the continued importance of local innovation nodes. Rather than a dichotomy of local OR international, more recent literature highlights the benefits of both: establishing inter-linkages and interrelations between spatial scales (Bunnell and Coe 2001, Freeman 2002, Asheim and Isaksen 2002), or linking local innovation nodes to global knowledge pipelines (Bathelt *et al.* 2004). As discussed in Section 2.1.1., linkages between different geographical spaces and systems of innovation are important because they increase knowledge spillovers and learning, strengthen absorptive capacity, and provide companies with helpful input from related actors (e.g. users, customers, suppliers, companies in related industries, research organizations). All of this serves to

stretch the existing knowledge base, inspire new ideas, and spawn continuous renewal. Such use of a diverse range of knowledge sources (including international sources) has been shown to contribute to more (and more radical) innovation (Fitjar and Rodríguez-Pose 2011).

With an increasingly interdependent nature of innovation processes, firms and other innovation actors must continue to develop their own unique strengths while simultaneously learning from (and possibly collaborating with) other actors internationally. This requires innovation actors to “start thinking in different scales...thinking smaller (in terms of regions), but simultaneously thinking bigger in terms of the global totality and amalgams of effective and progressive regions” (Ohmae 2005: 115). Internationally-interdependent models of innovation provide new opportunities, but also present a number of challenges. Innovation actors need particular capabilities for bridging geographical distance and addressing the challenges of innovating in transnational networks. The following section draws on relevant literature in the areas of innovation studies, economic geography, internationalization strategy and business management.

2.3.1. Transnational Innovation Networks – opportunities and challenges

Friedman (2007) projected that “connect and collaborate” would be the defining feature of the future, and that “traditional nation-states, governments, corporations, and news organizations would have to work together with emergent networks, virtual communities, super-empowered individuals, and companies to hammer out the new norms, new boundaries, and new mechanisms for operating in the flat world (*ibid.*: 239).” Innovation processes have followed this projection – and are now conducted in more open, internationally-disbursed networks.

The process of operationalizing or commercializing innovations is becoming more reliant on longer-term relationships. The firm is moving from selling a product to selling a service (where the product is an integral part of the service). This implies a shift from a transactional relationship with the customer to a service relationship with the customer – with the end goal of delivering not just a superior product or solution, but a superior *experience* for the customer (Prahalad and Krishnan 2008).

In terms of international innovation activities, it is important to be a part of relevant networks, as trust-building and knowledge creation are activities that build international commitment (Johanson and Vahlne 2009). “Especially important are weak ties with brokers. Brokers are nodes in a network, or actors who are tied to nodes. In other words, brokers establish ties between actors who, without a broker, have no link to each other. Thus brokers enable indirect ties. In international business, brokers often provide links across national borders between actors who want to conduct international business with each other (Oviatt and McDougall 2005: 545).”

The “internationalization” of the innovation process creates a number of opportunities and challenges. For firms (and other actors) involved in transnational innovation networks, three main opportunities can be highlighted: the opportunity to increase one’s own performance and dynamism by accessing new knowledge sources; the opportunity to develop differentiated and more competitive solutions; and the opportunity to address important societal issues.

The first opportunity associated with innovating in transnational networks is to increase one’s own performance and dynamism by accessing new knowledge sources. For researchers, performance is measured by publications and citations. It has been illustrated that international collaboration on publications (international co-authorship) results in higher citation rates than purely domestic papers (Glänzel 2001). For firms, internationalization enables exposure to a greater diversity of knowledge – which is crucial for learning and innovation in order to avoid cognitive lock-in, and which supports more radical innovation (Asheim *et al.* 2011). Amin and Cohendet (1999) have precisely claimed that non-local networks are crucial for more path-breaking innovations, while local learning results more in incremental innovations. Fitjar and Rodríguez-Pose (2011) also find that those firms with a greater diversity of international partners tend to innovate more and introduce more radical innovations. Supplementing these results, an INNO-Metrics report (Fillipetti *et al.*, 2009) presents research results illustrating a clear relationship between innovation and internationalization, and pointing to the relevance of both for the strong economic performance of countries. The inter-relationship between the two suggests that public authorities should consider links between their innovation support to enterprises and support to internationalization – particularly those policies that support cross-border movement of skilled people.

Internationalization of innovation may also contribute to spinoffs and stronger performance of network partners and neighboring regions. A recent study of

clusters in the United States provides evidence that clusters are stronger when they can benefit from related strengths in neighboring regions (and even in different states). The spillover effects from such collaboration drives growth and job creation in a broad range of industries and regions – not just the “home cluster” that is in focus (see Delgado, Porter and Stern 2011). Innovation collaboration across borders aims at engaging new constituencies, including non-business stakeholders, in order to access related knowledge that will strengthen one’s own performance. The undertaking of such activities over time helps to strengthen relationships and knowledge flows.

The second opportunity associated with innovating in transnational networks is the opportunity to develop differentiated and more competitive solutions. In the current competitive landscape, it no longer suffices to develop the best quality or cheapest products or services, or even to have the most efficient processes for delivering products or services. Today, companies’ competitive strategies must be based on unique competencies, and on *how* business is done (see, among others, Friedman 2007, Hamel and Prahalad 1994). More and more often, this kind of competitive advantage is achieved by accessing and collaborating with a global network of resources (including other companies, research organizations and consumer communities) in order to co-create unique experiences (Prahalad and Ramaswamy 2004, Prahalad and Krishnan 2008). Participants in collaborative networks are able to reach and maintain stronger competitive positions not only because of the specialized solutions that they are able to deliver, but also because of the way in which these solutions were made possible. The unique linkages, relationships and business models that lie behind these solutions are the elements that are most difficult to replicate elsewhere.

The third opportunity associated with innovating in transnational networks is the opportunity to address important societal issues (such as climate change, environmental degradation, etc.). Stiglitz (2006) discusses the need for a change in mindset “to both think and act more globally” in order to make globalization work. Now that collective action through collaborative networks is more common practice, there are opportunities to address a number of shared challenges that – to date – have been difficult to address by any entity (even countries) acting alone. In order to address these challenges, political support, mobilization of an array of actors, long-term financing and coordination of efforts are needed. This type of collaboration is highly complex and requires a good deal of strategic orchestration (Wallin 2006); yet successful collaborations have the opportunity not only to address important concerns of society – they

have the opportunity to reap enormous commercial rewards when demand is met.

Of course, there is always a “flip side”. In order to take advantage of the opportunities that transnational innovation networks offer, firms (and other actors) must address a number of challenges. Three main challenges can be summarized: the challenge of developing and continually renewing specialized and differentiated capabilities that meet market needs; the challenge of identifying and plugging-in to complementary knowledge and expertise located elsewhere; and the challenge of managing internationally dispersed innovation processes.

The first challenge associated with innovating in transnational networks is related to an increased need for differentiation, specialization and prioritization. In order to stand out from the masses and succeed on the global stage, all actors (companies, researchers, regions, countries, etc.) need to develop and foster specialized and differentiated capabilities that meet market needs. “Not being distinctive can be the fastest route to commercial ruin (Ohmae 2005:112).” This requires the ability to foster creativity and be open to new ideas (potentially coming from outside sources), and continually re-assess your unique competencies (as these are determined relative to what others can do better than you).

The next challenge associated with innovating in transnational networks is related to the first one. Once an actor has defined their unique area of competence and how this relates to particular market needs, there may be gaps between market demands (in terms of solutions) and the actor’s capacity to meet those demands. Thus, a second challenge is to identify what knowledge or capabilities may be missing, and plug-in to complementary knowledge and expertise located elsewhere. This requires market intelligence and methods to identify relevant collaboration partners globally, as well as methods to access these (new) sources of knowledge and collaboration globally.

The third challenge associated with innovating in transnational networks is managing geographically dispersed innovation processes. In these networks, tacit knowledge does not flow “automatically”. Rather, new management capacities are required to identify new sources of related knowledge, mobilize different actor groups to collaborate, and manage the activities through to implementation. In transnational innovation networks, firms connect various ‘islands of expertise’ either through managing processes of distributed learning

within the firm or through externalized networks of suppliers, partners and customers (Gordon 2001). Innovation intermediaries (see Section 2.1.3.) with “boundary crossing behavior” (Wenger 1998) – where people move between communities of practice in different functional or spatial parts of a firm, or act as brokers between different firms and institutions – may also support the management of distributed learning processes.

2.3.2. Capabilities Needed within Transnational Innovation Networks

The ability to access and combine globally-dispersed knowledge, form collaborative networks and partnerships to make use of this knowledge, and involve customers/users in the process to co-create valuable products/services and unique experiences are some of the new drivers of innovation (Prahalad and Krishnan 2008, FORA 2009). Companies that innovate in this manner are described as metanationals – “exploiting the potential of learning from the world by unlocking and mobilizing knowledge that is imprisoned in local pockets scattered around the globe” (Doz *et al.* 2001:219).

Although geographical proximity serves as a natural facilitator of learning and innovation processes (Cooke and Morgan 1998; Maskell and Malmberg 1999), it is not the only dimension of proximity that matters (Howells 2002; Boschma 2005). In transnational networks, other types of proximities (e.g. cognitive, social, and institutional) can bridge geographical distance and facilitate innovation processes (Amin and Cohendet 1999 and 2000; Lam 2000; Lam and Lundvall 2000; Gertler 2003).

Cognitive proximity refers to cultural (Hofstede 1983, Dunning 1993) and technologically-shared mindsets that enable actors to communicate effectively and understand each other. Individuals with a similar educational background and occupational experience, as well as organizations operating in the same industry or complementary fields, are more likely to have a similar knowledge base and cognitive proximity (see, for example, Asheim and Coenen 2005 and 2006). This strengthens absorptive capacity and the possibility to identify, interpret and exploit new knowledge (Cohen and Levinthal 1990). This, in turn enables actors to more easily define areas of common interest and opportunities for collaboration.

Social proximity refers to personal relationships and trust between individuals and actors in a network (see, for example: Granovetter 1985; Putnam 1993;

Putnam 2001). Innovation, learning and knowledge exchange not only benefits from, but requires social connectedness between actors. When there is strong social capital (connections among individuals), there is a stronger mutual trust, shared responsibility and commitment among the actors. Geographical proximity is not a pre-requisite for social proximity. In fact, communities of practice (Amin and Cohendet 1999 and 2000) and intermediary associations (Cooke and Morgan 1998) such as cluster initiatives, trade associations, civic associations, etc. can enable a continuity of social relations over time – which strengthens social capital and enables innovation and change.

Institutional proximity refers to common organizational (goals and practices) and institutional (rules and norms) frames that help people cooperate within firms, between firms and organizations as well as in global fora (Amin and Thrift 1994). Shared values, goals, expectations and routines enable stable relations between actors for a period of time – fostering confidence and trust-building, and enabling the sharing of tacit knowledge across occupational and cultural differences. Institutional infrastructures (including actors such as innovation intermediaries) at different spatial levels may provide structures and services which support innovation processes. Particularly in the case of international innovation processes, there is a value in having a neutral platform that provides both strategic goals and stable institutional norms to help facilitate collaboration.

To address the challenges and unlock the potential opportunities of transnational innovation networks (discussed above) actors must develop capabilities to strengthen these “alternative proximities”. Capabilities include:

- accessing actors with related areas of specialization (cognitive proximity) to more easily define areas of common interest and opportunities for collaboration
- building personal relationships and trust between actors in the network (social proximity) to enable a melding of expertise, and commitment to undertaking longer-term collaborative action
- establishing commonly agreed collaborative frameworks, goals, and operational practices (institutional proximity) to foster stability and accelerate action

Doz *et al.* (2001) provides a relevant synthesis of three overall goals and related capabilities that metanational (or transnational) innovation actors need to build. In short, innovation actors will need to: *sense* new knowledge faster and more

effectively than competitors (identify new opportunities and gain access to relevant partners), *mobilize* dispersed knowledge to innovate more creatively than competitors (initiate joint activities, develop a common vision and pursue longer-term collaborative relations), and *operationalize* innovations more efficiently than competitors (develop a neutral platform/framework for conducting business, and manage internationally-dispersed, collaborative innovation processes over time) – see Table 3 below.

Table 3: Six Capabilities the Metanational Will Need to Build

Goal	Capabilities
Sensing new knowledge faster and more effectively than competitors	<p><i>Prospecting Capabilities:</i> The predisposition to prospecting for emerging pockets of innovative technology and new market needs. This prospecting capability allows companies to anticipate emerging hotbeds of relevant knowledge ahead of competitors.</p> <p><i>Accessing Capabilities:</i> The ability to “plug in” to innovative technology and new market needs through an established network of relationships with foreign customers, suppliers, distributors, universities, and technical institutes. This provides access to emerging pockets of relevant knowledge.</p>
Mobilizing dispersed knowledge to innovate more creatively than competitors	<p><i>Moving Capabilities:</i> An effective process for setting up “magnets” (such as projects undertaken to serve global customers or to build global product or service platforms) that can identify and move globally dispersed knowledge so that it can be marshaled for innovative problem-solving.</p> <p><i>Melding Capabilities:</i> A capability to meld knowledge about new technologies and novel customer needs from diverse sources into coherent innovation, overcoming the problems associated with melding complex knowledge and integrating it into solutions.</p>
Operationalizing innovations more efficiently than competitors	<p><i>Relaying Capabilities:</i> An ability to transfer newly created solutions, in usable form, into the day-to-day operations that underpin the supply chain.</p> <p><i>Leveraging Capabilities:</i> The capability to leverage innovations across global customer segments or applications and to assemble an efficient global supply chain by flexibly combining operational strength from different sites. These may either be established sites in an existing network of operations or sites operated by a partner.</p>

Source: Doz *et al.* (2001: 83)

Firms and other innovation actors may have some or all of these capabilities in-house, and may be fully equipped to engage in transnational innovation networks. Those innovation actors without in-house capabilities may leverage networks of suppliers, partners and customers (Gordon 2001) to sense new opportunities and knowledge sources, to mobilize joint activities and collaboration, and to operationalize internationally-dispersed activities in an effective manner. In many cases, innovation actors “find their own way” in transnational innovation processes. However, some innovation actors (particularly small firms) may not have the in-house capabilities, the broader network contacts, or may experience other barriers that limit their ability to internationalize research and innovation activities (OECD 2009a). For these innovation actors, external support from innovation intermediaries may be a helpful catalyst.

This is another of the main issues that is explored in this thesis. That is to say, what factors drive innovation actors to use support from innovation intermediaries? Which are the support needs that different types of innovation actors (companies and research organizations) experience? The framework of metanational capabilities presented above will be used to operationalize these questions. This is further elaborated in Section 2.5.

2.4. Public Policy and International Innovation Processes

Lundvall (2001) highlights that tacit knowledge and interactive learning becomes more important in the globalizing learning economy. He goes on to explain that the process of interactive learning is not the same across individuals and organizations, but is socially embedded – and organizational forms and institutional set ups are crucial to the outcome of the interactions. This has implications on innovation policy, including a growing importance of networking and inter-firm cooperation in creating a more interdependent and coherent innovation system. With the increasingly interdependent nature of (national) economies and innovation processes that is occurring in the “global knowledge and innovation landscape”, innovation policy strategies and instruments are also changing. The following section draws on relevant literature in the areas of internationalization strategy and business management, and

innovation policy. The section aims to provide some theoretical background to a discussion on policy implications that will be taken up in the conclusions (Chapter 6) of this thesis.

2.4.1. The Rationale and Role of Public Policy in International Innovation Processes

In today's globalised and highly competitive world, many countries are increasingly reliant on their ability to work with other countries in order to ensure the successful implementation of national priorities. Archibugi and Iammarino (1999) emphasize the importance of countries' strengthening their technological competencies and absorptive capacities in order to be able to benefit from, rather than be negatively affected by, globalization. Similarly, Edquist (2008) argues that globalization may be strengthening the need for innovation policy. Given the rapidly changing and uncertain market and institutional conditions in the international context, the role of the public sector is to generate frameworks that are "conducive to firms' adaptability and efficient exploitation of the opportunities offered by globalization...enhancing firms' capabilities to operate in this globalized context (*ibid.*: 2-3)."

The break-up of the value chain and subsequent internationalization of innovation places new demands on policymaking. Governments (on regional, national and supranational levels) are challenged to design policies or enable conditions which ensure that their constituencies – both firms and human capital – are attractive to knowledge and innovation resources, that they secure a significant part of the value creation stemming from research and innovation, and that they have the skills to efficiently develop and manage globally-dispersed, collaborative innovation networks. This can take many forms including foreign direct investment and trade, student and researcher mobility, or multi-lateral networks and commercial alliances.

Cantwell and Janne (2000) highlight the need for coherence between the public and private sectors. As "firms' strategies are constrained by the institutional context in which they are embedded, local and national characteristics in which the firm operates matter...(I)t seems that government intervention is more and more solicited in support of corporate learning and an environment that facilitates the creation of tacit capabilities and an upgrading of skills with firms. The widely legitimate role of governments is recognized in particular in the

fields of basic research, education and training and standards...and in encouraging inter-company knowledge flows (*ibid.*: 259-260).” A recent study of clusters in the US highlights the benefits of collaboration between clusters in nearby geographies, and confirms the role for policy support. “Policies that enhance complementarities across jurisdictions, such as supporting infrastructure and institutions that facilitate access to demand, skills or suppliers in neighboring clusters, are important tools for regional development (Delgado, Porter and Stern 2011: 33).”

The taxonomy introduced by Archibugi and Michie (1995, 1997) and further developed in Archibugi and Iammarino (1999) presents three main categories of the globalization of innovation (processes): international exploitation of technology, global generation of innovation, and global technological collaborations. For each category, examples of the role that public policy can play in international innovation processes are discussed (see Table 4 below).

Table 4: Globalization of Innovation and the Role of Public Policies

Categories	Actors	Forms	Role of Public Policies
International exploitation of nationally-produced innovations	Profit-seeking firms and individuals	Exports of innovative goods	Reinforcing existing competitive strengths
		Transfer of licenses and patents	Enabling national enterprises to exploit their competencies on the world market
		Foreign production of internally-generated innovative goods	Prioritizing sectors or competencies abroad that complement “own”
Global generation of innovations	Multinational firms	R&D and innovative activities in both the home and the host countries	Monitoring inward and outward FDI (to understand quality of “own” business environment)
		Acquisitions of existing R&D laboratories or greenfield R&D investment in host countries	Stimulating high added-value activities in local contexts and communities
			Support links and balanced benefits between local and global levels
Global techno-scientific collaborations	Universities and public research centers	Joint scientific projects	Assuring sufficiently high level of domestic competition (to ensure domestic players are attractive partners for international collaboration)
		Scientific exchanges, sabbatical years	
	National and multinational firms	International flows of students	Supporting “own” enterprises’ ability to take part in this form of international collaboration-learning-innovation circle (particularly small and medium enterprises)
		Joint ventures for scientific innovative projects	
	Production agreements with exchange of technical information and/or equipment	Establishing relevant infrastructures and institutions to facilitate linkages “at home” and with others internationally	

Source: Archibugi and Iammarino (1999)

As mentioned in Section 2.2.2., Prange and Verdier (2011) make a distinction between two main objectives for internationalization: exploitation (asset- or knowledge-exploiting activities such as technology transfer or foreign direct

investment) and exploration (asset- or knowledge-seeking activities where firms develop new forms of organization and coordination to source and manage dispersed knowledge). Exploitation activities can be viewed as related to the first category of the taxonomy presented above (“international exploitation of nationally-produced innovations”). And exploration activities can be viewed as related to the second category of the taxonomy (“global generation of innovations”). The third category (“global techno-scientific collaboration” combines both exploitation and exploration goals. Table 5 below presents an overview of the categories of globalization of innovation and the role of public policies (Table 4 above) in relation to the international structures and strategies introduced in Section 2.2.2.

Table 5: Categories of Globalized Innovation Processes

Categories (from Archibugi and Iammarino 1999)	Strategic Purpose	Structure of Process
International exploitation	Cost advantages Economies of scale Focus on exploitation of nationally-produced innovations	“Global” - Centralized global hub - Centralized management
Global generation of innovations	Identify and respond to local needs Develop and retain knowledge in local hubs Focus on exploration	“Multinational” - Multiple local hubs - Decentralized management
Global techno-scientific collaborations	Leverage (geographically distributed) differentiated and specialized competencies Pool resources to address a common problem or opportunity Focus on both exploitation and exploration	“Transnational” - Dynamic network of hubs - Internationally-interdependent management

Source: author’s synthesis

Whereas the first two categories of globalized innovation processes imply competition between countries, global techno-scientific collaboration (the third category) is mainly characterised by a situation in which all participating economic actors have the possibility of gaining (Archibugi and Iammarino 1999). The home country can become an information node, acquiring expertise in a wide range of technologies. Spillovers and knowledge transfers can be broad – particularly when collaboration involves the partnership of different actors

(e.g. governments, research institutions and the business sector) – and have an indirect effect on competitive performance. Archibugi and Iammarino highlight that “...in the long run, it seems that (global techno-scientific collaboration) is the type of globalisation that can reinforce a country’s scientific and technological potential and, therefore, its competitive performance...(t)hus, there is a strong case for public policy to provide incentives for the development of such international cooperation (*ibid.*: 265).” As already introduced in Section 2.2.2., this thesis focuses on the third category of globalized innovation processes – which can be equated with transnational (internationally-interdependent) innovation networks.

Although there is a strong case for public policy to provide incentives to transnational innovation networks, there are a number of counter-arguments to providing public support which should be acknowledged. These include the challenge of appropriability and the risk of increasing regional disparities (Cantwell 1999, VINNOVA 2011). One of the main arguments against public policy action in this area is based on the ‘appropriability’ argument. Policy makers have difficulty motivating the investment of national funds to international sources, unless it is clear that national actors (or the country overall) will be able to appropriate a return on the investment. At the same time, investments in international innovation processes may not have the primary aim of creating a particular item of knowledge or innovation, but rather may have the primary aim of improving tacit capabilities and interactive learning processes (which, in turn, increase actors’ ability to exploit opportunities arising from new knowledge and skills, which has a positive impact on innovation outcomes over the longer-term).

Another argument against policy action in this area is the risk of market distortion by reinforcing regional or national specialization patterns – which may increase disparities over time. Here, it is important to consider the possible consequences of choosing not to act. Given the interdependent (and not always neutral or fair) nature of transnational innovation networks, governmental innovation policies have a role in facilitating the most appropriate patterns of specialization, ensuring that economic and societal needs are addressed in the processes being undertaken, and encouraging a greater international coordination of productive activity (Cantwell 1999: 239). These thoughts are also reflected in the new innovation policy concept of “smart specialization” (Foray and Van Ark 2007; Foray 2009; Foray, David and Hall 2009 and 2011)

– which the European Commission has implemented in order to promote the efficient and effective use of public investment in research and innovation.²¹

2.4.2. Policy Strategies and Instruments supporting Globalization of Innovation

Innovation policy has been coupled to the concept of national innovation systems; therefore, policy instruments have generally focused on impacting actors and processes within national borders. As innovation processes become more globally interdependent, innovation policy is challenged to find ways to enable domestic actors to connect to world-leading knowledge and innovation hubs in ways that benefit and strengthen competitiveness and lead to value creation in the home regional and national innovation systems. Public policy is expanding in this area. In addition to bilateral agreements, researcher mobility schemes and joint research programmes, new policy instruments (e.g. support to joint strategic fora and information and brokerage services abroad) are emerging (Commission of the European Communities 2012b). With their proximity to companies and other innovation actors, innovation intermediaries may be an appropriate channel to provide support to international innovation processes (cf. Commission of the European Communities 2012c: 36).

The instruments for internationalisation of innovation differ, depending on national strategic interests and historical contexts. Some countries may concentrate on obtaining inexpensive supply of components or broadening export markets, while others may concentrate on upgrading scientific competence or developing capacity to participate in long-term innovation collaborations. Niosi and Bellon (1994) highlight the influence of national innovation systems on the choices toward (and instruments of) internationalisation. “National innovation systems are historically rooted and, like learning processes, institutions, firm routines, and technologies, share cumulative traits, including path dependencies and trajectories. NSIs are open systems that relate to domestic and international environments.” This implies

²¹ See http://ec.europa.eu/research/regions/index_en.cfm?pg=smart_specialisation and <http://s3platform.jrc.ec.europa.eu/home?CFID=9610ee32-578b-40be-87ca-da8e04d65695&CFTOKEN=0> for additional information

that certain national innovation systems will be more open and (internationally) interactive than others. This can be evidenced by many different types of indicators, including: R&D by multinational firms, international technical alliances, international technology transfer, international trade of capital goods, international flows of S&T personnel, and joint international science projects/publications.

Through an analysis of the various indicators, Niosi and Bellon (1994: 189) highlight the rate and types of globalization efforts when it comes to national systems of innovation. “Smaller countries, including Canada, are at one end of the spectrum with higher levels of flows of scientific and technological knowledge and embodied technology crossing their borders. The larger non-European countries, including the U.S. and Japan, are at the other end, being much more self-sufficient and less affected by international technological and scientific flows.” They also argue that the new complexity of the process of innovation is one of the most important factors that determine the internationalization of innovation. The internationally immobile factors of innovation – highly skilled labour, niche markets, research institutions, and regulation – must be incorporated wherever they exist. Thus, the creation of international links between agents located in different countries is necessary.

The internationalization of innovation is therefore defined as a multidimensional process through which some key stages of the innovative activity are conducted by agents located in different national systems. Among these phases, the most important are: fundamental or basic research conducted increasingly through international scientific collaboration, and applied research and development conducted either by inter-firm alliances or through the international network of R&D laboratories of MNCs, sometimes with the help of universities and government laboratories. (Niosi and Bellon 1994: 193)

As firm’s innovation processes and patterns of internationalization change, policy strategies and instruments also need to be revisited (CREST 2008, TAFTIE 2010). Public policies play a different role in different “categories” of the globalization of innovation (Archibugi and Iammarino 1999). And as the policy objectives broaden (discussed below), the range of instruments that are used broaden as well. Edler and Boekholt (2001) examine the role of policy by comparing government policies or initiatives in a number of selected countries. They identify three overall categories of policy instruments, namely instruments to increase attractiveness, to absorb knowledge created abroad, and to “open

doors both ways”. They conclude that “despite the wealth of analyses of the rising importance of internationalization of science and research, governments have been slow to react. ...[O]nly a minority of countries has given internationalization in public science and industrial research policy priority, supported by the political will to invest money beyond short-term considerations of reciprocity” (*ibid.*: 320).

In a more recent paper, Boekholt *et al.* (2009) identify and analyze drivers of international science, technology and innovation cooperation. The authors identify six main policy drivers for international STI collaboration: competition for scarce human resources and achieving research excellence in a globalized world (within what is termed “the narrow paradigm”); improving competitiveness of industries and firms, maintaining good and stable diplomatic climate, S&T capacity building, and tackling societal issues and challenges within research (within what is termed “the broad paradigm”). The paper also highlights examples of policy instruments for each driver. It is interesting to note that the policy drivers and instruments to support international STI cooperation described by Boekholt *et al.* have evolved somewhat from those described in Archibugi and Iammarino ten years earlier – demonstrating a broadening scope for innovation policy in the globalization of innovation.

One of the conclusions highlighted in Boekholt *et al.* (2009) is that policy activities are increasingly focused on coordinating efforts and collaborating on joint programmes (i.e. the “global techno-scientific collaboration” category of Archibugi and Iammarino 1999). Furthermore, policy measures to address the competitiveness driver – and other drivers of the “broad paradigm” – are more complex (involving multiple target groups), and are less often seen “in operation” (in the 20 country cases examined). One of the contentions of this thesis is that while it is relatively straightforward for governments to promote the internationalization of research and international research cooperation – particularly when it is based on academic excellence, it is far more difficult to promote the internationalization of innovation and internationally-interdependent learning processes.

The reflection on the lack of experience with implementing instruments targeting broader innovation policy aims and more complex international learning processes is also mirrored in a recent Global Innovation Index:

Collaboration, the flow of ideas between different innovation actors, and access to knowledge are all increasingly important ingredients of innovation. So-called

innovation ecosystems have become more complex and are now built on more internationalized, collaborative, and open innovation models and knowledge markets. This is an important field of innovation policy, and one that garners increasing attention. While there is broad agreement that linkages among innovation actors are key...experiences and lessons in designing effective policies that foster innovation linkages are still scarce. (INSEAD and WIPO 2012: v)

Whereas there is considerably more experience with implementing policy instruments to foster international exploitation of knowledge and global generation of knowledge²², there is relatively less experience with implementing policy instruments to foster global techno-scientific collaboration (i.e. international linkages and interdependent learning processes). Some examples of alternative policy instruments for strengthening linkages and interactive learning processes include:

- Information and brokerage services abroad
- Infrastructures (e.g. physical platforms such as demonstrators or test beds, or digital platforms) and institutions to attract and facilitate linkages with others internationally
- International innovation collaboration programmes
- Mobility programmes/exchanges between professionals on a regular basis over a longer period of time

Given the role that innovation intermediaries currently play as part of the innovation support system (fostering flows of knowledge and information, and enabling interactive learning processes between various actors), it seems reasonable that innovation intermediaries could be leveraged in policy support to globalized innovation processes. Innovation intermediaries are, in fact, currently used as “institutions to attract and facilitate linkages with others internationally”. This thesis aims to explore their role in more detail – investigating why companies and research organizations may need intermediary support, and what specific functions that they fulfill to support globalized (or transnational) innovation processes.

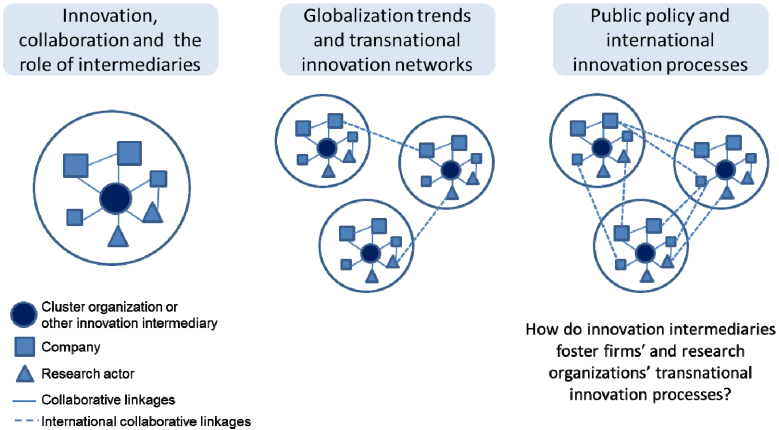
²² through e.g. trade and investment promotion, or through promoting international research collaboration, joint funding of research infrastructure and student/researcher mobility

2.5. Analyzing the Role of Innovation Intermediaries in Transnational Innovation Networks

The thesis is based on several key theoretical propositions (or “building blocks”) introduced at the beginning of this chapter. The previous sections have reviewed these building blocks, drawing from the fields of innovation management and innovation systems, economic geography, internationalization strategy and business management, and innovation policy. An overview of these building blocks is illustrated in Figure 3 below.

The first part of the picture addresses innovation, collaboration and the role of intermediaries. Innovation is an interactive learning process – where interaction and collaboration between various actors helps to expand and transform knowledge into new products, services, processes, etc. and spawn continuous renewal. Geographic proximity is a natural enabler of interaction between various actor groups – which increases knowledge spillovers and learning, strengthens absorptive capacity, and provides companies with helpful input from related actors (e.g. users, customers, suppliers, companies in related industries, research organizations). Innovation intermediaries are part of the “innovation support system” and play a role in strengthening linkages and fostering learning processes and collaboration between actors.

Figure 3: Theoretical Building Blocks



Source: author's synthesis

As innovation processes become more interdependent and globally dispersed (in transnational innovation networks), firms (or groups of firms and other innovation actors – called “innovation nodes”) seek linkages with each other in order to access complementary specialized knowledge and explore innovation collaboration opportunities (Amin and Thrift 1992). Such internationally interdependent innovation models require firms and other innovation actors to have capabilities for bridging geographical distance in order to sense new market opportunities that can be addressed by their own differentiated strengths; to access complementary knowledge and mobilize internationally-dispersed actors; and to operationalize innovation processes internationally. Firms and other innovation actors may have some or all of these capabilities in-house, and may be fully equipped to engage in transnational innovation networks. Those innovation actors without in-house capabilities may leverage networks of suppliers, partners and customers. Innovation actors that lack certain capabilities, broader network contacts, or that experience other barriers that limit their ability to internationalize research and innovation activities may also need (or be interested in) external support to their efforts.

Innovation policy plays a role in developing (or strengthening) linkages and interactive learning processes between actors – both within and outside of national boundaries. As innovation processes become more globally interdependent, innovation policy is also expanding in this area. Policy activities are expanding beyond traditional investment attraction and export promotion, and beyond international research collaboration. Policy activities are increasingly focused on coordinating efforts and collaborating on joint programmes targeting the internationalization of innovation (i.e. strengthening knowledge linkages and interdependent learning processes between actors that are internationally dispersed).

Innovation intermediaries are currently used as “institutions to attract and facilitate linkages with others internationally” (Archibugi and Iammarino 1999), yet their role in supporting transnational innovation processes is relatively obscure in both existing theory and the policy debate. This thesis aims to explore their role in more detail – investigating two key issues: why companies and research organizations may need intermediary support, and what specific functions that they fulfill to support transnational innovation processes. The analytical framework used in this thesis leverages existing theoretical frameworks on metanational capabilities (Doz *et al.* 2001, Doz and Wilson 2012) and functions of innovation intermediaries (Howells 2006) to operationalize

questions on factors driving innovation actors' need for external support and corresponding support functions of innovation intermediaries.

2.5.1. Operationalizing Factors Driving Innovation Actors' Need for External Support

Some of the main problems with bridging geographical distance are problems of integration and coordination: interpretation of information (on various disbursed nodes), facilitating social interaction, and moderating innovation processes (Amin 2002). One aspect of the analytical framework aims at exploring the factors that drive innovation actors' need for (or interest in) support from innovation intermediaries – and what support needs this implies for different types of innovation actors (companies and research organizations).

In this thesis, this is explored by examining both innovation actors' current knowledge sourcing and collaboration patterns, as well as the barriers and capability gaps that companies and research organizations have in undertaking international innovation activities. Examining current knowledge sourcing and innovation collaboration patterns helps to highlight how innovation actors²³ engage other actors in their innovation processes. The analysis explores both geographical aspects (how spatially proximate are knowledge sources and collaboration partners?), and organizational aspects (how cognitively and institutionally proximate are knowledge sources and collaboration partners?). This helps to explain what challenges of geographical, cognitive or institutional distance the different innovation actor groups may face. In addition, the main barriers to international innovation processes are examined.

These factors that drive innovation actors' need for external support are then translated into support needs for each group of innovation actors (research organizations, large/medium companies and small companies). Support needs are structured relative to the three categories of “metanational capabilities” (i.e. sensing, mobilizing and operationalizing) presented in Doz *et al.* 2001 (see Table 6 below). The left column presents the capabilities that companies and research organizations should have, while the right column presents examples of

²³ In this thesis, innovation actors are grouped into three categories: research organizations, large/medium companies and small companies.

areas where their current knowledge sourcing and collaboration patterns, or expressed barriers and capability gaps drive an interest in support from intermediaries.

Table 6: Categorization of Innovation Actors' Support Needs

Metanational Capabilities	Examples of Support Needs
<i>Sensing</i>	
<p>Prospecting Capabilities: The predisposition to prospecting for emerging pockets of innovative technology and new market needs.</p> <p>Accessing Capabilities: The ability to “plug in” to innovative technology and new market needs through an established network of relationships with foreign customers, suppliers, distributors, universities, and technical institutes.</p>	<ul style="list-style-type: none"> - understanding foreign systems of innovation and relevant contacts within these - understanding foreign markets and needs/opportunities there - identifying relevant international opportunities and actors with complementary expertise - gaining exposure and access to complementary knowledge, expertise, or infrastructure in foreign locations
<i>Mobilizing</i>	
<p>Moving Capabilities: An effective process for setting up projects and other “magnets” that can identify and move globally dispersed knowledge so that it can be marshaled for innovative problem-solving.</p> <p>Melding Capabilities: A capability to meld knowledge about new technologies and novel customer needs from diverse sources into coherent innovation, overcoming the problems associated with melding complex knowledge and integrating it into solutions.</p>	<ul style="list-style-type: none"> - providing contextual legitimacy (and branding) of actors’ areas of specialized expertise - proactively facilitating exposure to new partners and collaboration opportunities internationally - engaging actors in collaborative activities or joint projects - marshaling globally-dispersed knowledge around a shared problem or opportunity
<i>Operationalizing</i>	
<p>Relaying Capabilities: An ability to transfer newly created solutions, in usable form, into the day-to-day operations that underpin the supply chain.</p> <p>Leveraging Capabilities: The capability to leverage innovations across global customer segments or applications and to assemble an efficient global supply chain by flexibly combining operational strength from different sites.</p>	<ul style="list-style-type: none"> - establishing common practices and operational business models - accessing needed investments in order to implement common activities - gaining longer-term anchoring/backing from public sector actors in home market

Source: Doz *et al.* (2001) and author

2.5.2. Operationalizing Intermediary Support Functions in Transnational Innovation Processes

Innovation intermediaries are institutions (or organizations) that can fulfill a number of functions, such as: mobilizing actors and building social proximity (gathering information, establishing or maintaining coalitions, and monitoring trust and implicit contracts); representing their constituents (i.e. generating and disseminating discourses, collective goals, etc.); monitoring other relevant nodes and identifying opportunities; serving as points from which other nodes can tap into knowledge structures; and catalyzing and moderating collaborative activities with external partners.

The importance of accessing non-local knowledge (access to the most advanced technologies, best know-how and complementary collaboration partners) is well-acknowledged. Firms and research organizations are already active within research and innovation networks and global value chains. Yet because the development of global linkages requires conscious efforts and investments, institutional and infrastructural support (particularly for smaller companies) may be needed from the public sector. Innovation intermediaries may be one of the means to provide this support.

A second aspect of the analytical framework aims at exploring what functions provided by innovation intermediaries are viewed as most useful by the different actor groups (e.g. small companies, large companies, or research organizations). In this thesis, this is explored by using an existing list of innovation intermediation functions (presented in Howells 2006) to develop and test a list of “international innovation intermediary functions”.

Using the 10 functions presented in Howells 2006 (see Table 1) as a starting point, relevant literature (both academic articles and policy reports) was reviewed to understand what activities or services were provided in relation to international innovation processes. Next, policy experts at VINNOVA (the Swedish national innovation agency) who work with analyzing and developing mechanisms to support international innovation processes defined a list of functions that intermediaries may fulfill in relation to this process. This list was anchored with other international experts, and tested on an intermediary (cluster) organization (to ensure relevance). These international intermediation functions were then structured in relation to the three overall categories introduced in Section 2.1.3. (intelligence and innovation initiation, network

composition and knowledge transformation, and innovation process management and commercialization) – presented in Table 7 below.

The left column presents the three categories of innovation intermediary functions as introduced in Section 2.1.3., while the right column presents the list of “international intermediary functions” that was developed and tested in this research. In this thesis, the three categories of functions of innovation intermediaries are considered to roughly correspond to the three categories of “metanational capabilities” (sensing, mobilizing and operationalizing – described above). In this way, it is possible to analyze how the “supply” of innovation intermediaries’ support functions relate to the “demand” for support expressed by the innovation actors.

Table 7: Intermediary Support Functions in Transnational Innovation Processes

Functions of innovation intermediaries	Functions of innovation intermediaries in globalized innovation processes
Intelligence and innovation initiation (including foresight and diagnostics; scanning and info processing)	<ul style="list-style-type: none"> - Providing access to unique market information - Providing access to benchmarking - Providing access to external knowledge sources (e.g. individuals or centres with specific skills/expertise, customer insights) - Providing access to external technology (e.g. patented R&D) - Providing access to external infrastructure (e.g. physical or virtual laboratories, demonstration or test facilities)
Network composition and knowledge transformation (including knowledge processing and combination/ recombination; gatekeeping and brokering)	<ul style="list-style-type: none"> - Providing access to new international contacts/ cooperation partners - Providing access to new markets - Building a common identity and stronger international visibility
Innovation process management and commercialization (including testing and validation; accreditation; validation and regulation; protecting the results; commercialization; evaluation of outcomes)	<ul style="list-style-type: none"> - Facilitating access to funding for joint research and innovation activities - Influencing government and policy

Source: Howells (2006), Batterink *et al.* (2010) and author

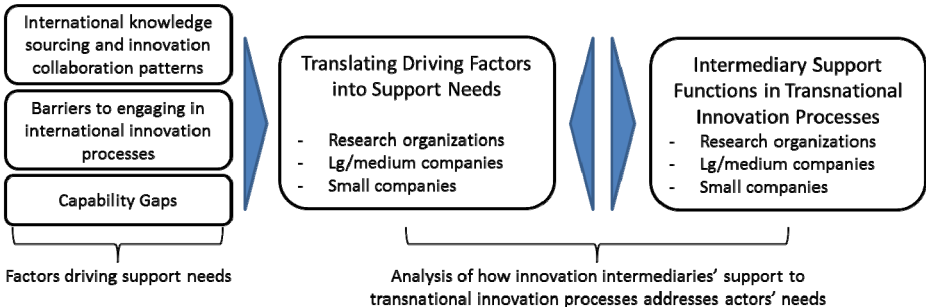
2.5.3. An Overview of the Analytical Framework

This thesis explores how innovation intermediaries foster firms’ and research organizations’ transnational innovation processes. The thesis investigates two main questions in particular: what drives innovation actors’ interest in intermediary support to transnational innovation processes, and what functions innovation intermediaries fulfill in this regard – providing information for policy development in this area.

The analytical framework is structured on these two overarching sub-questions – i.e. what drives external support needs in different actor groups, and what support functions address these needs.

An overview of the analytical framework (a more detailed view of the analysis phase presented in Figure 1 – operationalizing the research questions) is presented in Figure 4 below.

Figure 4: Analytical Framework – Support Needs and Support Functions in Transnational Innovation Processes



Empirical data and an analysis of each of these aspects are presented in Chapter 5. A discussion of the findings and their possible implications on innovation policy is presented in Chapter 6.

3. Research Design and Methods

This study focuses on improving understanding about how innovation intermediaries are used to support companies' and research organizations' transnational innovation processes – which is related to questions about why companies and research organizations need external support, what different actor groups' external support needs are, and what functions innovation intermediaries fulfill that meet these external support needs. The underlying view is that innovation intermediaries may be used as a policy instrument to help catalyze international innovation processes. (This is discussed in Chapter 6.)

A case study approach has been used to explore these questions. The study focuses on two main research objects (or units of analysis): innovation actors (grouped into research organizations, large/medium companies and small companies), and innovation intermediaries (cluster organizations or similar). Interviews, surveys and participant observation have been used to gather data from these two groups – enabling this case to compare innovation actors' demands for (or interests in) external support with innovation intermediaries' supply of support services.

This chapter explains the choice of research perspective and type of research, as well as the methods and process used in carrying out the study. The first section will explain the rationale behind the qualitative research approach and the choice of applying a case study research strategy. The second section will elaborate on the research context – explaining the choice of the StarDust project case and the various groups of participants involved in the study, and describing the unique “insider role” I was afforded as a researcher. The third section describes the methods of data collection and analysis – elaborating on the overlapping process between the two. And the final section highlights a number of limitations and challenges.

3.1. Overall Approach and Rationale

The role of innovation intermediaries – organizations or bodies that act as an agent in any aspect of the innovation process between two or more parties – is well-documented within the field of innovation studies (see Chapter 2). Yet as innovation processes are becoming more internationally dispersed – involving complex networks of firms and users – the role of innovation intermediaries is also evolving. Although academic articles acknowledge the rationale for institutions to facilitate international linkages and contemporary empirical studies provide evidence that intermediaries are indeed providing support in this area (see Chapter 2), the role and particular functions of innovation intermediaries in this regard is not well-elaborated. As this is an under-researched area, this study aims at exploring this topic in more depth – and thus follows a qualitative research approach, attempting to make sense and provide an interpretation of this observed phenomena.

A qualitative, rather than quantitative, approach was chosen for two reasons. First, the purpose of the research is to *explore* the rise and role of innovation intermediaries in transnational innovation processes and provide information and insights based on a particular case. The purpose is not to prove usefulness of specific functions or specific intermediaries – nor to prove a relation between innovation intermediaries' services and innovation performance. Secondly, the scope of data collected (on both the level of the node and the level of the firm/research organization – explained in section 3.3) was not broad enough to conduct statistical analyses.

Following Yin (2009), a useful research strategy for examining a contemporary event is the case study. Case studies can be used to provide description, test theory, or generate theory (Eisenhardt 1989: 535). According to Yin, the case study research approach is especially fruitful when the researcher's objective is to explain how and why, for example, certain events or developments have taken place (Yin 2009: 9). In relation to this study of innovation intermediaries in transnational innovation networks, it is the first and last-mentioned aims that are of relevance. In other words, the objective of this case study research is firstly to provide a description of the role innovation intermediaries have in the context of the five transnational innovation networks operating within the StarDust project. In addition, the case study research aims to contribute to the generation of theory by constructing an analytical framework with which it will be possible to analyze and explain the capability gaps in different actor groups that drive the

need for external support, as well as the innovation intermediary functions that address these gaps. The analytical framework builds on existing theoretical work on “innovation intermediation functions” (Howells 2006) by relating the functions to “metanational capabilities” (Doz *et al.* 2001), and further developing Howells’ list of innovation intermediation functions to include activities and services related to innovation processes undertaken in transnational networks (see section 2.5).

3.2. Research Context

This section elaborates on the research context – explaining the choice of the StarDust project case and the various types of participants involved in the study, and describing the unique “insider role” I was afforded as a researcher.

3.2.1. Constructed Transnational Innovation Networks - the StarDust case

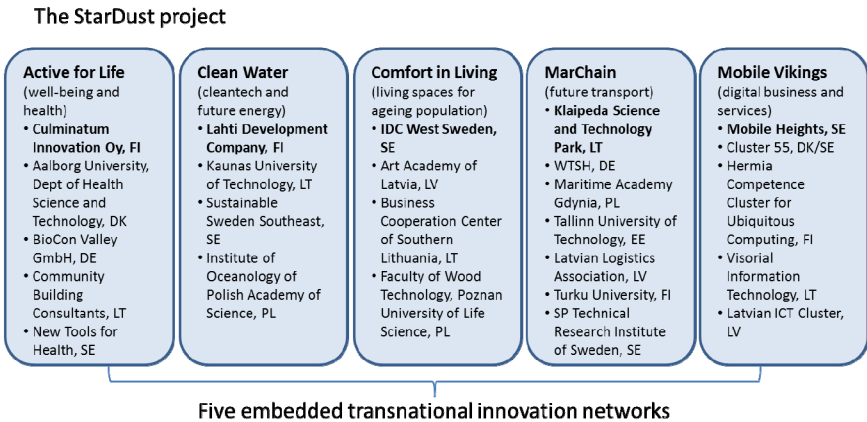
This study explores how innovation intermediaries are used to support companies’ and research organizations’ transnational innovation processes – using a single, embedded case: the StarDust project. The case provided the opportunity to study a number of innovation intermediaries who worked actively to support international innovation processes for particular groups of innovation actors (including companies and research organizations). The intermediaries represented clusters or other types of specialized innovation environments in different business sectors. These innovation environments partnered together in five transnational innovation networks. All five transnational innovation networks participated in one single case context – the StarDust project.

The case study investigates both innovation actors’ needs for external support, and the support functions that innovation intermediaries fulfill in relation to these needs. Thus, the case study has two embedded units of analysis: innovation actors (i.e. companies and research organizations) and innovation intermediaries.

The StarDust project (the Strategic Project on Trans-national Commercial Activities in Research & Innovation, Clusters and in SME-Networks) is a three year (2011-2013) project, financed within the European Union’s Baltic Sea Region (BSR) Programme. StarDust aims at strengthening competitiveness and economic growth in the Baltic Sea Region by fostering transnational linkages between specialized research and innovation nodes in the region – and is part of the broader BSR Stars programme framework.²⁴

The core of StarDust is its set of 5 transnational innovation networks – called “pilots” – operating in the fields of well-being and health, clean water, design of living spaces, sustainable transport, and digital business and services. Each pilot is a network comprised of innovation nodes²⁵ in at least three countries, with one node serving as the “lead partner” of the network. The pilots have the objective of mobilizing competencies that are found in different locations around the BSR – leveraging the whole of the resource base. An overview of the five transnational pilots (including lead partners and partnering nodes) is provided in Figure 5 below.

Figure 5: Five Transnational Innovation Networks (Pilots) in StarDust



²⁴ More detailed descriptions of both the BSR Stars programme and the five transnational innovation networks embedded in the StarDust project are provided in sections 4.2 and 4.3 respectively.

²⁵ Where each innovation node can be a research milieu, cluster initiative, or group of SMEs

Whereas the innovation intermediaries studied in this case are also partners in the five transnational networks (see above), the innovation actors (companies and research organizations) that are studied have not necessarily been involved in the project's implementation. Rather, the innovation actors are associated with a particular innovation intermediary through local/regional cluster initiatives or other types of specialized innovation environments. The focus of the study is on innovation actors' needs for external support, and the support functions that innovation intermediaries fulfill in relation to these needs. The project goals and implementation are not the focus of the study. Rather, the StarDust project has provided a case of constructed transnational innovation networks that can be explored as a first step to better understanding how innovation intermediaries could be used to foster firms' and research organizations' transnational innovation processes.

The StarDust case was chosen for a number of reasons: it exemplifies the typical goals and structure of transnational innovation networks (where there is least operational experience from which to draw lessons for policy development); it provided the chance to examine two embedded units of analysis; and it provided the opportunity to group and analyze results by business sector.

The StarDust pilots exemplify the typical goals and structure of transnational innovation networks. Transnational innovation networks are characterized by knowledge transfer and other links between an innovation node in one country, with other actors embedded in innovation nodes in other countries. These innovation processes are internationally-interdependent – leveraging differentiated and specialized competencies brought together in collaborative activities to address a shared goal. This makes StarDust a kind of representative case of “global techno-scientific collaboration...the type that can reinforce a country's scientific and technological potential and, therefore, its competitive performance” and where “there is a strong case for public policy to provide incentives for the development of such international cooperation” (Archibugi and Iammarino 1999: 265). As this is an area of innovation policy with high relevance, but less experience from which to draw, this makes the StarDust case an interesting one from which to learn and inform future policy development.

The StarDust case also provided the chance to examine two embedded units of analysis – both innovation actors' support interests and innovation intermediaries support responses – at the same time. Existing literature typically focuses on either the actors' barriers to internationalization and support needs, or the role of intermediaries in the process. This case study has enabled a

comparative analysis of what needs and support interests innovation actors have, relative to the support functions that innovation intermediaries provide. This study provides a new contribution to the research field by bringing these two perspectives together.

Finally, the StarDust case provided the opportunity to group the embedded units in the different constellations – i.e. the transnational networks that were the core of the StarDust project. The five pilots represent a range of sectors or areas of specialized knowledge, providing the opportunity of analyzing research results for the case as a whole, as well as for the individual networks. Each of the five networks has the same relative “network maturity”, yet the individual innovation nodes have different ways of working with internationalization. Thus, this case also provides a unique opportunity to study a heterogeneous set of innovation intermediaries.

An additional reason for choosing to study the StarDust case has been my insider role²⁶ on the project, which has provided rather unique access to studying both innovation intermediaries (the pilot partners) and their associated innovation actors (companies and research organizations) over the three-year project period.

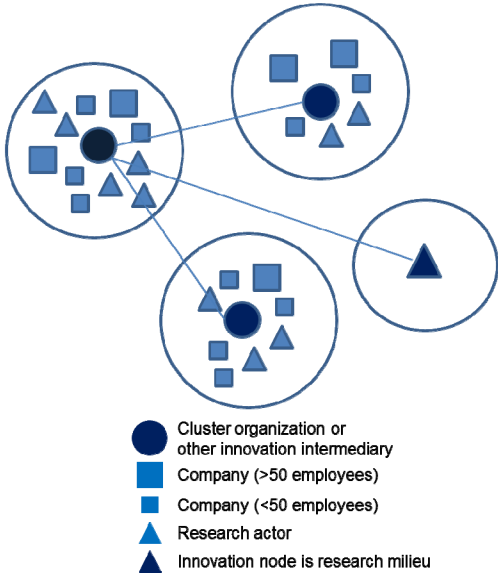
Although there have been a number of positive aspects contributing to the choice of the StarDust project as the focus for this case study, the overall programme construct of BSR Stars (and StarDust project), as well as the top-down method of selection of the transnational innovation networks involved in the project might have contributed to a bias in research results. These, and other limitations and challenges, are explained in section 3.4.

²⁶ I elaborate on this insider role in section 3.2.3.

3.2.2. Research Participants on multiple levels

As mentioned above, the StarDust case has allowed studying two embedded units of analysis – or two levels of research participants: the level of the innovation intermediary and the level of their associated innovation actors (i.e. companies and research organizations) – see Figure 6 below.

Figure 6: Illustrative view of Research Participants in each StarDust pilot



One level of participants was the level of the innovation intermediary. For each of the five networks, the lead partner was asked to identify three other partners or associated partners to include in the study (see Appendix I). In total, 20 innovation nodes were included in the study (see Appendix III for a list of innovation nodes included in the study). Innovation nodes were either a research milieu, cluster initiative, or group of SMEs. The latter two types of innovation nodes were represented by an innovation intermediary (a cluster organization or organization with

similar responsibilities). Of the 20 innovation nodes involved in the study, 14 were represented by innovation intermediaries. (The six others were represented by individuals working within the research milieu.) A more detailed description (e.g. type of organization, geographical location, sector of specialization, etc.) of each of the 20 innovation nodes involved is included in section 4.3 (empirical context). For innovation intermediaries, additional information is provided, including: number of member organizations, description of activities/ services offered, how much time spent with “internationalization” services, etc. The innovation intermediaries had a mandate to foster international innovation processes as a part of the project construct, yet may not have been representative of their innovation actors’ needs or interests.

The second level of participants was the level of innovation actors – the companies and research organizations associated with each of the innovation intermediaries. Each of the 14 innovation intermediaries involved in the study was asked to send a list of five (or more) companies and research organizations operating within the innovation node to involve in the research/learning activities (see Appendix II). In total, contact information was received for 73 innovation actors, of which 15 were research organizations, 20 were large or medium companies, and 38 were small companies (see Appendix IV for a list of innovation actors involved in the research). As mentioned above, the innovation actors (companies and research organizations) that are studied have not necessarily been involved in the project’s implementation.

3.2.3. Researching as an “insider”

I have had a rather unusual journey as a PhD student – not only because my industry sponsor (VINNOVA) is not a company but a governmental agency with a mandate for innovation policy development and implementation in Sweden, but also because I have conducted my PhD research parallel to maintaining an active role on projects. Most of my project work has focused on analysis and policy development related to clusters and international linkages between them, with a particular connection to this discussion in the BSR countries.

As is typical to the process, the research questions I had at the start (in 2007) were much broader – exploring the internationalization of innovation policy in the BSR. My research questions became more focused as the discussion and activities between policymakers in the BSR evolved. When the EU Strategy for the BSR was launched in 2009, catalyzing transnational linkages between specialized research and innovation environments was one of the prioritized flagship activities (see section 4.2. below). The BSR Stars programme was designed based on this overall objective.

The StarDust project was developed (in 2010) to be a first milestone in implementing BSR Stars and was in many aspects viewed as a policy experiment – testing different approaches for initiating transnational innovation projects, and different methods for strengthening collaborative innovation activities between innovation nodes and “their” innovation actors. Thus, research activities were included as an integral part of the project in order to learn from this experiment – feeding into future policy development in this area.

As explained above, one of the reasons the StarDust case was chosen was because of the unique access it provided me as a researcher. In fact, VINNOVA (who coordinates the project and where I have been employed part-time) gave me the responsibility to lead the research and learning activities within the StarDust project. I was thus able to design the research to address both general questions about how to develop transnational innovation projects, as well as my more specific research questions focused on improving understanding of innovation intermediaries' role in this process. In essence, StarDust provided me with a case to study.

Since the project start (in January 2011), my role in the project has been clear: I have had responsibility for studying the five transnational innovation projects both as an outside researcher (conducting a case study for my PhD), and as an embedded (or "inside") researcher/analyst (providing input to the ongoing development of the transnational innovation networks and drawing lessons learned for future development of the BSR Stars programme). This has meant wearing two hats over the course of the project, yet I have not experienced a conflict between the two as my role of researcher (observing and analyzing, rather than being directly involved in the transnational innovation projects' activities) has been communicated from the start.

As a member of the StarDust management team, I was considered an insider to the project – which provided me with legitimacy, acceptance, and unique access to the partners of the five transnational network pilots. Through my mandate as "StarDust researcher", I was afforded some level of "priority access" both to interviews with project partners (i.e. the various innovation nodes in the five transnational networks), as well as to contact information to their associated companies and research organizations. Following my request, the innovation nodes also provided assistance with disseminating the survey to their associated companies and research organizations – in essence giving me acceptance and legitimacy even with companies and research organizations I had never contacted before. This insider role provided me with easier access to more in-depth data. Being an insider to the project has also provided me with a greater depth of understanding of the context in which the various innovation nodes/project partners operate.

Another – and perhaps the most notable – benefit of being an "insider researcher" is the ability to more directly apply research findings into practice. Aside from VINNOVA, there are several other regional and national innovation policymakers involved in the project who are interested in the research results.

The results will be used not only to inform the future development of the BSR Stars programme, but may also be useful inputs to regional and national policy design in the future.

Corbin Dwyer and Buckle (2009) highlight a number of the same benefits to being a member of the group one is studying – namely increased trust and openness of research participants, access into groups that might otherwise be closed to outsiders, and a common ground (understanding) from which to begin the research. Being an insider provides substantial benefits, but also has the potential to impede the research process if “participants make assumptions of similarity and fail to explain individual experiences fully, or if the researcher’s perceptions are clouded by his or her personal experience” – possibly affecting the analysis (*ibid*: 58). I have tried to address this challenge by conducting a series of data collection activities and continually iterating between the data collection and analysis processes (see next section).

Another challenge to being an “insider researcher” is continually having to balance the dual role of employee/project participant and academic researcher. In practice, this has meant that I have not been able to focus 100% on either role. Rather, I have had to shift back and forth from being mostly an academic researcher (spending limited time taking care of project tasks), to being mostly a project analyst (spending limited time taking care of academic research tasks).

3.3. Methods of Data Collection and Analysis

This section describes the methods of data collection and analysis – elaborating on the overlapping process between the two.

3.3.1. Sources of Evidence

This study of the role of innovation intermediaries in supporting transnational innovation networks has relied on two main sources of evidence: interviews and surveys. This data was supplemented with participant observation over the

course of the three-year StarDust project.²⁷ By combining several sources of evidence, particular themes emerging from one source of evidence could be further explored using another source of evidence. This data triangulation (Yin 2009: 116) was an essential element in the iterative process of analysis.

Interviews

Within the realm of this study, a total of 44 interviews have been conducted. 37 interviews were conducted with innovation nodes (partners and associated partners involved in each of the five pilots) in two phases over the course of the project (see process of data collection below, as well as Appendices III and X). And 7 follow-up interviews were conducted with companies or research organizations who had participated in the survey (see Appendix VIII).

Interview guides were developed to help operationalize the research questions (see section 1.2) as well as collect additional information relevant to the StarDust project. Questions posed in initial interviews and the surveys (see below) were designed to provide direct responses to research questions. Later interview sessions focused on providing more in-depth information and explanatory factors behind earlier interview and survey responses. Interview guides were developed in consultation with colleagues at VINNOVA, colleagues in the StarDust project management team, and procured experts (in relation to questions on cluster dynamics, which are not included in this research). An overview of the various interview guides is provided in Table 8 below. Additional information is provided in the description of data collection and analysis.

²⁷ See, for example, Marshall and Rossman (2006) and Yin (2009) for descriptions of various sources of evidence.

Table 8: Overview of Interview Guides – target groups and objectives

Target Group	Objective	Interview Guide	# of Interviews
Innovation Nodes (initial interviews)	- Understand background of the pilot network	Appendix I	(5)
	- Collect information on the innovation node (including how the organization works with fostering international innovation processes)	Appendix II	20
Associated Innovation Actors (companies and research organizations)	- Collect more in-depth information on internationalization priorities, practices and support needs (following-up and gathering more detailed information on survey responses)	Appendix VII	7
Innovation Nodes (follow-up interviews)	- Collect information on activities and services provided to associated actors, and on results achieved in the transnational innovation network (pilots) in order to compare to initial data collected	Appendix IX	17

Interviews focused on a number of themes (outlined in the introduction of each interview guide). Interviewees were asked to provide structured responses (with some elaboration) on some themes, and more open responses to other themes. Thus, the interviews can be characterized as a combination of structured and semi-structured. Interview sessions typically lasted 1-2 hours, and were simultaneously transcribed. Transcribed notes from each interview were sent interviewees for confirmation and adjustments.

Surveys

In addition to interviews, a cross-sectional survey was used to collect data from the companies and research organizations associated with the innovation

intermediaries involved in the study (see research participants in section 3.2.2. above). Surveys were used to collect basic information from innovation actors, and reach a larger number of companies and research organizations from each involved innovation node.

A questionnaire was designed following desk research on cluster organizations'/intermediaries' activities related to facilitating international networks (see, for example, Meier zu Köcker *et al.* 2011) and consultation with colleagues at VINNOVA²⁸ and in the StarDust management team. As with the interview guides, the questionnaire was designed to operationalize the research questions and provide other information relevant to the StarDust project. (Additional information is provided in the description of data collection and analysis.)

In the questionnaire, an introduction provided an explanation of the objectives, as well as a definition of basic concepts used in the questions. *Research* was defined as activities focused on developing (internally or in collaboration with others) and exchanging/transferring knowledge. *Innovation* was defined as activities focused on transforming knowledge into new products, services, production processes, organizational structures, or business models. *Internationalization* (of research and innovation) was defined as activities focused on leveraging international sources to develop and transfer knowledge, or to transform knowledge into innovations. The questionnaire included a combination of close-ended questions (using a Likert scale) and open-ended questions (see Appendix V).

The questionnaire was 'programmed' into an online survey system available at VINNOVA (Smart Reports) and tested – with support from Kenth Hermansson at VINNOVA. The survey was disseminated electronically (each targeted survey respondent had their own ID/password), with the support of the innovation intermediaries (i.e. the cluster organizations sent out links to the electronic surveys and instructions to each of the targeted companies and research organizations for "their" innovation node).

²⁸ Anna Sandström and Kenth Hermansson

The survey was sent to the 73 associated actors (companies and research organizations) identified by the 14 innovation intermediaries involved in the study. An overview of the targeted survey participants is found in Appendix IV.

Responses were collected over the course of several months. The innovation intermediaries assisted with sending reminders – helping to increase the response rate. Results were collected from 59 respondents (see description of data collection and analysis below, and Appendix VI), leading to a final response rate of 81%.

Participant Observation

The two main sources of evidence (interviews and surveys) were supplemented by participant observation. Given my role of “insider researcher” on the StarDust project, I have had ongoing access to observe the development of the five transnational innovation network “pilots”. I have had a moderate degree of participation – maintaining a balance between “insider” and “outsider” roles and allowing a good combination of involvement and necessary detachment to remain objective in my role as researcher on the project. This observation with a moderate level of participation has helped me to simultaneously reflect and inquire – aiding my interpretation and understanding of the data collected in interviews and surveys (see, for example, Evered and Louis 1981, Zahlne 2012).

In addition to the interviews with the innovation nodes, I have had continuous contact with the pilot leads through regular management meetings (held 4 times a year) and other conferences. I have had the opportunity to observe interactions between all network partners through various internal pilot workshops, and through two evaluation/coaching sessions (held in January 2012 and January 2013).

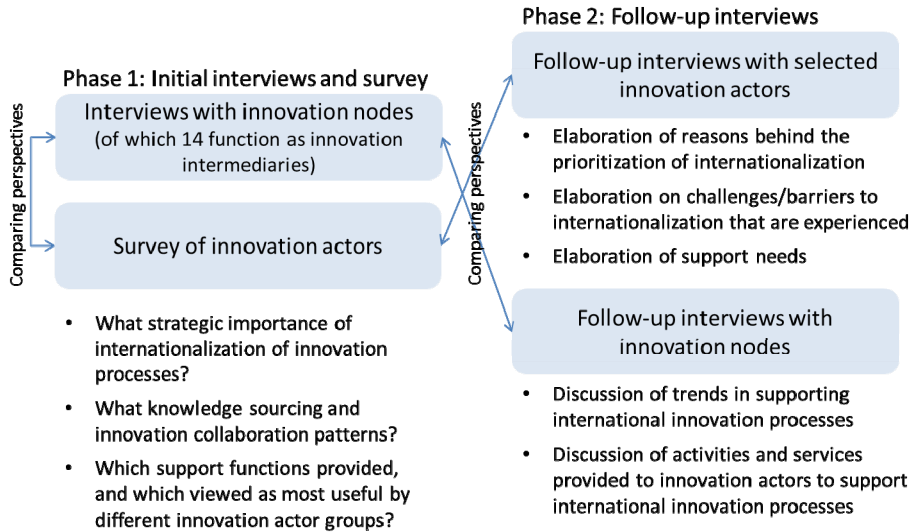
Other StarDust management team members have had more active participant roles. These colleagues have given regular status reports – providing me with secondary sources of evidence over the course of the project.

3.3.2. Overlapping Process of Data Collection and Analysis

The research process in this case study has been characterized by overlapping processes of data collection and analysis (Eisenhardt 1989: 538), employing multiple sources of evidence to derive results (Yin 2009: 114-118). The iterative

process of data collection and analysis has been structured into two main phases, illustrated in Figure 7 and described in more detail below.

Figure 7: Overlapping Process of Data Collection and Analysis



Phase 1 – Initial Data Collection and Analysis (March-December 2011)

The purpose of initial data collection and analysis was to describe the starting point for the five pilots and provide answers to the following initial research questions:

- Do companies and research actors find innovation intermediaries useful to facilitate external knowledge inputs and collaboration?
- For which actors (e.g. small companies, medium/large companies, or research organizations) are innovation intermediaries deemed most useful?
- What functions do these innovation intermediaries fulfill?

The first phase of data collection was comprised of two main steps: interviews with 20 innovation nodes/partners within the five transnational innovation networks, and surveys of companies or research organizations working within (some of) the above-mentioned innovation nodes.

First, structured interviews were conducted with the lead partners of each of the five pilots, as well as three additional nodes involved in the pilot activities (in total four nodes for each pilot). The pilot lead was asked to identify which other three nodes should be included in the research. (The interview guides are included as Appendices I and II, and the list of 20 interviews is included as Appendix III.) Questions were posed regarding: general information about the innovation node and if/how they support international innovation processes; the importance of, strategy for, and main barriers to international cooperation; location/types of collaboration partners, and current status of collaboration/cluster dynamics within clusters and between the nodes of pilots. Of the 20 nodes interviewed, 14 were innovation intermediaries (cluster organizations or similar). These 14 nodes were asked to send lists of at least five innovation actors (companies or research organizations acting within their nodes). Contact information was received for 73 innovation actors (companies or research organizations).

Second, online surveys were conducted with the innovation actors identified in the first step. Scaled questions were posed on the following topics (see survey in Appendix V):

- Importance of international knowledge sources and collaboration
- Usefulness of cluster organization/intermediary in facilitating outside knowledge inputs and collaboration
- Which functions/activities and services were viewed as most useful
- Location/types of outside sources of knowledge and collaboration

Results were collected from 59 respondents (see Table 9 below, and Appendix VI), leading to a final response rate of 81%. Companies had a higher response rate (at 83%) than research organizations (at 73%). Among companies, small companies had the lowest response rate (at 79%). Based on a sampling of non-respondents, research organizations' lower response rate seems due to their lack of familiarity with the transnational initiative. For companies, a lack of time seems to be the driving factor. However, analyzing the response rates by innovation node is more telling. It seems that innovation nodes that put extra effort into following-up and encouraging their actors to respond to the survey had higher response rates; whereas innovation nodes that did not follow up (due to lack of time or other motivation) had much lower response rates.

Table 9: Overview of Survey Responses

Pilot Name	Responses from Intermediaries ²⁹	Responses per Innovation Actor Respondent Category				Total # of Innovation Actor Responses
		Research Orgs.	Large Companies (>250 employees)	Medium Companies (51-249 employees)	Small Companies (< 50 employees)	
Active for Life <i>(well-being and health)</i>	3	2	1	1	6	10
Clean Water <i>(cleantech and future energy)</i>	2	0	2	1	7	10
Comfort in Living <i>(living spaces for ageing population)</i>	2	2	0	2	7	11
Marchain <i>(future transport)</i>	3	4	3	3	3	13
Mobile Vikings <i>(digital business and services)</i>	4	3	2	3	7	15
TOTAL RESPONSES:	14	11	8	10	30	59

Results from the initial data collection and analysis were summarized in “baseline reports” for each of the five pilots and for the StarDust project overall. These reports included information on the patterns of external knowledge sourcing and innovation collaboration, reported strategic importance placed in internationalization of research and innovation, perceived usefulness of innovation intermediaries in providing support to these activities, and the

²⁹ For the purpose of the survey, (innovation) intermediaries were defined as organizations (working with multiple companies and research organizations) focused on facilitating innovation processes.

particular functions that were viewed as most useful. The reports highlighted distinctive knowledge sourcing/collaboration patterns and intermediary support interests for each actor group (and for each pilot/business sector), and how support interests coincided or diverged from support priorities reported from innovation intermediaries.

These were presented and discussed with the StarDust pilots (as an input to their strategic action planning), and provided initial insights that lead to additional questions (regarding internationalization priorities, capability gaps and reasons behind needs for intermediary support) which were explored during a second phase of data collection and analysis.

Phase 2 – Follow-up Interviews and Iterative Analysis (January – June 2013)

The purpose of the second phase of research was to conduct follow-up interviews with both innovation actors and the innovation nodes in order to develop a deeper understanding of their perspectives and confirm (or not) initial interpretations of the data.

Follow-up interviews were conducted with a selection of survey respondents in order to develop a deeper understanding of their priorities for internationalization, any challenges or barriers to internationalization that they experience, and which capabilities they feel may be lacking – where they feel external support would facilitate their internationalization activities.

Structured and semi-structured interviews (see interview guide in Appendix VII) were conducted with a limited number of survey respondents (5 small companies, 1 large company, and 1 research organization), selected from two innovation nodes within the Active for Life pilot and two innovation nodes within the Mobile Vikings pilot (see list of follow-up interviews in Appendix VIII). Innovation nodes in these pilots were chosen as they represented the highest and lowest ratings of usefulness of innovation intermediaries. In addition, by conducting follow-up interviews with survey respondents from two different pilots, it was possible to see if companies and research organizations that operate in different business sectors had notably different capability gaps and needs for external support (or not) – guiding the method for organizing and interpreting the data (discussed later).

In addition, a second round of structured and semi-structured interviews were conducted with the innovation nodes interviewed in phase one (see interview guide in Appendix IX). Some innovation nodes had left the project, and some

new innovation nodes had been added. Therefore the list of interviewees in the follow-up (see Appendix X) is not identical to that of the initial baseline. These interviews aimed at discussing activities and services provided to innovation actors, and discussing results achieved in the transnational innovation networks (both in terms of closer social and institutional proximity/cluster dynamics within the network – and in terms of new collaborative projects and product/service development). Results on cluster dynamics from these interviews were compared to results from initial interviews, and were summarized in a “follow-up measurement” report (but are not included as part of this thesis).

During the final phase of analysis, informal discussions with innovation nodes and participant observation during workshops with innovation policymakers has contributed to the interpretation of results.

3.3.3. Organization and Interpretation

The analysis of this case study used both qualitative and quantitative data in order to explore factors driving support needs for different groups of innovation actors (small companies, medium/large companies and research organizations), and how these relate to support functions provided by innovation intermediaries. The data was organized and interpreted according to actor group, business sector (i.e. the five pilots), as well as across actor groups for the StarDust case as a whole.

Data collected during the first phase was analyzed to establish some initial patterns regarding the usefulness of intermediaries and the functions that they provide. The data was analyzed first for the StarDust case as a whole in order to compare responses and establish patterns between innovation intermediaries and innovation actors, as well as between groups of innovation actors: between companies and research organizations, as well as between small and medium/large companies. The patterns for all innovation actors and for each innovation actor group were displayed in graphs illustrating percentages of respondents, which could then be used to compare results for each of the five pilots and each of the 14 innovation intermediary nodes.

The overall baseline report presented an analysis of results (on internationalization priorities, knowledge sourcing and collaboration patterns, and perspectives on the usefulness of various support functions) by actor group (i.e. small companies, medium/large companies and research organizations) –

and compared these to the perspectives of the innovation intermediaries. The “baseline analyses” for each of the five pilots highlighted any patterns that diverged from the overall results for the StarDust case as a whole.

The analysis after the first phase of data collection highlighted a number of things that guided the next phase of research:

- the lack of differentiated patterns by pilot (indicating that business sector/area of specialization was perhaps not much of a driving factor for external support needs to international innovation processes)
- the differentiated patterns by actor group (indicating that external support needs to international innovation processes were driven by factors that were specific to each actor group)
- the different perspectives that innovation intermediaries and “their” actors had on the most useful functions to support international innovation processes (indicating a need for further exploration to explain the gap)

This led to new questions about what drives external support needs in each actor group, and how innovation intermediaries work practically to address these needs. These questions were explored during the second phase of data collection and analysis.

Data collected during the second phase was analyzed to understand the overall barriers and capability gaps that drive innovation actors’ need for external support to international innovation processes. This data on support needs was interpreted and categorized according to the three “metanational capability” areas (explained in section 2.5.1.) for each actor group. This data was also analyzed in relation to data collected in the first phase in order to understand the relation between support needs and intermediary support functions that were most prioritized. This phase of analysis contributed to a revision of the initial grouping of intermediary support functions – establishing three “internationalization support” categories.

Follow-up data collected from innovation intermediaries was analyzed to establish a better understanding of intermediaries’ perspectives on their involvement in supporting international innovation processes, as well as how their role had changed over recent years. This data was also useful in conducting an initial analysis of the particular role of cluster organizations – as one type of intermediary supporting international innovation processes.

3.4. Limitations and Challenges

Although this case study research has provided the opportunity to collect in-depth information over time from multiple actor groups (intermediaries, as well as their client companies and research organizations) across several different business sectors (the five transnational pilots), it has had a number of limitations and challenges related to the choice of the StarDust case, and the choice of research methods (in particular the insider role I have had as a researcher).

3.4.1. Limitations and Challenges related to the choice of the StarDust case

One of the limitations related to the choice of the StarDust case is its focus on a particular set of innovation actors and intermediaries engaged in transnational innovation networks, and not including a control group engaged in other forms of internationally-interdependent innovation activities (such as bilateral innovation projects or global value chains, etc.).

In particular, the StarDust case is limited by the potentially biased nature of the innovation intermediaries and actors being studied. The five transnational networks were selected from a pool of applicants responding to an open call for proposals conducted in early 2010 aimed at strengthening international linkages to address grand challenges. The call period was quite short (to meet application deadlines), so national agencies put extra efforts into communicating the call to existing innovation nodes (in most cases, cluster initiatives or similar centers of expertise) in their geography and encouraging these nodes to apply. The innovation intermediaries (cluster organizations or similar) played an active role in developing the strategic vision for these networks – with little time to involve their associated companies and research organizations. Although each network is considered as an open platform seeking to involve other research and innovation nodes in their activities, the set of partners and associated partners included in each pilot is formalized through project contracts.

Given the objective of the call, only innovation nodes with an interest in developing transnational cooperation applied. The set of innovation intermediaries that participated in the research have chosen to be involved in the StarDust project, and therefore likely have both a “pro internationalization” bias, and higher levels of experience in working with international innovation

processes. This has most likely contributed to positive bias in the responses – both from innovation intermediaries and their associated innovation actors.

Given that the five transnational innovation networks/pilots are a project construction (despite the call), and the participating innovation intermediaries likely have a positive bias, it is uncertain if the StarDust case can be considered representative of the broader set of innovation intermediaries and innovation actors. The strong likelihood of a positive bias in the research results is an embedded challenge of the StarDust case. Future research could examine innovation intermediaries in other transnational innovation networks, employing the same (or similar) research approach in order to confirm (or disprove) the results of this case study research.

In addition to the focus on a particular construct of transnational innovation networks, this case study has been conditioned by its focus on a particular type of innovation intermediary, namely “cluster organizations” – i.e. specialized institutions (taking on various legal forms) responsible for managing organized efforts to increase the growth and competitiveness of a cluster³⁰. Cluster organizations work with firms, government and/or the research community primarily on the local/regional level. In addition to cluster organizations, there are other types of intermediaries that are involved in supporting transnational innovation processes (e.g. trade and investment attraction agencies, business development and innovation agencies – on regional and national levels). To address this limitation, interviews have included questions on how the various actors (cluster organizations, companies and research organizations) work with other types of intermediaries to address the support needs. Future research could explore this (i.e. the different roles that various types of intermediaries play in supporting transnational innovation processes) further.

³⁰ Clusters are geographical proximate groups of interconnected companies and associated institutions in a particular field, linked by commonalities and externalities.

3.4.2. Limitations and Challenges related to choice of research methods

The selection of and limited number of company and research actors involved in the survey is another factor that may contribute to a positive bias in the research results. The method of selection of innovation actors participating in the research has not been random. Rather, they were identified by the innovation intermediaries. These innovation actors may therefore not be representative of the broader population of actors.

The limited scope of innovation actors participating in the survey (only five innovation actors per node with an innovation intermediary) and lack of information regarding the total population of innovation actors (i.e. how many innovation actors are active within the 14 nodes in total) can also leave questions about the reliability of the results.

My role as “insider researcher” has also presented challenges. One challenge is related to my personal experience with and perspectives on the role that innovation intermediaries can play in international innovation processes. These perspectives have developed over time – before initiating the PhD research – and have created an interest in researching the topic (which has supported the project), but also a number of biased beliefs which could affect the reliability of the research results. As discussed earlier, my insider role may also have affected research participants’ assumptions on what I know or how I interpret their responses.

3.4.3. Ensuring Reliability and Validity

To address the limitations and challenges related to the choice of the StarDust case and the research methods, several reliability and validity tests were considered.

Yinn (2009: 40) highlights four validity and reliability tests that are common to all social science methods: construct validity, internal validity, external validity and reliability. For this case study, internal validity tests have not been considered as the case has had the objective of exploring and describing a phenomenon – not to establish a causal relationship.

In order to ensure construct validity – ensuring that correct operational measures were used for the concepts being studied – this case study research

employed multiple sources of evidence (interviews, surveys and participant observation), and attempted to establish a clearer chain of evidence through follow-up interviews with survey respondents and two rounds of interviews with innovation nodes.

By working with existing theoretical frames on metanational capabilities (Doz *et al.* 2001) and functions of innovation intermediation (Howells 2006), the aim is that the case study findings (i.e. the role/functions of innovation intermediaries in facilitating transnational innovation networks) could be applied in other case contexts.

Reliability of the case study research was ensured through documenting and validating interview protocols with each interviewee, and maintaining a database with quantifiable results from interviews and surveys.

4. Empirical Context

This chapter provides a description of the broader contextual background that has led to the initiation of the StarDust case. The chapter is divided into three parts. First, the historical background and current trends in institutional and economic collaboration in the Baltic Sea Region (BSR) are presented. Second, a brief overview of the European Union’s construct of macro-regional strategies – and how this has been applied in relation to innovation policy in the BSR – is provided. Finally, the five transnational innovation networks (“pilots”)³¹ and the 20 innovation nodes that were the focus of this case study research are presented in more detail.

4.1. A Brief History of the Baltic Sea Region³²

The origins of a common regional identity around the Baltic Sea can be traced as far back as the Viking era (8th-11th centuries). A common language, developments in maritime transport (i.e. longboats), and use of the Baltic Sea as a channel to reach new territories (for trade and other purposes) are all characteristics of the regional identity in this period. The “Viking brand” is most often associated with violent raids (rather than trade) and is therefore not usually highlighted as an impetus of today’s macro-regional collaboration.

³¹ introduced in section 3.2.1.

³² Based on various web references including: Wikipedia, Encyclopedia Britannica, www.norden.org and YouTube videos from “Baltic Sea Region Setting Sails” conference organized by the University of Turku (<http://www.youtube.com/playlist?list=PL51079E7731A09953>)

Instead, the historical origin of choice is the Hanseatic League – an alliance between merchant guilds and towns for the protection and promotion of commercial trade. Initial cooperation activities between trading centers in Visby (on the island of Gotland in Sweden) and Lübeck (in Saxony, now Germany) started in the 13th century. The formal foundation of the League is set to 1356, when the first general assembly of member Hansa towns was held in Lübeck – establishing a structure to the alliance. Assemblies met irregularly, and the roster of network members fluctuated between 70-170 cities. Although the League had a fluid structure, its members shared some similarities. Many Hansa cities were independent (or gained increased independence through the collective bargaining power of the League), and they had strategic locations along trade routes (giving them economic and political clout).

The League expanded and gained strength – establishing kontors (or trading posts) in Bruges, Bergen and London; negotiating profits from trade agreements; controlling the shipbuilding market; and developing skills and methods to protect their trade investments. Yet increased power of the League led to internal rivalry and attracted competition from stronger territorial states (e.g. Denmark and Sweden). The last recorded meeting of the League was held in 1669.

The collaboration within Hansa was followed by a long period of competition between Kingdoms and nation-states. During this period, territories were integrated under different crowns.³³ Despite various wars and exchanges of territory, the countries of the Nordic region (Denmark, Finland, Iceland, Norway and Sweden) developed along similar paths – prioritizing social welfare and economic openness.

The 20th century marked a renaissance of neighborly cooperation among the Nordic countries, characterized by the formation of several institutions. The Nordic Association – founded by Denmark, Norway and Sweden in 1919 (and joined by Iceland in 1922, and by Finland in 1924) – was the first. The Nordic Association had the goal of promoting open borders, cultural affinity and closer Nordic cooperation. This was followed by the Nordic Council – an inter-parliamentary body formed in 1952 by Denmark, Iceland, Norway and Sweden

³³ For example, the Danish kingdom included Norway, Iceland, Greenland and the Faroe Islands, while the Swedish kingdom included Finland, and other territories of the Baltic Sea Region (parts of modern-day Estonia, Germany, Latvia, Lithuania, Poland and Russia).

(and joined by Finland in 1955), and by the Nordic Council of Ministers – an inter-governmental body formed in 1971.

With the fall of the Berlin Wall in November 1989, the Nordic countries renewed contact and cooperation activities with Eastern Germany, Poland, and the Baltic countries. The Nordic Council of Ministers has worked closely with Estonia, Latvia, and Lithuania (as well as Northwest Russia) for many years. The focus areas for this cooperation include education and research, innovation and the creative industries, the environment, climate and energy, economic cooperation and strengthening civic society. Today, a key international priority for the Nordic Council of Ministers (NCM) is development and growth in the Baltic Sea Region, and the NCM plays an important role in the implementation in the EU's strategy for the Baltic Sea Region (see next sub-section).

Today, the Nordic institutions have been joined by many other institutions promoting collaboration in the Baltic Sea Region, including: the Council of Baltic Sea States (CBSS), the Baltic Sea Chambers of Commerce Association (BCCA), the Baltic Sea States Sub-Regional Cooperation (BSSSC), and the Baltic Development Forum (BDF), among others.³⁴

Today's political and institutional collaboration in the Baltic Sea Region is driven not only by historical alliances (e.g. from the Hansa League), but also by existing trends in knowledge and business flows. Data on student flows, research cooperation and trade (see below) indicates that there are some very strong linkages and inter-dependencies, and that the trend towards greater integration has increased over time.

4.1.1. Student Flows

Data on international student flows provides an indication of where exchanges of knowledge and people take place. Data on international student flows among the Baltic Sea Region countries (see Table 10 below) illustrates relatively strong levels of intra-regional student flows. In 2000, around 27% of outgoing international students from BSR countries chose to study in another country in

³⁴ See Technopolis (2011), pp. 59-62 for a listing of other institutions working in the field of innovation.

the region. The incoming flow of international students was more diverse – with only 13% coming from other BSR countries.

Table 10: International Flows of Mobile Students at Tertiary Level (2000, 2007 and 2010)

	Outgoing Total	Outgoing to BSR	%	Outgoing to UK	%	Outgoing to US	%	Incoming Total	Incoming from BSR	% Incoming from BSR
2000										
Denmark	6483	2354	36,3%	1909	29,4%	984	15,2%	12 871	3548	27,6%
Estonia	3402	1131	33,2%	72	2,1%	533	15,7%	863	684	79,3%
Finland	10095	5167	51,2%	2579	25,5%	1699	16,8%	5 570	1472	26,4%
Germany	53048	3260	6,1%	13466	25,4%	14011	26,4%	187 033	14291	7,6%
Iceland	2417	1523	63,0%	222	9,2%	497	20,6%	403	204	50,6%
Latvia	2591	966	37,3%	86	3,3%	285	11,0%	5 991	375	6,3%
Lithuania	3814	2017	52,9%	77	2,0%	374	9,8%	539	67	12,4%
Norway	13145	3866	29,4%	4070	31,0%	2150	16,4%	8 699	2747	31,6%
Poland	17052	9964	58,4%	621	3,6%	2025	11,9%	6 117	1149	18,8%
Sweden	12269	3087	25,2%	4009	32,7%	1748	14,2%	25 548	8798	34,4%
	124316	33335	26,8%	27111	21,8%	24306	19,6%	253634	33335	13,1%
2007										
Denmark	4891	1542	31,5%	1567	32,0%	984	20,1%	12 695	5643	44,5%
Estonia	3240	1503	46,4%	230	7,1%	245	7,6%	966	641	66,4%
Finland	5768	2305	40,0%	835	14,5%	579	10,0%	10 066	2106	20,9%
Germany	76457	5031	6,6%	9047	11,8%	8847	11,6%	206 875	17815	8,6%
Iceland	2445	1369	56,0%	388	15,9%	431	17,6%	783	330	42,1%
Latvia	3834	1209	31,5%	882	23,0%	440	11,5%	1 433	588	41,0%
Lithuania	6707	2767	41,3%	1487	22,2%	548	8,2%	1 901	414	21,8%
Norway	11671	3694	31,7%	3017	25,9%	1217	10,4%	15 618	3839	24,6%
Poland	32264	13757	42,6%	6768	21,0%	2872	8,9%	13 021	2331	17,9%
Sweden	13511	4156	30,8%	3382	25,0%	2985	22,1%	22 135	3626	16,4%
	160788	37333	23,2%	27603	17,2%	19148	11,9%	285493	37333	13,1%
2010										
Denmark	5228	1508	28,8%	1536	29,4%	980	18,7%	12582	7195	57,2%
Estonia	3951	1677	42,4%	952	24,1%	218	5,5%	1087	779	71,7%
Finland	7282	3207	44,0%	1737	23,9%	657	9,0%	14097	2212	15,7%
Germany	103110	4442	4,3%	15162	14,7%	9463	9,2%	200862	13616	6,8%
Iceland	2635	1605	60,9%	288	10,9%	403	15,3%	889	378	42,5%
Latvia	4720	1344	28,5%	1623	34,4%	283	6,0%	1760	572	32,5%
Lithuania	8230	2847	34,6%	2913	35,4%	358	4,3%	2973	174	5,9%
Norway	12973	4022	31,0%	3295	25,4%	1454	11,2%	15737	4225	26,8%
Poland	30895	10793	34,9%	8316	26,9%	2244	7,3%	16976	3211	18,9%
Sweden	14794	4924	33,3%	3159	21,4%	3088	20,9%	31534	4007	12,7%
	193818	36369	18,8%	38981	20,1%	19148	9,9%	298497	36369	12,2%

Source: UNESCO Institute for Statistics, author's analysis

While Icelandic students exhibited the strongest preference for staying within the region (with 63% of outgoing students choosing another BSR country), Germany exhibited the weakest outgoing student flows to other BSR countries. Excluding Germany, all other countries had between 25-63% of outgoing students choose a study destination within the region.

Even when comparing against other English-speaking study destinations both within (UK) and outside of Europe (US), most students in BSR countries seem to prefer studying in other BSR countries. (German students are the exception.)

The data illustrates that the UK and the US are preferred over other BSR countries as study destinations.)

Within the group of BSR countries, Estonia and Iceland have substantially high levels of both outgoing and incoming student flows from other BSR countries (in all years sampled). This is perhaps due to the fact that both of these countries are quite small – and strongly linked to their nearest neighbors.

International student flows (both outgoing and incoming) increase in absolute terms over time, yet student flows within the BSR do not. While the level of incoming students from other BSR countries remains relatively stable, the level of outgoing students choosing other BSR countries decreases over time (from 27% in 2000 to 19% in 2007). If Germany is removed from the analysis, the results are a bit different. Intra-BSR outbound flows are at 42% in 2000 and 35% in 2010, and intra-BSR inbound flows are at 29% in 2000 and 23% in 2010. This data exhibits quite strong intra-BSR student mobility, yet highlights a decreasing trend over time. This decreasing trend can be due to new opportunities (including higher incomes or financial support) to study in more distant locations, relative attractiveness of other destinations, or a general ‘broadening’ of international student mobility.

4.1.2. Research Cooperation

Data on international co-publications provides an indication of research cooperation, illustrating the level of international collaboration (and with which countries they tend to partner) in the production of knowledge. Data on co-publications among the Baltic Sea Region countries (see Table 11 below) illustrates strong and increasing levels of intra-regional knowledge production. As with the data on student flows, the data on research cooperation provides support to the thesis that there is strong intra-regional collaboration in the BSR. At the same time, the data illustrates that certain countries (e.g. the Baltic countries and Iceland) are very strongly linked to their BSR neighbors, while others (e.g. Germany) have stronger ties elsewhere.

Table 11: International Co-Publications (2000, 2006 and 2012)³⁵

				Total co-published with other BSR	% of intl co-pub	Top 5 partners (by order of # of co-published articles)
2000	Total Articles	Total intl co-published	% of total	country		
Denmark	10729	4929	45,9%	2279	46,2%	USA, England, Germany, Sweden , France
Estonia	832	318	38,2%	307	96,5%	Sweden, Finland, Germany , USA, England
Finland	9945	3663	36,8%	1948	53,2%	USA, Sweden, Germany , England, France
Germany	92253	29060	31,5%	4004	13,8%	USA, England, France, Switzerland, Russia
Iceland	411	231	56,2%	180	77,9%	USA, Sweden, Norway, Denmark , England
Latvia	506	197	38,9%	161	81,7%	Germany, Sweden , USA, England, Russia
Lithuania	707	287	40,6%	207	72,1%	Sweden, USA, Germany , France, Poland
Norway	6378	2471	38,7%	1472	59,6%	USA, Sweden , England, Denmark, Germany
Poland	12894	4325	33,5%	1663	38,5%	USA, Germany , France, England, Russia
Sweden	19674	7729	39,3%	3470	44,9%	USA, Germany , England, France, Denmark
2006	Total Articles	Total intl co-published	% of total	Total co-published with other BSR	% of intl co-pub	Top 5 partners (by order of # of co-published articles)
Denmark	13088	6732	51,4%	3618	53,7%	USA, England, Germany, Sweden , France
Estonia	1151	495	43,0%	400	80,8%	Sweden, Finland , USA, England, Germany
Finland	12033	4876	40,5%	2851	58,5%	USA, Sweden, Germany , England, France
Germany	108851	42441	39,0%	6582	15,5%	USA, England, France, Switzerland, Italy
Iceland	689	402	58,3%	321	79,9%	USA, Sweden , England, Denmark, Norway
Latvia	536	233	43,5%	203	87,1%	Germany , Russia, Sweden , USA, France
Lithuania	1866	549	29,4%	410	74,7%	Germany, USA, Sweden , France, Poland
Norway	9642	4468	46,3%	2691	60,2%	USA, England, Sweden, Germany, Denmark
Poland	20444	6813	33,3%	2561	37,6%	USA, Germany , France, England, Italy
Sweden	23366	10860	46,5%	5372	49,5%	USA, Germany , England, France, Denmark
2012	Total Articles	Total intl co-published	% of total	Total co-published with other BSR	% of intl co-pub	Top 5 partners (by order of # of co-published articles)
Denmark	18900	10629	56,2%	6558	61,7%	USA, England, Germany, Sweden , France
Estonia	1888	1020	54,0%	1232	120,8%	Finland, Sweden , USA, England, Germany
Finland	13576	7078	52,1%	4829	68,2%	USA, Germany , England, Sweden , France
Germany	130424	59472	45,6%	11531	19,4%	USA, England, France, Switzerland, Italy
Iceland	1169	800	68,4%	838	104,8%	USA, Sweden , England, Denmark, Germany
Latvia	1043	338	32,4%	331	97,9%	Germany , USA, Estonia , England, Russia
Lithuania	2634	860	32,6%	951	110,6%	Germany , USA, France, Italy, England
Norway	13785	7633	55,4%	5132	67,2%	USA, Sweden , England, Germany, Denmark
Poland	27892	8461	30,3%	4778	56,5%	USA, Germany , France, England, Italy
Sweden	28726	16233	56,5%	9342	57,5%	USA, Germany , England, France, Italy

Source: Thomson Reuters Web of Knowledge, author's analysis

³⁵ International co-publications are determined based on the address of the authors. The fact that the percentage of intra-BSR co-publications exceeds 100% in 2012 (for Estonia, Iceland and Lithuania) is likely because multiple authors were from the foreign country.

The data shows that, in general, international collaboration on knowledge production has increased over time for all countries (illustrated by the rising percentage of international co-publications for nearly every country). This trend for collaboration on academic publications is particularly strong among the BSR countries. In 2000, around 30% of all international co-publications in BSR countries were with another country in the region. And the level of intra-BSR publications increases steadily over time – rising to 32% in 2006, and nearly 41% in 2012.

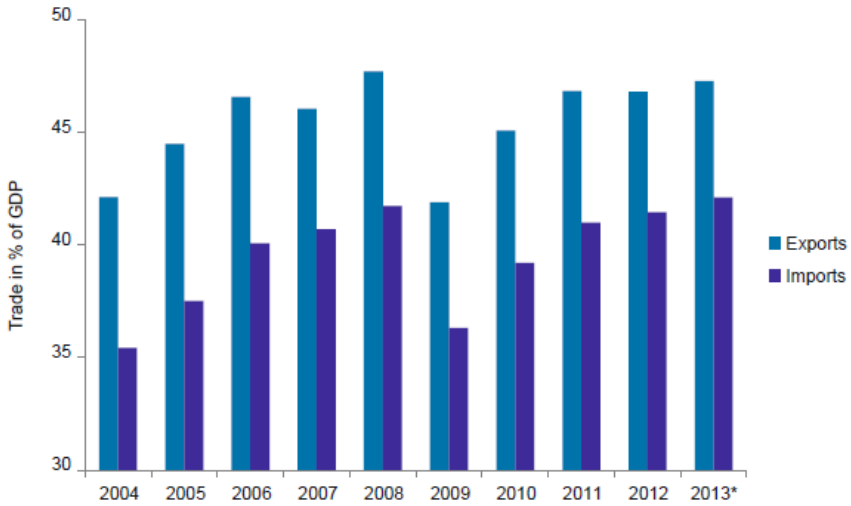
Of the articles that are co-published internationally, most of the BSR countries have quite strong co-publishing levels (39% or higher in 2000, and 57% or higher in 2012) with others in the BSR. Germany is again the exception to this trend. Estonia shows the consistently highest levels of intra-BSR co-publications (with levels of 80% or higher), and Germany shows the consistently lowest levels of intra-BSR co-publications (with levels increasing from 14% in 2000 to 19% in 2012).

It is also interesting to note that most countries’ “partners of choice” within the BSR region are similar: Germany and Sweden are most often in the top five, followed by Denmark, Finland, Norway and Poland. Researchers in the Baltic countries are not prominent partners for publications (although Estonia figures in the top five “partners of choice” for Latvia in 2012).

4.1.3. Trade Flows

International business flows can be measured in a number of ways. Trade flows (e.g. data on exports and imports of a country) is one indicator of linkages or inter-dependencies on a commercial level. The most recent State of the Region Report (Ketels 2013) provides an overview of intra-regional trade patterns over the last decade (see Figure 8 below), demonstrating relatively strong commercial linkages – with average intra-regional export levels between 41-47%, and import levels between 35-42%.

Figure 8: Trade Intensity of the Baltic Sea Region

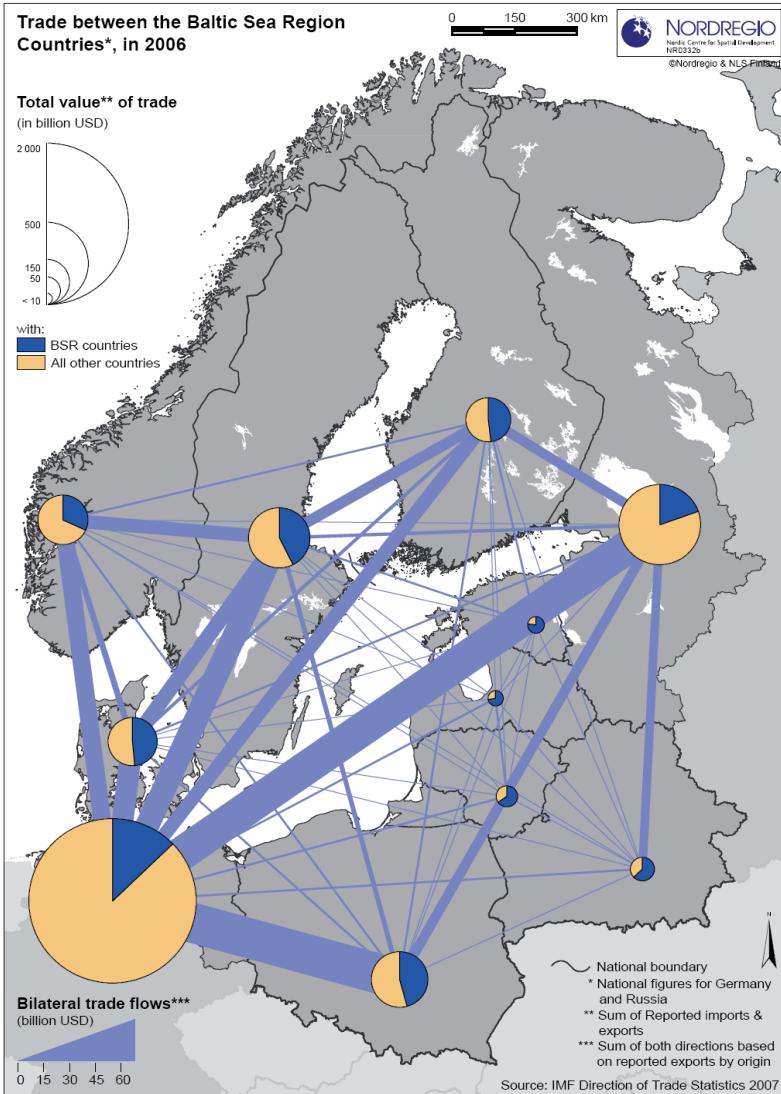


Source: Ketels (2013)

Schmitt and Dubois (2008) provided a more detailed picture of intra-regional trade flows on a country level (see Figure 9 below).

This data (from 2006) shows that the three Baltic countries (and Belarus) have a substantial degree of intra-regional trade. The Nordic countries (excluding Iceland – not included in the analysis) also have relatively high levels of intra-regional trade – around 30-50%. Germany and Northwest Russia, however, show quite low levels of trade with partners in the BSR – primarily due to their geographical location closer to larger continental European and internal markets (respectively).

Figure 9: Trade Flows in the Baltic Sea Region, 2006



Source: Schmitt and Dubois (2008)

The data presented above – demonstrating strong trends in cooperation/integration of knowledge and business activities in the Baltic Sea Region – indicates a certain level of functional integration in the territory. The existence of historical connections, political will and institutional frameworks, as well as relatively strong knowledge and business flows, served as a starting point for the initiation of the European Union’s first strategy for a macro-region.

4.2. Overview of EU Macro-Regional Strategies – and the EU Strategy for the BSR

The concept of macro-regions has its roots in international relations, and is used to describe a group of states that are linked together by a geographical relationship and a degree of mutual interdependence (Dubois *et al.* 2009: 18). In the context of the EU, the concept of macro-regions has been used in relation to multi-level governance, transnational cooperation, and territorial cohesion over the past decades, but was not introduced explicitly until 2009.³⁶

The EU Strategy for the Baltic Sea Region (EUSBSR)³⁷ is the first macro-regional strategy in Europe. The development of the strategy was driven by two parallel political processes: a European Council call to present a strategy for the Baltic Sea Region (European Council 2007), and a European Commission call for “an integrated approach to addressing problems on an appropriate geographical scale which may require local, regional and even national authorities to cooperate” (Commission of the European Communities 2008b: 11). The Baltic Sea Region was considered an appropriate test case for macro-regional strategic action based on the fact that BSR countries had an established history of networking and cooperation in many policy areas, and demonstrated considerable interdependencies (see sub-sections above).

The resulting strategy and accompanying action plan were adopted in June 2009 as one of the priorities of the Swedish presidency of the EU (Commission of the

³⁶ Dubois *et al.* 2009 provides a detailed review of the use of the macro-regional concept in EU policy documents.

³⁷ See <http://www.balticsea-region-strategy.eu/>

European Communities 2009b and 2009c). The strategy aimed at reinforcing cooperation within the BSR³⁸ in order to face several challenges by working together as well as promoting a more balanced development in the region. The strategy also aimed at optimizing the use of existing national and EU funds for territorial cooperation, and exploiting synergies across policy areas – thus contributing to major EU policies and reinforcing integration within the BSR. The macro-regional strategy was considered as a new model for cooperation to inspire other regions.

Two years later, the EU adopted a strategy for the Danube Region (EUSDR). In 2013, the European Commission submitted a report that clarified the concept of macro-regional strategies and evaluated their value (Commission of European Communities 2013). This report “confirmed that a macro-regional strategy is “an integrated framework relating to Member States and third countries in the same geographical area, that address common challenges or opportunities, and that benefits from strengthened cooperation for economic, social and territorial cohesion” (*ibid.*: 3). A macro-regional strategy (MRS) does not provide additional funding or create new policy, legal and institutional frameworks; rather the aim is to foster a better and more effective use of existing funds, institutions/structures, (local, regional, national, EU) policies, etc. Hence, the added value of a MRS is principally through more effective trans-national coordination and creation of synergies between national and regional policies.

The Commission’s 2013 report highlighted a number of areas where these macro-regional strategies have delivered value, including: improved policy development and joint policy initiatives, greater integration and coordination, improved value for money, and promotion of multi-level governance. This report also highlighted a number of challenges with macro-regional strategies, including: maintaining political commitment, alignment of funding, and measuring progress.

The EUSBSR established an integrated approach for addressing common challenges or exploiting unrealized potential, and was structured along four overall goals (or pillars): making the BSR an environmentally sustainable place;

³⁸ The EU strategy includes eight countries (all EU member states): Sweden, Denmark, Estonia, Finland, Germany, Latvia, Lithuania and Poland. Many activities include two additional (Nordic) countries: Iceland and Norway.

making the BSR a prosperous place; making the BSR an accessible and attractive place; and making the BSR a safe and secure place. Each pillar of the strategy was further broken down into priority areas and a number of specific actions (or flagships). Each priority area and action is coordinated by a region, country or supranational organization (alone, or in collaboration with others), and the coordinators have the responsibility of establishing concrete goals and measurements, monitoring implementation, and updating the composition of priority areas over time. The overall pillars in the EUSBSR have now been consolidated (to three), and priority areas updated. The latest pillars and priority areas are presented in Table 12 below.

Within the EUSBSR, the second pillar (making the region a prosperous place) outlines four priority areas related to achieving a more balanced economic development in the region: removing hindrances to the internal market; exploiting the full potential in research and innovation; implementing the Small Business Act; and reinforcing sustainable agriculture, forestry and fishing. The priority area (7) on research and innovation includes a number of activities (or flagship projects) to strengthen transnational collaboration on both policy and business levels in order to develop more efficient innovation systems that offer entrepreneurial dynamism and intensive linkages between top-level knowledge institutions, private investors, incubators and related business services. Achieving better coherence among the countries of the BSR is a challenge, as there are still quite notable differences between the capacity and performance levels of the more established innovation systems on the northern and western shores and those of the eastern and south eastern shores.³⁹ There are also differences in industrial structure and specialization. In line with the Commission's call for innovation strategies for smart specialization⁴⁰, the research and innovation activities within the EUSBSR aim at developing or strengthening linkages in complementary sectors or areas of expertise.

³⁹ See Technopolis 2011 for a more detailed analysis of innovation systems in the BSR.

⁴⁰ See <http://s3platform.jrc.ec.europa.eu/home> for more information about the concept of “innovation strategies for smart specialization”.

Table 12: Pillars and priority areas of the EU Strategy for the Baltic Sea Region

Pillar/priority area	Coordinating country/ies	Number of actions
<i>Pillar I: Save the Sea</i>		
Reduce nutrient inputs to the sea to acceptable levels	Poland/Finland	5
Preserve natural zones and biodiversity, including fisheries	Germany	3
Reduce the use and impact of hazardous substances	Sweden	8
Become a model region for clean shipping	Denmark	6
Mitigate and adapt to climate change	Denmark	3
<i>Pillar II: Increase Prosperity</i>		
Remove hindrances to the internal market	Estonia	7
Exploit the full potential of the region in research and innovation	Sweden/Poland	6
Implement the Small Business Act	Denmark	8
Reinforce sustainability of agriculture, forestry and fisheries	Finland	11
<i>Pillar III: Connect the Region</i>		
Improve access to, and efficiency and security of energy markets	Latvia/Denmark	4
Improve internal and external transport links	Lithuania/Sweden	5
Maintain and reinforce attractiveness of the BSR through education, tourism and health	Germany/Northern Dimension	14
Become a leading region in maritime safety and security	Finland/Denmark	8
Reinforce maritime accident response capacity and protection from major emergencies	Denmark	3
Decrease the volume of, and harm done by, cross-border crime	Finland	5

Source: Bengtsson (2009) and
http://ec.europa.eu/regional_policy/cooperate/baltic/doc/priority_areas.pdf

Despite quite strong functional linkages in several areas (see section 4.1 above), the linkages between specialized innovation environments (e.g. centres of expertise, cluster initiatives, etc.) across the BSR has been quite weak. In 2011, 80% of cluster initiatives did NOT have specific cooperation projects or networks in the BSR, yet noted the opportunities for strengthening cooperation

in particular fields (Technopolis 2011: 53). Several European programmes (e.g. INTERREG programme IVC and the BSR Programme, Regions of Knowledge, ERA-NET and INNO-NET programmes, BONUS, etc.) have helped catalyze stronger research and innovation linkages in the BSR. Establishing ‘joint programmes’ where BSR Member States pool national funds and launch common calls for proposals for RDI projects could help strengthen current cooperation patterns. One of the priority area flagships – BSR Stars – aims to do just this.

Building on existing commercial strengths and competencies around the BSR, the BSR Stars flagship aspires to foster the development of strategic alliances and collaborative innovation projects (between specialized research and innovation nodes) aimed at tackling common challenges. The vision for BSR Stars is to achieve global market leadership within particular “grand challenge areas” such as health, energy, sustainable transports and digital business and services.⁴¹ Since the launch of the action plan in 2009, the BSR Stars flagship has been highlighted as a good practice example both of policy-level programme development and governance, as well as operational-level activities to foster transnational innovation networks.

The original aim of the policymakers responsible for developing the BSR Stars programme was to launch a common call for proposals. However, with no new funding allocated to the implementation of the macro-regional strategies and little flexibility in national budgets, funding through the BSR Programme provided the first opportunity to put the programme into action. This was done through the StarDust project (introduced in section 3.2.1.). The focus of the StarDust project has been fostering the development of stronger linkages between the specialized nodes of five transnational innovation networks.

⁴¹ See the BSR Stars programme description at <http://www.bsrstars.se/wp-content/uploads/2012/09/BSR-Stars-Programme.pdf>, and additional information about the BSR Stars flagship at <http://www.bsrstars.se/>

4.3. Presentation of the Five Transnational Innovation Networks within StarDust

An overview of the partners involved in the five transnational innovation networks was presented in Figure 5. A more detailed description of each of the transnational innovation networks (pilot projects) within StarDust is presented below.⁴² The description includes a short briefing on each of the partners involved in the case study research, the background to the network partnership, objectives and expectations of the transnational cooperation, and interesting features of the network collaboration within StarDust.

4.3.1. Active for Life

Active for Life is a transnational innovation network aimed at creating business opportunities for companies from the Baltic Sea region. It supports the development of innovative service solutions that promote the wellbeing and healthy lifestyles of people entering retirement. Active for Life aims to make the Baltic Sea region into a global wellbeing business hub, acting as a springboard for accessing global markets and attracting foreign investment, expertise and industry. The network offers information on market needs and trends, networking and matchmaking, rapid international partnerships creation, access to Nordic and Baltic markets, user testing, and other expert support.

Active for Life partners

Active for Life is comprised of partners from five different countries (see Figure 10 below) – all working within the field of healthcare and wellness.

⁴² The descriptions are written in the present tense, even though the StarDust project ended at the end of 2013. Some changes have occurred since the descriptions were written.

Figure 10: Partners in Active for Life⁴³



The lead partner (Culminatum Innovation) is a regional business development organization from Finland that manages cluster initiatives in a range of industrial areas. Other partners are located in Denmark, Germany, Lithuania, and Sweden. Four of the partners are innovation intermediaries (cluster organizations or similar) and have good connections to industry, and one partner is a research organization with limited connection to industry. Of the four innovation intermediaries, three have relatively strong organizational capacity (with 5-10 years' experience in facilitating their respective clusters); while the fourth has relatively weak organizational capacity and less experience.

The four Active for Life partners involved in this case study research are: Culminatum Innovation Oy Ltd (FI), Aalborg University Department of Health Science and Technology (DK), Community Relationship Consultants (LT), and New Tools for Health (SE). A more detailed description of each of these organizations, and how they work to support international research and innovation activities follows.

⁴³ The lead partner in each network (always a cluster organization or similar) is denoted by a star. Cluster organizations (or similar) are denoted by circles. Research organizations are denoted by triangles.

Culminatum Innovation Oy Ltd (Espoo, Finland)⁴⁴ is the lead partner of Active for Life and functions as a cluster organization for a number of cluster initiatives in the Helsinki region. Culminatum Innovation was established in 1995 to implement the national Centre of Expertise programme⁴⁵ in the Helsinki region and to serve as a joint instrument of regional development for its owners. Culminatum Innovation Oy Ltd seeks to improve the international competitiveness of the Helsinki region and to encourage the business utilization of the region's educational, scientific and research resources. The company is owned by the Uusimaa Regional Council, the city authorities of Helsinki, Espoo and Vantaa and the universities, polytechnics, research institutes and business community of the region. Culminatum Innovation facilitates clusters (or centres of expertise) in seven market areas: biotechnology, digi-business, environmental technologies, food processing, living business, nanotechnology, tourism and experience management, ubiquitous computing, and wellbeing.

The Health and Wellbeing Centre of Expertise (founded in 2007)⁴⁶ has had the operational leadership of Active for Life. The Wellbeing Centre of Expertise has more than 100 members (companies, research and public sector actors located primarily in the Helsinki region) – acting as a bridge between companies, the public sector, and research institutions in order to develop new types of wellbeing services. Services include identifying new development opportunities and establishing them as permanent operational practices, as well as creating partnerships with international business networks and global links.

The organization's main role in relation to international cooperation is to facilitate connections and pre-screen/evaluate opportunities for cooperation. Many international business development and cooperation opportunities are identified by external contacts (e.g. Finnish ministries or universities, visiting

⁴⁴ See <http://www.culminatum.fi/en/sivu.php?id=4> for more information

⁴⁵ Under the Finnish government's Centre of Expertise Programme (OSKE), Culminatum helps to create the basis for new, profitable partnerships within the so-called Helsinki-Uusimaa region (Helsinki and its neighbouring municipalities). The OSKE programme will continue until the end of 2013, combining high-level research with technology and business expertise. Culminatum also provides networks and services to companies and the higher education and research sectors.

⁴⁶ See <http://www.wellbeingbusiness.fi/en> for more information

international delegations). Some are initiated in connection with individual member's needs.

The importance of international collaboration on research and innovation has increased over the last two years, and the organization now spends between 40-50% of its time supporting its members with these activities. Some examples of support services include: providing platforms or portals to facilitate development of joint products/services, developing testbeds for demonstrating solutions within health and wellbeing, and implementing international business-to-business matchmaking events in cooperation with FINPRO (the national trade, internationalization and investment development organization in Finland).

Aalborg University Department of Health Science and Technology (Aalborg, Denmark)⁴⁷ is a research organization that has participated as a partner within Active for Life.⁴⁸ The Department of Health Science and Technology is the largest medical technology environment in Denmark, specializing in the areas of biomedical engineering and medical informatics. The mission of the department is to establish and disseminate technological and medical competencies within the health scene “from cell to system”.

The department works with both basic and applied research (including “third mission” activities such as networking, collaboration with industry, and innovation/entrepreneurship services for students). The department works actively to develop university-industry linkages and implement research activities that are based on industry needs. The department has active collaboration with two cluster initiatives in the region (BioMed Community⁴⁹ and Brains Business⁵⁰) in order to secure its connection with industry and local municipalities.

Several research projects in which the department has been engaged place increasing importance on ensuring international engagement and/or application. This was the main reason driving the department's engagement in Active for Life.

⁴⁷ See <http://www.hst.aau.dk/> for more information

⁴⁸ The organization withdrew from the project in 2012.

⁴⁹ See <http://www.biomedcom.dk/about/> for more information

⁵⁰ See http://www.brainsbusiness.dk/en/welcome_to_brainsbusiness.htm for more information

Community Relationship Consultants (Vilnius, Lithuania) was established in 2010 as a non-profit association that functions as a cluster organization within wellbeing (including physical, psychological, social, etc. factors). The association has around 50 core members, who work together to develop improved management systems or other activities to improve wellbeing services (within the Sustainable City Cluster Initiative).

The organization's main role in relation to international cooperation is to provide information, look for new partners, facilitate connections, and find funding for new international projects. International cooperation opportunities are identified by network contacts of their member companies and research organizations, as well as through political channels in Lithuania.

Participation in Active for Life was driven by the desire to access new market niches and respond to societal challenges prioritized on the national political agenda. Yet not much was known about other partners' goals and strategic approaches to new markets, or whether partners had complementary business cultures.

New Tools for Health (Linköping, Sweden)⁵¹ is a partner within Active for Life and functions as a cluster organization operating within the healthcare and medical technologies sector in East Sweden. The initiation of the cluster organization in 2002 was inspired by a call within the national VINNVÄXT programme.

New Tools for Health has the aim creating new products and services that result in more efficient healthcare and increased independence – with the home as a base. The cluster organization has around 60 members, of which most are companies. In partnership with other stakeholders that support innovation, New Tools for Health supports mobile solutions based on information and communication technology within four focus areas: patients with diabetes, patients with heart failure, fall prevention, and products/services that ensure that the elderly feel safe and socially included. The ideas may come from companies, innovators, researchers or employees in working in the care/healthcare sector.

The cluster organization has a large contact network within the region, as well as nationally and internationally, and therefore has access to a wide range of

⁵¹ See <http://www.newtoolsforhealth.com/> for more information

expertise. New Tools for Health provides resources in the form of financing, contacts with potential customers and unique testing and development environments, among other things. New Tools for Health supports the entire process, from pre study and development to the commercialization of new products and services that may eventually reach an international market.

The organization's main role in relation to international cooperation is to monitor market trends/changes, catalyze and support companies to be engaged, identify relevant partners or international channels, sort through different ideas/opportunities (selecting those most relevant to companies' and research actors' needs), and mobilize appropriate funding. International business development and cooperation opportunities are identified by looking for strong regions with complementary competencies, and exploring member organizations' network contacts.

The importance of international collaboration on research and innovation has increased over the last two years, and the organization now spends 25% or more of its time supporting its members with these activities. Some examples of support services include: hosting international visits, arranging and hosting the largest conference in the branch, as well as participating in EU and other collaborative projects and workshops.

Background of the Network Partnership

The driving concept of Active for life was formed during the development of the BSR Stars programme. The cluster manager of the Helsinki Health and Wellbeing Center of Expertise was part of the design of the BSR Stars programme and saw an opportunity to expand on the activities already underway within a short-term Active Ageing project (financed by Nordic Innovation/Nordic Council of Ministers during 2010). Transnational cooperation in this area was also well-aligned with the aims of the Finnish OSKE (Centres of Expertise) programme.

Some Active for Life partners were already involved – or recommended by organizations that were involved – in the Nordic Innovation-financed project in 2010. New partners were suggested by the Finnish Ministry and national innovation agency representatives in the BSR Stars high-level group, or identified through existing personal networks (of the pilot lead).

Different partners brought different areas of expertise or experience to the pilot. The pilot lead from Finland brought expertise in health and wellbeing, and

experience in working with new methodologies for innovation (e.g. user-driven innovation). The Swedish partner brought experience with ubiquitous computing technologies. The Danish (research) partner brought experience with digital content. And the Lithuanian partner brought experience with wellbeing in a broad sense (including social communities). The idea behind the consortia was not based on “traditional cluster concepts”, but rather on the idea of building an open platform for gathering different skills, areas of expertise and network contacts.

Initial Objectives and Expectations of Active for Life

The objectives of the pilot were to: develop solutions that are based on a holistic view of users and their future needs; build better BSR-level cooperation, knowledge-sharing and new strategic business coalitions; provide innovative and cross-sectorial solutions and business concepts to keep the ageing population an active part of society; and build a strong mutual springboard for cooperation with Asian markets.

The pilot lead’s expectations were to see that a sustainable (long-term) platform for innovation collaboration in this area is created, and that “Active for Life” develops into some kind of a brand. In order to achieve this, it was viewed as necessary to ensure continuous engagement and deep motivation/commitment to activities, which would likely require additional financing.

4.3.2. Clean Water

Clean Water is a transnational innovation network aimed at creating a vital Baltic Sea Region Clean Water Cluster – a cooperation platform for interaction between companies, research and public sector actors from different clusters in the BSR. The purpose of this platform is to develop water protection with new and innovative technologies, products and services. The network combines competencies in water protection (wastewater treatment, hazardous chemical substitution, etc.), to bring business opportunities and boost competitiveness of the Baltic Sea Region.

Clean Water partners

Clean Water is comprised of partners from four different countries (see Figure 11 below) – all working within business or research fields related to energy and environmental technologies. The lead partner (Lahti Development Company –

LADEC Oy) is a regional business development organization from Finland that manages cluster initiatives in a range of industrial areas. Other partners are located in Lithuania, Poland and Sweden. Two of the partners are innovation intermediaries (cluster organizations or similar), with extensive experience (nearly 10 years each) working with companies and facilitating business development in their respective clusters. Two of the partners are research organizations with more limited connections to industry, yet both are increasingly trying to involve companies in their research projects.

Figure 11: Partners in Clean Water⁵²



All four Clean Water partners (Lahti Development Company, FI; Kaunas University of Technology, LT; Institute of Oceanology Polish Academy of Sciences, PL; and Sustainable Sweden Southeast, SE) were involved in this case study research. A more detailed description of each of these organizations, and how they work to support international research and innovation activities, follows.

Lahti Development Company, LADEC Ltd. (Lahti, Finland)⁵³ is the lead partner of Clean Water and functions as a business development company in the

⁵² The lead partner in each network (always a cluster organization or similar) is denoted by a star. Cluster organizations (or similar) are denoted by circles. Research organizations are denoted by triangles.

Lahti region. Lahti Development Company LADEC Ltd initiated its operations at the beginning of 2013, bringing together operations from three business development companies in the region: Lahti Science & Business Park, Lahti Regional Development Company, and Lahti Region Enterprise Agency.

Prior to 2013, Lahti Science and Business Park was the lead partner of Clean Water. Lahti Science and Business Park functions as the facilitating organization for the Lahti region's cleantech cluster – aimed at developing the Lahti region into a world-class centre for environmental business and research. The organization is also responsible for the development and internationalization of the Finnish Cleantech Cluster – the national cleantech hub. The Science and Business Park unit within LADEC also has the role of promoting the establishment of growth companies, facilitating development and investments in the Lahti region, and cultivating innovative activity in the region.

LADEC provides business development and commercialization services to more than 100 companies in the region – specializing in the areas of environmental technologies and industrial design. Within cleantech, LADEC acts as a bridging organization between environment technology businesses, universities and research organizations, and the public sector. With responsibility for the national cleantech cluster, LADEC activities engage more than 60% of Finnish research actors, and 80% of companies in the field of eco-industries. Services include identifying and developing new network contacts (with a particular focus on China, India and Russia), arranging and hosting events, and mobilizing funding.

The organization's main role in relation to international cooperation is to scan for new partners and project opportunities, facilitate connections, develop and mobilize funding, and support international partnerships over time (based on needs of companies involved). Most international business development and cooperation opportunities are identified by existing networks and contacts. The Finnish Ministries are helpful in highlighting new international project opportunities. Other opportunities are identified by referrals from companies participating in ongoing projects, and from benchmarking exercises.

⁵³ See <http://lahti.uusyrityskeskus.fi/lahti-development-company-ladec-ltd> for more information

Opportunities are evaluated based on the strengths and complementary capabilities of potential partners, and the possibility for concrete cooperation that is of value for all involved.

The importance of international collaboration on research and innovation has increased over the last two years, and the organization now spends about 50% of its time supporting its members with these activities. Some examples of support services include: hosting international experts, developing education and business development opportunities, arranging or participating in international events and networks (e.g. Global Cleantech Association, Cleantech Scandinavia), and developing/facilitating/participating in various international cooperation projects.

Kaunas University of Technology, Institute of Environmental Engineering (Kaunas, Lithuania)⁵⁴ is a research organization and partner within Clean Water. The Institute works with education and research in the fields of life science, energy and environment. The Institute works with companies (involving them in research projects and conducting training sessions on e.g. chemical handling and clean production) – spending about 75% of its time on third mission activities with companies and the policy level. The institute participates in a number of international research projects (focused on guidelines on energy-saving and waste-avoiding industrial practices), and got engaged in the StarDust project in order to share its expertise in chemical handling and legislation, as well as to demonstrate the value of working directly with companies to other research institutions at the University.

The importance of international collaboration on research and innovation has increased over the last two years, and the organization spends about 50% of its time on international activities. Most of the time is spent on research projects with international partners, but more and more time is spent on networking and building collaboration projects involving companies and other users of their expert knowledge.

Institute of Oceanology of the Polish Academy of Sciences – IO PAN (Sopot, Poland)⁵⁵ is a research organization and partner within Clean Water. The

⁵⁴ See <http://en.ktu.lt/> for more information

⁵⁵ See <http://www.iopan.gda.pl/> for more information

Institute's mission is to generate knowledge required to support the understanding, the sustainable use and protection of the marine environment in the Baltic and European Arctic Seas. The Institute focuses on basic research projects (aimed at building systems that are useful for other institutions and government agencies) and has limited connections with companies – although collaboration with companies is gaining in importance. (The possibility to link their research with industry needs, and learn more about practically collaborating with industry were both drivers to IO PAN's participation in StarDust.)

The importance of international collaboration on research and innovation has increased over the last two years, and the organization spends about 50% of its time on international activities. Almost all of this is spent on research projects with international partners, academic seminars, etc. StarDust is the only international project where companies are involved; however, IO PAN expects to have more collaboration with industry in the future (through implementation of educational seminars coupled to business development opportunities that address societal challenges).

Sustainable Sweden Southeast (Kalmar, Sweden)⁵⁶ is a partner within Clean Water and functions as a cluster organization operating within the energy and environment sector in Southeast Sweden. The organization was established in 2001 as a limited liability company with shareholding companies and municipalities, associated companies, universities and institutions. The cluster organization addresses the needs of approximately 50 client companies and shareholders in various industrial areas, including: recycling and environmental management, water resource management, land use management, hazardous waste management and contaminated land reclaiming, waste water treatment, process water treatment, development and design of heating, ventilation and sanitation systems, energy optimization, bio-fuels, hydropower and wind power, equipment for the handling of refuse and recycling materials, etc.

Sustainable Sweden Southeast AB assists clients and investors worldwide in establishing business solutions that support sustainability. They link and coordinate experiences and knowledge on environmental technology and sustainability from Swedish trade, industry and authorities with research

⁵⁶ See <http://www.newtoolsforhealth.com/> for more information

resources from universities. The cluster organization does this through a number of services: offering a one-stop-shop for the region's total supply of environmental technology, creating business concepts, facilitating transfer of experience and knowledge, supporting business relations between Swedish industry and international partners, and supporting financial solutions.

The organization's main role in relation to international cooperation is to bridge actor groups – interpreting needs and competencies; to serve as a door opener – identifying relevant cooperation opportunities and facilitating new contacts; market the capabilities of the cluster/region; motivate and mobilize companies' (particularly SMEs') participation in international activities; and help secure funding for international activities. Many international business development and cooperation opportunities are identified by stakeholders in Kalmar and their network contacts. Opportunities are prioritized based on the competencies and interests that companies in the cluster have.

The importance of international collaboration on research and innovation has increased over the last two years, and the organization now spends about 50% of its time supporting its members with these activities. Some examples of support services include: helping to find relevant partners, brokering/developing new projects (including working with researchers to develop projects), hosting international visits, and helping to find project financing.

Background of the Network Partnership

Lahti Cleantech volunteered to take the role as lead partner and define the driving concept for the transnational cooperation – building on their existing international activities. Sustainable Sweden Southeast was known through cooperation in a previous project. And relevant research partners were also identified through Lahti's own network.

The different partners brought complementary areas of expertise: two partners are cluster initiatives (working close with businesses), and two partners are strong research organizations.

Initial Objectives and Expectations of Clean Water

The objective of the pilot was to establish a BSR “water cluster” based on the Finnish and Swedish experiences. Behind this cluster (or BSR hub), there will be multiple value chains that complement each other and can operate in different constellations to provide tailor-made services/solutions based on market needs. Cooperation with Vodokanal in Russia was a strong focus for the pilot – in

order to increase the level of knowledge of developing water treatment ‘system solutions’, and to strengthen cooperation within the BSR partnership.

The pilot lead’s expectations are to have synergies between the different pilots – and develop a strong network among the various StarDust partners/pilots that will be sustained in the long-term (after the project period). Pilot partners have highlighted the expectations of getting access to new international contacts/cooperation partners, access to funding for joint research/innovation activities, and access to external technology. There is a desire to find useful solutions to challenges that exist.

4.3.3. Comfort in Living

Comfort in Living is a transnational innovation network focused on developing products for the comfort of living among the growing population of elderly people in the Baltic Sea Region. The project responds to the societal challenge of an aging population in Europe as well as in other parts of the world. The consortia of cluster organizations and research milieus in the project will provide different competencies when it comes to design and housing concepts for the needs of elderly people.

Comfort in Living partners

Comfort in Living is comprised of partners from six different countries (see Figure 12 below).

Figure 12: Partners in Comfort in Living⁵⁷



The six partners work in different (but related) business and research areas ranging from design, interior and furniture production, kitchen appliances, new materials, production efficiency, and knowledge of user needs. The lead partner (IDC West Sweden) is a regional development company for industry in the Skaraborg region. IDC West manages the Inredia cluster initiative, working within interior design. Other partners are located in Denmark, Finland, Latvia, Lithuania and Poland. From the start of StarDust, there were four partners (in Latvia, Lithuania, Poland and Sweden). Two additional partners (in Denmark and Finland) joined the network over the course of the project. Of these six partners, four are innovation intermediaries (cluster organizations or similar) with strong experience (more than five years each) working with companies and facilitating business development in their respective clusters. The remaining two partners are research organizations – both with relatively strong connections to industry.

The four original Comfort in Living partners (IDC West Sweden, SE; the Art Academy of Latvia, LV; the Business Cooperation Center of Southern

⁵⁷ The lead partner in each network (always a cluster organization or similar) is denoted by a star. Cluster organizations (or similar) are denoted by circles. Research organizations are denoted by triangles.

Lithuania, LT; the Faculty of Wood Technology, Poznan University of Life Science, PL) were involved in this case study research. Associated partners (the Development Centre UMT in Denmark and Culminatum Innovation in Finland) were not. A more detailed description of each of these organizations, and how they work to support international research and innovation activities follows.

IDC West Sweden AB (Skövde, Sweden)⁵⁸ is the lead partner of Comfort in Living and functions as Skaraborg region's development company for industry (since 2007). IDC West works with around 50 actors in the region, with the mission of strengthening long-term competitiveness and profitability for manufacturing industry in Skaraborg. The organization does this by offering different services including: coordination and development of training programmes, assessments and coaching, facilitation of clusters and networks, and collaboration with other actors (in the region, nationally and internationally).

IDC West is one of the initiators of the interior design cluster initiative Inredia – a collaboration between furniture companies in Tibro, Tibro municipality and IDC. Inredia provides a unique meeting place between producers, academia and interior designers/architects. Inredia strengthens existing producers, creates new decorating experiences and an international platform for Swedish furnishings.

IDC West's main role in relation to international cooperation is to scan for new opportunities and facilitate connections for companies – helping them to access knowledge and contacts in order to retain and develop their competitiveness and market presence. International business development and cooperation opportunities are identified by member companies. IDC West explores new ideas and contacts to determine their benefit to companies.

Although the importance of international collaboration on research and innovation has increased over the last two years, the organization spends a minor (5%) portion of its time supporting its members with these activities. Some examples of support services include: participating in trade fairs, organizing and conducting study trips with companies, participating in EU projects, matchmaking, and hands-on facilitation of collaboration and joint product

⁵⁸ See <http://idcab.se/> for more information

development activities (e.g. organizing an international innovation camp to develop prototypes). IDC West has also supported companies' international attractiveness through the establishment of the global material library Material ConneXion⁵⁹.

The Art Academy of Latvia (Riga, Latvia)⁶⁰ is a research organization and partner within Comfort in Living. The Design Department, who is the operational participant in the project, implements education in a number of design areas and helps students to gain both theoretical knowledge and practical skills. During the study process, it is possible to work on design objects fit for industrial production. For this reason, the department works closely both with companies and the Design, Innovation and Technological Lab Development Center (which co-finances design development to make it more practical). International collaboration on these activities is considered important in order to learn from other organizations and gain knowledge on how to incorporate entrepreneurship in design education. Organizations within Scandinavia are targeted given their strong design tradition.

The Business Cooperation Center of Southern Lithuania (Alytus, Lithuania)⁶¹ is a public organization established in 2009 to facilitate cooperation and business development for companies and other organizations operating within sectors related to house-building (e.g. construction, IT, engineering, planning, design and management) in Southern Lithuania. The Cooperation Center has only 14 members, yet some of these members are groups of companies and cooperatives (with hundreds of their own company members). The Cooperation Center is responsible for facilitating the Modern House Creation Cluster. It is this grouping of actors who participate as partners in Comfort in Living.

The Cooperation Center functions as a cluster organization, providing a number of services to its member companies, including: vouchers for advisory consultation, talent search, identification of new market opportunities, development of joint projects, and coordination of project activities.

⁵⁹ See <http://www.materialconnexion.se/> for more information

⁶⁰ See <http://lma.lv/eng/> for more information

⁶¹ See http://www.monak.lt/en/vsi_pietu_lietuvos_verslo_kooperacijos_centras/ for more information

The organization's main role in relation to international cooperation is to provide a neutral platform for cooperation and enable hands-on cooperation activities by identifying new partners, facilitating connections, mobilizing funding for projects, and actively orchestrating collaboration activities. New partners and cooperation opportunities are identified through public sector contacts (e.g. ministries) and member networks. Opportunities are pursued as long as all partners can bring something to each other.

The importance of international collaboration on research and innovation has increased over the last two years, yet the organization spends only about 10% of its time supporting its members with these activities. The priority focus is to develop cooperation among companies in Southern Lithuania; international activities can then follow more easily. Some examples of services to support international activities include: hosting conferences, participating in international exhibitions, and participation in EU projects.

The Department of Furniture Design, Faculty of Wood Technology at Poznan University of Life Science (Poznan, Poland)⁶² is a research partner within Comfort in Living. The Faculty works with education and research related to the structure, properties and construction methods of wood. The Department of Furniture Design works with both basic and applied research. The department has a strong relationship with the furniture industry (working together with two clusters in the region – furniture design and upholstery, and construction). Approximately 70% of staff time is spent on projects with industry (on e.g. construction, safety of furniture, innovative materials, computer programs for factories, technological problems in factory design, production processes, etc.), with the remaining 30% spent on teaching and research. Projects with industry are the primary source of financing for basic research, and this research is always used in practice.⁶³

Within the Faculty, the Center of Transfer of Innovation to Furniture Industry works with transferring research results to industry applications. The same staff (from the Department of Furniture Design) work in both organizations. Furniture companies approach the Department with specific problems in

⁶² See <http://en.puls.edu.pl/?q=content/faculty-wood-technology-0> for more information

⁶³ The large number of patent applications – more than 10 during the first half of 2011 – is evidence of this.

design, production, or technical aspects, and researchers at the Center then help to find a solution. Approximately 80% of these are put into practice.

The importance of international collaboration on research and innovation has increased over the last two years. Staff at the department feel that increased global competition has driven a need to be linked into international networks in order to be updated on market trends and opportunities. Approximately 50% time is spent on international collaboration activities. Most of this is via participation in research projects and conferences, yet some is also spent on facilitating knowledge exchange and operational cooperation activities involving companies. Together with cluster organizations in the region, they identify relevant opportunities, mobilize company engagement, facilitate knowledge exchange and new partnerships, and support development of projects.

Background of the Network Partnership

The lead partner and driving concept was developed during the BSR InnoNet project.⁶⁴ Möbelriket (Kingdom of Furniture) led the transnational pilot for wood/furniture within the BSR InnoNet, and – during that time – realized that there was interest from many countries on cooperation. Instead of working on the broad area of wood/furniture, it was decided to focus on a smaller area (the design and product development process) – targeting a challenge that all were interested in addressing (living for elderly populations).

Due to the requirements of the Inter-Reg programme, Möbelriket (a private company) could not lead the StarDust pilot. Thus, IDC West Sweden (who works with industrial development in the region, including work with the Tibro Interior cluster initiative and collaboration with Möbelriket) was approached to lead the Comfort in Living pilot. Partners were identified through recommendations from BSR countries for participation in the BSR InnoNet wood/furniture pilot. (Every country – ministry or agency – recommended clusters/innovation nodes with furniture/wood competencies.) Those who were together during BSR InnoNet continued to work together in the StarDust pilot.

The different partners brought complementary areas of expertise: IDC West and the Art Academy of Latvia brought design competence. The Department of

⁶⁴ See http://www.norden.org/sv/publikationer/publikationer/2009-731/at_download/publicationfile for the project's final report

Furniture Design in Poznan contributed with an academic environment for furniture construction and design. And the Modern House Creation Cluster in LT contributed with production capacity.

Initial Objectives and Expectations of Comfort in Living

The objective of the pilot was to develop a design concept (product ideas) and examine the commercial potential for products/systems related to elderly living. By 2020, these product ideas/concepts should be prototypes and commercial innovations. (This work is dependent on how design thinking/design management concepts can be communicated and understood.)

The pilot lead's expectations were to develop a joint understanding for what design management (design work) is, and develop a joint product/market concept based on this. Another goal was to find commercial actors interested in working with product development of the concept jointly developed within StarDust.

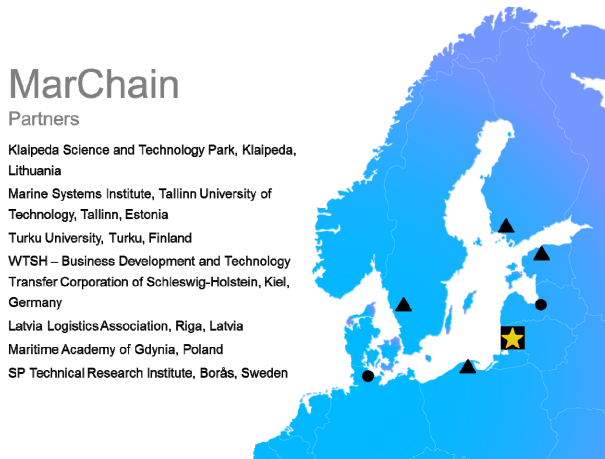
4.3.4. MarChain

MarChain is a transnational innovation network focused on connecting maritime clusters in the Baltic Sea Region in order to strengthen and improve the marine transport supply chains, efficiency and competitiveness. The project builds on cooperation between cluster initiatives around the Baltic Sea addressing issues such as environmentally-friendly transport systems and intelligent ships, harbor and logistics solutions. MarChain also addresses cooperation on issues like new technology solutions and innovations promoting energy-efficient and environmentally safe and secure solutions.

Marchain partners

MarChain is comprised of seven partners from seven different countries (see Figure 13 below), all working with business or research fields related to maritime transport and logistics (including the topics of energy efficiency, materials, safety, etc.). The lead partner (Klaipeda Science and Technology Park) is a science and technology park that supports technology transfer and transport development in Western Lithuania, and acts as a cluster organization for companies in the maritime transport sector. Other partners are located in Estonia, Finland, Germany, Latvia, Poland and Sweden.

Figure 13: Partners in MarChain⁶⁵



In addition, MarChain has six associated partners from two additional countries: the Maritime Development Center of Europe (Denmark), West Pomeranian Maritime Cluster Association (Poland), the Pomeranian Sea and Vistula Catchment Basin Cluster Association (Poland), Nordland Research Institute (Norway), Vestfjords Regional development Agency (Norway), and the Maritime Cluster Programme (Finland).

Among the seven partners, three are innovation intermediaries (cluster organizations or similar) with relatively strong experience (around five years each) working with companies and facilitating business development in their respective clusters. The remaining four partners are research institutes or universities with more limited connections to industry.⁶⁶

⁶⁵ The lead partner in each network (always a cluster organization or similar) is denoted by a star. Cluster organizations (or similar) are denoted by circles. Research organizations are denoted by triangles.

⁶⁶ In 2012, SP Technical Research Institute of Sweden replaced the Swedish Marine Technology Forum (a cluster organization in West Sweden) as partner in MarChain. The individual involved stayed the same. This person continues to maintain a business focus and actively engage companies in MarChain activities.

The four MarChain partners involved in this case study research were: Klaipeda Science and Technology Park, LT; Centre for Maritime Studies, University of Turku, FI; Latvian Logistics Association, LV; and SP Technical Research Institute, SE. A more detailed description of each of these organizations, and how they work to support international research and innovation activities follows.

Klaipeda Science and Technology Park (Klaipeda, Lithuania)⁶⁷ is the lead partner of MarChain, and supports technology transfer and commercialization activities for the Marine Valley cluster initiative⁶⁸ in Klaipeda. Klaipeda Science and Technology Park (KSTP) was founded in 2002 in cooperation with Klaipeda University and the Ministry of Economy. KSTP gathers various actor groups (students, researchers and entrepreneurs) together – providing infrastructural and consulting services to support business development and enhance collaboration between science and industry.

KSTP is one of the three founding organizations of the Marine Valley cluster initiative (or valley) started in 2009 as part of a government programme to support integrated centres for business, education and research in Lithuania. Marine Valley is comprised of around 25 companies and related organizations in the fields of transport and logistics, energy and environment, shipbuilding and repair, and coastal management. The main objectives of Marine Valley are: to create a modern research infrastructure for the general needs of Lithuania's maritime research, academic studies and technological development; to update and modernize the infrastructure of university-level maritime studies; to strengthen the interaction between science, academic studies and business activities; to create conditions for the emergence of knowledge-driven enterprises relying on the commercialization of scientific output; and to increase the global competitiveness of Lithuania's marine science and maritime technologies. The founding organizations work together with the members to support the attainment of these objectives.

KSTP's main role in relation to international cooperation is to work proactively to set-up new partnerships (for knowledge exchange and business development), facilitate linkages with research organizations, support knowledge sharing and

⁶⁷ See <http://www.kmtp.lt/index.php/about-kmtp> for more information

⁶⁸ See <http://www.ku.lt/en/marine-valley/> for more information

matchmaking activities, and mobilize financing for joint projects. International business development and cooperation opportunities are explored based on members' needs. New contacts and projects are primarily identified by scanning through and contacting similar organizations (e.g. within the International Association for Science Parks or other business support organizations), as working with “like-minded” intermediaries is an efficient way to initiate business-oriented activities that have legitimacy and anchoring in a particular regional context.

The importance of international collaboration on research and innovation has increased over the last two years, and KSTP spends between 30-40% of its time supporting its members with these activities. Some examples of support services include: participating in international fairs, organizing matchmaking events, hosting and organizing outgoing study visits with companies, and participating in EU projects.

Centre for Maritime Studies (CMS), University of Turku (Turku, Finland)⁶⁹ is an international education and research centre that offers education, research services and conferences related to maritime, logistics and other related fields. CMS works with both basic and applied research (involved as partners in innovation processes with companies, and with public administration). Projects with companies are typically focused on internal processes and business models, rather than technological solutions. Within MarChain, CMS has been responsible for coordinating a study of maritime competencies around the BSR (highlighting national structures of stakeholders involved in maritime cluster networks in each country).

CMS has experienced that the importance of international collaboration on its research activities has increased over the past years – with more and more projects conducted in collaboration with partners in other countries (primarily within the EU). CMS spends an estimated 60% of its time on research projects with international partners. In order for these international efforts to be successful, “it is important to identify partners with complementary capabilities – organizations that can communicate and understand each other, but also offer something that the other doesn't have” (interview with Tapio Karvonen, Senior Researcher, Centre for Maritime Studies, Turku University).

⁶⁹ See <http://www.utu.fi/en/units/cms/Pages/home.aspx> for more information

The **Latvian Logistics Association (Riga, Latvia)**⁷⁰ (LLA) is a voluntary association gathering around 20 companies and private individuals who work in the fields of logistics and customs. The association was formed in 1997 to promote international trade, ensure safe and reliable cargo flow through Latvia, and develop logistics and customs brokers' activities in Latvia. In 2009, the Latvian Logistics Association initiated the Latvian Supply Chain Cluster (LSCC)⁷¹ – gathering 17 organizations (leading manufacturers, logistics and R&D institutions) – with financial support from the Ministry of Economics.

LSCC has the primary goal of creating value for all supply chain partners (including manufacturers, suppliers, distributors, customers, and customers' customers) by providing overarching supply chain strategy development and implementation for particular markets or segments in order to operationalize and support companies' business strategy. The LSCC's current focus is facilitating business development and networking processes for supply-chain management.

As facilitator of the Supply Chain Cluster, LLA's main role in relation to international cooperation is to continually meet with members companies to discuss their capabilities and needs for international opportunities, facilitate new contacts, identify or develop new opportunities and help companies prioritize among these, and provide support with project coordination (when needed). International business development and cooperation opportunities are explored through the internet and network contacts, as well as via project tenders. If opportunities of interest to member companies are identified, then LLA begins searching for potential partners – individuals that are part of reliable organizations.

The importance of international collaboration on research and innovation has increased over the last two years – driven by the need to be well-positioned within international networks that can respond to EU priorities for establishing green corridors. LLA spends around 50% of its time supporting its members with international activities. Some examples of support services include: scanning calls, public procurement and other tenders and identifying relevant

⁷⁰ See <http://www.lla.lv/> for more information

⁷¹ See <http://www.lscclv.lv/> for more information

opportunities; identifying appropriate international partners and facilitating new partnerships; and providing support to project development and coordination.

SP Technical Research Institute (Borås, Sweden)⁷² replaced the Swedish Marine Technology Forum⁷³ as partner in MarChain in 2012. SP is a leading international research institute that works closely with its customers (companies, other research actors and the public sector) to create value – delivering high-quality input in all parts of the innovation chain and supporting the competitiveness of industry and its evolution towards sustainable development. SP is headquartered in Borås, but has research sites in 30 locations across Sweden. Research areas cover a number of business⁷⁴ and technical⁷⁵ areas. In partnership with other institutes, universities and the business sector, the SP Group runs and cooperates with a series of research centres. Research centres are important in creating strong research and innovation milieus which allow urgent research to be tackled on a broad front. Through collaboration, sub-tasks can be divided between the players with the best resources and equipment.

One of these research centers is “SP Novel Designs at Sea”⁷⁶ – focusing on addressing the increasing demand for energy efficient transports. SP’s maritime knowledge center initiates, coordinates and supports activities leading to an increased use of advanced lightweight materials and constructions. The center works in close cooperation with companies, public authorities, shipping companies and classification societies – and participates in the work of the IMO (International Maritime Organization). Researchers and technical offers related to this center participate in MarChain in an effort to develop project ideas through international cooperation.

SP’s main role in relation to international cooperation is to monitor and understand market trends and opportunities, develop new project ideas, arrange

⁷² See <http://www.sp.se/en/about/Sidor/default.aspx> for more information

⁷³ a cluster initiative established in 2007 that gathers more than 60 actors in the maritime industry in West Sweden – see <http://www.smtf.se/en/start.html> for more information

⁷⁴ energy, ICT, life science, safety and security, materials and construction, and transportation

⁷⁵ Including structural and solid mechanics, materials, energy technology, process development, and wood technology

⁷⁶ See <http://www.sp.se/en/centres/sjofart/Sidor/default.aspx> for more information

workshops and other events where companies can meet potential partners, have continual dialogue with companies and other actors in their network to keep them informed of opportunities, help them to prioritize among these opportunities, and facilitate their engagement (through project development, coordination and mobilization of funding). Similar to the work of the Swedish Marine Technology Forum cluster organization, SP proactively engages particular companies when it's deemed most relevant.

SP perceives that the importance of international collaboration on research and innovation has increased over the last years, which has resulted in more efforts to strengthen competencies, work proactively to identify international project opportunities, and catalyze company engagement. SP estimates that they spend 50% or more of their time with international activities. As a research institute, international collaboration projects are the norm.

Background of the Network Partnership

The driving concept of MarChain was developed by the lead partner in 2008-2009 (who was thinking about how to develop a cluster in Klaipeda, which could also be a BSR cluster). The concept was proposed to the Ministry, who then invited them to submit the proposal within the StarDust call for proposals (in early 2010). The Klaipeda Marine Valley does not have an internal market, so the initiating concept was to work internationally.

Partners were identified as a joint effort. The lead partner presented a list of partners they were considering (based on those with whom had worked on other InterReg and FP projects over past years), and discussions were held with the Lithuanian Ministry of Economy and VINNOVA. Through a dialogue, the composition of the network was decided. All partners were new; Klaipeda had previously worked with two associated partners.

Different partners brought different areas of expertise or perspectives to the pilot. The pilot lead brought an orientation to SMEs. The Finnish maritime cluster was oriented to big shipyards and technology solutions. The Swedish Marine Technology Forum was oriented towards smaller (sailing) boats. Research partners brought strengths in research with applications to energy/alternative energy.

Initial Objectives and Expectations of MarChain

The objectives of the pilot were to establish a communication and cooperation environment in the BSR – forming a platform for existing organizations to

cooperate and form a new supply chain for the maritime industry in the BSR. A perceived initial challenge was finding a common niche on which to focus efforts. From initial discussions, the focus could have been a product; it could have been a new business concept for shipyards; it could have been a new way to work with research organizations to deliver knowledge to SMEs.

The pilot lead's expectations were to get communication and cooperation working. An internet platform (providing access to data, experiences, etc.) was a proposed starting point. The lead partner also expected to expand the network and incorporate other regions/countries (for better data exchange and support to service development). (New products and services were not expected.)

4.3.5. Mobile Vikings

Mobile Vikings is a transnational innovation network joining strong clusters and innovation milieus within telecom/mobile applications – focused on exploring new ways for collaborative innovation.

Mobile Vikings partners

Mobile Vikings is comprised of five partners from five different countries (see Figure 14 below), all working within the ICT and mobile communications industries. The lead partner (Mobile Heights) is a cluster organization in Southern Sweden supporting collaborative research, innovation and entrepreneurship in hardware, software and services. Other partners are located in Denmark, Finland, Latvia and Lithuania.

Figure 14: Partners in Mobile Vikings⁷⁷



In addition, Mobile Vikings has nine associated partners from three additional countries: Brains Business/ICT North Denmark (Denmark), Forum Virium (Finland), Mobkom.net (Germany), Trådlös Framtid/Oslo Teknopol (Norway), IKT Grenland (Norway), ICT West Pomerania (Poland), Wielkopolski Klaster Teleinformatyczny (Poland), Pomerania ICT Cluster (Poland), and Future Position X (Sweden).

All five partners are innovation intermediaries (cluster organizations or similar) with relatively strong experience (between 5-10 years each) working with companies and facilitating business development in their respective clusters. All nine associated partners also function as innovation intermediaries in their respective geographies.

The four Mobile Vikings partners/associated partners involved in this case study research were: Mobile Heights, SE; Hermia, FI; Latvian ICT Cluster, LV; and the Wielkopolski Klaster Teleinformatyczny (Wielkopolska ICT Cluster), PL. A more detailed description of each of these organizations, and how they work to support international research and innovation activities follows.

⁷⁷ The lead partner in each network (always a cluster organization or similar) is denoted by a star. Cluster organizations (or similar) are denoted by circles. Research organizations are denoted by triangles.

Mobile Heights (Malmö, Sweden)⁷⁸ – an industry-driven triple helix (or cluster) initiative within ICT and embedded systems – is the lead partner of Mobile Vikings. The initiative was founded in 2008 by Ericsson, Ericsson Mobile Platforms, TeliaSonera, Sony Mobile, Lund University, Malmö University, Blekinge University, and the Skåne Regional Council. Relevant companies, industry associations, academic institutions and public organizations are invited join in strengthening the region as an international hotspot for mobile communications and its entire value chain. Members (currently around 50) are expected to contribute with insights, expertise and experience for the benefit of other members and start-ups.

Mobile Heights is a member-financed, non-profit organization (a cluster organization), offering members exclusive access to seminars and tailor-made workshops, trend analysis, access to new partners and test-beds, and facilitation of innovation and commercialization⁷⁹. Mobile Heights provides access to world-class knowledge through three research centers (focusing on hardware, software and services)⁸⁰, and one research institute⁸¹. Mobile Heights also represents its members with public bodies – providing knowledge of innovation systems and developing new projects.

Mobile Height's main role in relation to international cooperation is to provide the context and legitimacy to attract international partners, share international networks and open doors, develop and coordinate new projects. New contacts and projects are primarily identified through member organizations' own networks.

The importance of international collaboration on research and innovation has increased over the last two years, and Mobile Heights spends about 50% of its time supporting its members with these activities. Some examples of support services include: organizing study visits and international matchmaking events,

⁷⁸ See <http://www.mobileheights.se/> for more information

⁷⁹ Through the Mobile Heights Business Center – see <http://mobileheights.org/innovation/>

⁸⁰ System Design on Silicon (SoS), Embedded Applications Software Engineering (EASE) and Network for Mobile Services & Applications (NMSA)

⁸¹ The Mobile and Pervasive Computing Institute at Lund University (MAPCI) focuses on research on distributed cloud architecture and also functions as a bridge between the research programmes for the three research centers.

participating in trade fairs, hosting Demola (where student teams develop solutions to address industry needs⁸²), developing and facilitating projects, and mobilizing financing for international activities.

Hermia (Tampere, Finland)⁸³ is a partner within Mobile Vikings – functioning as a network and accelerator of innovation and technology transfer (focused on the areas of machine-building and automation, information technology and energy technology) in the Tampere region. Hermia has also functioned as a cluster organization – facilitating two national centres of expertise (in the fields of ubiquitous computing and intelligent machines)⁸⁴.

Tampere University of Technology and the City of Tampere are the main owners of Hermia, which has hundreds of member organizations (including companies, research and public sector actors). As an accelerator, Hermia networks the organisation and expertise of businesses, the public sector and different fields of research – supporting the growth, development and competitiveness of technology businesses in Tampere. Hermia offers a number of services: developing and coordinating projects, building national and international networks, and providing training and other activities to develop professional expertise.

Hermia's main role in relation to international cooperation is to actively search for appropriate partners (based on innovation actors' needs and ideas for projects) and facilitate connections – building consortia, developing projects and mobilizing funding. Hermia works in collaboration with FINPRO (Finland's export promotion agency) to help companies work within international networks. Hermia provides an interpretation of company needs and prioritizes collaboration opportunities based on this. New international business development and collaboration opportunities are identified primarily through own or members' existing networks – scanning for regions that are known for a particular expertise or field of knowledge. New partners are chosen based on their complementary expertise and reputation, as well as the project's mutual benefit.

⁸² See <http://southsweden.demola.net/>

⁸³ See http://www.hermia.fi/in_english/ for more information

⁸⁴ See http://www.hermia.fi/in_english/services/coordination-of-programmes-and-p/the-centre-of-expertise-oske/

The importance of international collaboration on research and innovation has increased over the last two years, and Hermia spends about 30% of its time supporting its members with these activities. Some examples of support services include: hosting international study visits, organizing seminars with international experts, conducting regular dialogue with companies to understand their needs and build trust, identifying and facilitating contacts with international partners (through e.g. matchmaking events and the Demola network⁸⁵), mobilizing company engagement by filtering through and offering concrete opportunities that meet their needs, freeing companies/research organizations from bureaucratic burdens within international projects (by helping to prepare project applications and participate in projects), and mobilizing funding. Hermia also provides the “known context” to help attract international partners.

The **Latvian IT Cluster (Riga, Latvia)**⁸⁶ is a partner within Mobile Vikings – and functions as a collaboration platform for around 50 companies and related actors in the information technology sector in Latvia. The Latvian IT Cluster’s mission is to increase competitiveness and growth of IS and IT services export, through promotion of collaboration between companies on the basis of the shared vision. The cluster was established as an NGO in 2007 in order to facilitate knowledge sharing and collaboration, provide continuous education and training, and mobilize the creation of new solutions, and attract investment to the IT sector.

The cluster organization’s main role in relation to international cooperation is to facilitate cross-border networking and innovation activities – finding potential clients or cooperation partners, facilitating these linkages, scanning to identify the most relevant opportunities, and attracting external funding. New international business development and collaboration opportunities are primarily identified by scanning through and contacting similar organizations (e.g. other cluster organizations, business support organizations or innovation centres) that combine sector players. In addition to other intermediary organizations, the Latvian IT Cluster leverages academic partners’ international collaboration partners and companies’ networks. New partners are chosen based

⁸⁵ An example of this is the Demola network – see <http://demola.net/>

⁸⁶ See <http://www.itbaltic.com/en/home/> for more information

on their complementary expertise and reputation, as well as the project's possibility to deliver mutual benefit and tangible results.

The importance of international collaboration on research and innovation has increased over the last two years – as competitors are stronger, it is more important to collaborate. The Latvian IT cluster spends about 60% of its time supporting its members with these activities. Some examples of support services include: marketing and export promotion, conducting and hosting international study visits, attending trade fairs and external conferences, scanning/networking and connecting with new partners, facilitating networking and matchmaking events, searching for project financing and participating in projects. “The Latvian IT Cluster is looking for cooperation partners in other regions with an aim to share knowledge, know-how, and professional experience, to expand business borders and find cooperation partners for companies and common international projects.” (website of the Latvian IT Cluster)

The **Wielkopolska ICT Cluster (Poznan, Poland)**⁸⁷ is an associated partner within Mobile Vikings and functions as a cluster organization – facilitating collaboration between around 50 companies and related actors in the information and communications technology (ICT) sector in the region. The cluster initiative originated from a research team working with supercomputing in biosciences (within the Poznan Supercomputing and Networking Center, Polish Academy of Science) in 1995. Applied research projects often ended with pilot implementation in companies – catalyzing the start of the collaborative initiative.

The Wielkopolska ICT Cluster organization was founded as an association in 2008 by Poznan Supercomputing and Networking Center, Poznan City Hall and ICT companies from the region. The Wielkopolska ICT Cluster's companies implement energy-efficient communication networks, mobile and fixed applications and industry management solutions. They have high expertise in e-government, medical and banking areas and smart grid projects. Companies cooperate with research and development, mutual trainings, internships, and audits. In addition, companies and research actors work together on a number of applied research ICT projects (including over 50 framework programme projects, several as coordinator).

⁸⁷ See <http://wkklaster.pl/en/> for more information

The cluster organization's main role in relation to international cooperation is to monitor market trends and socio-economic change, find cooperation opportunities, filter through/prioritize among these based on members' needs and interests, and facilitate collaborative projects. New international business development and collaboration opportunities are identified through ICT events, trade organizations, members' networks and web-based tools. Preference is given to partners from regions that are known for their technical expertise, and their ability to offer complementary competencies.

The cluster organization perceives that the importance of international collaboration on research and innovation has stayed the same over the last two years, yet they spend more time (around 50%) working with these activities. Some examples of support services include: participating in international fairs and business meetings, developing projects and preparing project applications (for e.g. EU calls), and facilitating joint initiatives.

Background of the Network Partnership

The driving concept of Mobile Vikings was inspired from the development of the BSR Stars programme. The former cluster manager of Mobile Heights was part of the design of the BSR Stars programme, and realized that participation in StarDust could be a good way for Mobile Heights to work with internationalization – and to work with new elements of innovation activities within the cluster initiative (e.g. working with open innovation and across sectors). Given that a key actor within Mobile Heights (TeliaSonera) worked with BSR as a home market, and had R&I activities in Finland, TeliaSonera's representative on the Mobile Heights' board was asked about their interest in being involved in such activities. In addition, discussions were held with the coordinator of the ICT transnational pilot within BSR InnoNet – in order to take into account 'lessons learned' from that experience.

Mobile Vikings' partners were identified through existing network contacts (from Mobile Heights and from the BSR InnoNet ICT pilot), and from suggestions from national agencies in additional countries wishing to participate (e.g. LT and NO).

As there was a very pragmatic approach to identifying partners (including all who wished to be involved), it was not clear at the outset what different partners 'brought to the table'.

Initial Objectives and Expectations of Mobile Vikings

The initial objective of the pilot was to develop a BSR testbed for applications' development and implementation of new mobile services.

The pilot lead's expectations were to see a substantial number of new instruments (financial support or other) at EU and national levels that support collaboration in the BSR – collaboration that is focused on addressing solutions to grand challenges. In the future, partners want to see instruments that address innovation platforms (across sectors). There is an ambition to have Mobile Vikings be the catalyst for EU, etc. to renew policy instruments – to be the case that exemplifies the way of working (highlighting the industry perspective).

5. Analytical Results

The aim of this chapter is two-fold: to analyze the case context, and to present the results from the data collection and analysis.

The first section will elaborate on the specific factors that lie behind the case, on which the results are premised. The results are then presented in the following three sections. The results are structured based on the analytical framework presented in Chapter 2 (see Figure 4): first reviewing factors driving support needs for each group of innovation actors (i.e. research organizations, large/medium companies and small companies), and then reviewing how innovation intermediaries' support functions address these needs. In these sections, the abbreviation CO is used for cluster organization, and the abbreviation Co. is used for company.

Section two presents the analysis of what drives external support needs, ending with an overview of support needs for each innovation actor group (research organizations, large/medium companies and small companies). The third section presents the analysis of how well innovation intermediary functions address these needs, including an analysis of the particular role that cluster organizations may play in supporting international innovation processes.

The final section of this chapter will relate the results to the categories defined in the analytical framework – providing a summary view of external support needs in different actor groups, as well as the innovation intermediary functions that address these needs.

5.1. Analysis of the Case Context

As discussed in Chapter 3, the results of this case are influenced by the case context. It is important to understand the specific factors that lie behind this case in order to establish the premises on which the results are based, and position the results within an appropriate frame.

The StarDust case is a policy initiative to foster transnational collaboration between specialized research and innovation nodes in the Baltic Sea Region. Within the three-year project period, public support was provided to a particular set of organizations (cluster organizations or other organizations representing specialized innovation nodes) to mobilize and foster interaction between actors (companies and research organizations) in a number of different settings. Innovation actors (companies and research organizations) did not receive direct public support. The project goals and target of public support imply a premise that international interaction between different actors is positive, and that leveraging innovation intermediaries to achieve this aim is positive.

The cluster organizations or other innovation intermediaries that were involved in this study are all “institutions for collaboration” (Porter and Emmons 2003, Sölvell *et al.* 2003), whose purpose is to facilitate linkages and collaborative activities that strengthen competitiveness. These organizations are typically financed by a majority share of public funding, with private funding in the form of membership fees or sales of services (Lindqvist *et al.* 2013: 24). This implies that the intermediaries have a specific mandate to facilitate collaborative linkages – although this may not necessarily imply a mandate (or expertise) with facilitating international linkages. The form of financing that these intermediary organizations typically have implies that the activities they undertake are influenced by the public sector. That is to say, their mandate and motives to facilitate international collaborative linkages may be driven more by the interests of the public sector, than by the interests/needs of the innovation actors (companies and research organizations) that they represent.

Whereas the innovation intermediaries studied in this case are a direct part of the policy initiative and are financed by the project, the innovation actors (companies and research organizations) that are studied have not necessarily been involved in the project’s implementation. Rather, the innovation actors are associated with a particular innovation intermediary through local/regional cluster initiatives or other types of specialized innovation environment. The

perspectives provided by the innovation actors are not a reflection of the policy initiative *per se*, nor do they necessarily reflect how much/how often innovation actors rely on support from innovation intermediaries. Rather, the data collected from innovation actors is a reflection of the actor's view of particular functions that innovation intermediaries provide. This implies that the results do not reflect a perspective on whether or not intermediaries are "useful" in general, but rather reflect which functions are perceived as most useful when intermediary support is provided.

The results presented in the next sections are shaped by all of these factors in conjunction.

5.2. What factors drive the need for external support?

Innovation actors (i.e. companies and research organizations) experience a strong strategic importance of international knowledge sourcing and innovation collaboration, and currently use a number of non-local sources for these activities. However, they also experience a number of barriers to accessing knowledge and collaborating with partners internationally. Research organizations, large/medium and small companies have different capabilities to address these barriers. In areas where barriers are high or where capability gaps exist, innovation actors experience various needs for external support.

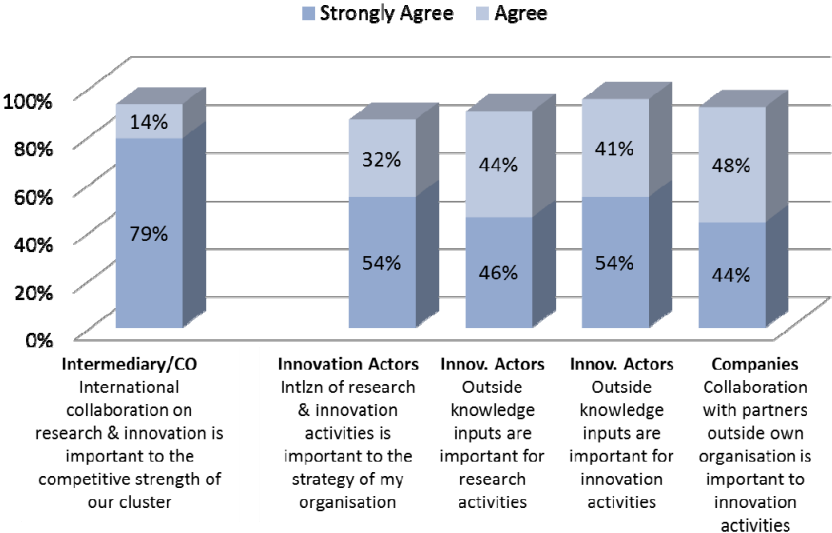
This section presents the analysis of various factors that drive external support needs, ending with an overview of support needs for each actor group.

5.2.1. International knowledge sourcing and collaborative innovation activities have strategic importance

Innovation actors (i.e. companies and research organizations) recognize the strategic importance of internationalization of research and innovation – both in terms of accessing international knowledge sources and collaborating with international partners for further development and exploitation of knowledge. This is illustrated through the high ratings of strategic importance that were given both by the innovation actors, as well as by the intermediaries/cluster organizations that represent them (see Figure 15 below).

Overall, cluster organizations/intermediaries have a more positive view on the importance of internationalization of research and innovation. The large majority (93%) of cluster organizations (COs) strongly agree/agree that international collaboration is important to the competitive strength of the cluster. Innovation actors' had less strong views, with 86% strongly agreeing/agreeing that internationalization of research and innovation was important to the strategy of their organization, 90% strongly agreeing/agreeing that outside knowledge inputs were important for research activities, 95% strongly agreeing/agreeing that outside knowledge inputs were important for innovation activities, and 92% strongly agreeing/agreeing that collaboration with outside partners was important for innovation activities.

Figure 15: Importance of Internationalization of Research and Innovation (innovation actors in all StarDust pilots)



Source: Survey

The difference in perspectives of importance between COs (93% of the 14 COs included) and innovation actors (at 86%) is an interesting one – COs view internationalization as more of an imperative than their innovation actors do. This could be due to the mandate that cluster organizations have in their local innovation node. With increasing understanding of the benefits of more open

and international innovation processes, cluster organizations' steering groups (including companies and research actors, but also governmental actors) place high strategic importance on the internationalization of their cluster. The difference in perspectives could also be due to the fact that the group of cluster organizations that participated in this research have a particular focus on international collaboration on research and innovation – and thus have a more positively biased view of the strategic importance of international activities than the general population of cluster organizations.

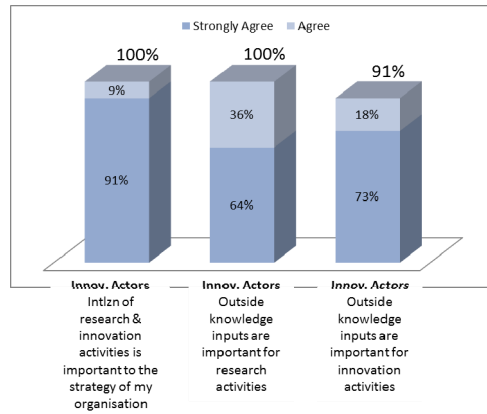
Within the set of innovation actors, the difference in perspectives between research organizations and companies, and large/medium and small companies is particularly interesting. Companies (particularly small companies) gave lower ratings of the strategic importance of internationalization of research and innovation. Based on follow-up interviews, this is due to a lack of time and human resources to work with international knowledge sharing and innovation collaboration – not because it is not considered important. Further elaboration on the different perspectives of innovation actors is provided below.

Research Organizations vs. Companies

Research organizations prioritize internationalization of research and innovation more than companies do. Whereas 100% of research organizations strongly agree/agree that internationalization of research and innovation is important to their organization's strategy, only 84% of companies do (see Figure 16 and Figure 17 below). Research organizations also prioritize outside knowledge inputs for research activities more than companies do (100% vs. 88%). Follow-up interviews highlighted the fact that research organizations actively develop and leverage international networks as an integral part of their research and innovation activities. This is in contrast to companies (particularly smaller companies), who may not necessarily view international knowledge sources and collaboration partners as an integral part – or “must have” characteristic – of their research and innovation activities.

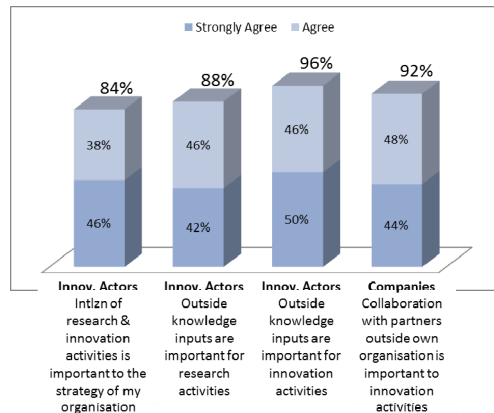
Yet companies have a higher prioritization of outside knowledge inputs for innovation activities (96% vs. 91%). This is likely due to the fact that companies – more than research actors – actively engage in innovation activities. The question on the importance of outside collaboration partners for innovation activities was only posed to companies.

Figure 16: Importance of Internationalization of Research and Innovation (Research Organizations)



Source: Survey

Figure 17: Importance of Internationalization of Research and Innovation (All Companies)



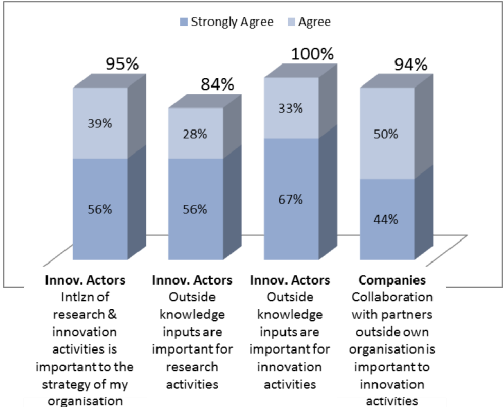
Source: Survey

Large/Medium vs. Small Companies

Larger companies prioritize internationalization of research and innovation more than smaller companies do (see Figure 18 and Figure 19 below). Whereas 95% of large/medium companies strongly agree/agree that internationalization of research and innovation is important to their organization's strategy, only 77%

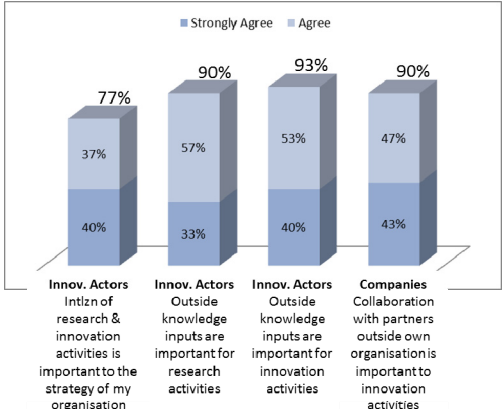
of small companies do. Based on follow-up interviews with small companies, this difference of perspectives is reportedly due to a lack of time and human resources to work with international knowledge sharing and innovation collaboration – not because it is not considered important.

Figure 18: Importance of Internationalization of Research and Innovation (Medium and Large Companies)



Source: Survey

Figure 19: Importance of Internationalization of Research and Innovation (Small Companies)



Source: Survey

For any size company, the most important activity is accessing external knowledge inputs for innovation activities (exploitation of the idea), followed by

collaboration with outside partners for innovation activities. This high rating can be an indication of the appreciation that more open innovation processes – involving external partners – deliver better results.

As with the overall prioritization of internationalization of research and innovation activities, larger companies give higher ratings of the importance of specific activities than small companies do. Larger companies place a higher prioritization on external knowledge inputs for innovation activities (100% for large/medium and 93% for small companies) and collaboration with external partners on innovation (94% for large/medium and 90% for small companies).

However the pattern is reversed regarding prioritization of external knowledge inputs for research activities, where smaller companies rated a higher importance than large/medium companies (90% for small vs. 84% for large/medium companies). This is most likely due to limited internal research capabilities of small companies, compared to larger companies.

Overall, it can be observed that intermediaries/cluster organizations and various types of innovation actors place a high strategic importance on international knowledge sourcing and collaborative innovation activities. It seems that actor groups place highest importance on those activities that are they already pursue (i.e. research organizations place strongest importance on external knowledge sourcing for research activities; large/medium companies place strongest importance on external knowledge sourcing for innovation activities). It also seems that lower priority is placed on the overall strategic importance and on certain activities when they are not pursued as predominantly (i.e. small companies give the lowest ratings on the overall strategic importance and on external knowledge sourcing and collaboration for innovation activities). This observation is further supported by other data that was collected (see next subsection).

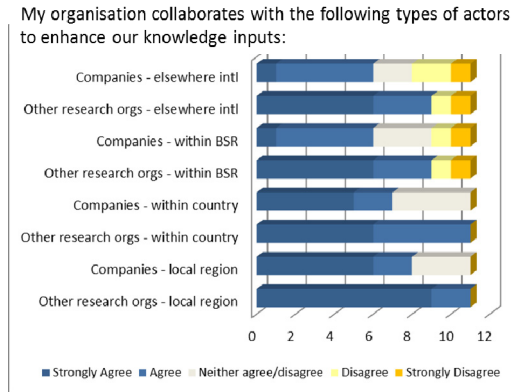
5.2.2. Non-local partners are used for knowledge sourcing and innovation collaboration activities

Innovation actors' different levels of strategic prioritization of external knowledge inputs for research and innovation, and of innovation collaboration with external partners is mirrored in their different patterns of knowledge sourcing and collaboration.

Research Organizations vs. Companies – external knowledge sources

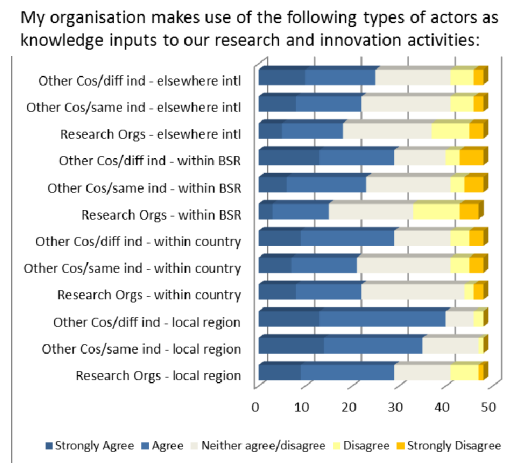
Both research organizations and companies have rather strong tendencies to seek knowledge from outside their own organizations (see Figure 20 and Figure 21 below).

Figure 20: Types and Location of Knowledge Sources
(Research Organizations)



Source: Survey

Figure 21: Types and Location of Knowledge Sources
(All Companies)



Source: Survey

Among responding research organizations, 55-100% strongly agreed/agreed that they used external knowledge sources for their research and innovation activities. Among responding companies, external knowledge sourcing was a bit weaker – with 25-79% strongly agreeing/agreeing that they used external knowledge sources for their research and innovation activities. Within these ranges, external knowledge sourcing patterns can be differentiated in terms of the type of knowledge sources that are targeted, as well as in terms of geography.

Types of external knowledge sources can be differentiated both by type of organization (i.e. research organizations or companies) and – for companies – by industry (i.e. companies within the same or a different industry). Survey results highlighted that – across all geographic levels – companies seem to prefer other companies (over research organizations) as sources of knowledge (with 42-79% of respondents strongly agreeing/agreeing that other companies were used as knowledge sources, compared to 24-58% of respondents strongly agreeing/agreeing that research organizations were used as knowledge sources). Correspondingly, research organizations seem to prefer other research organizations (over companies) as sources of knowledge (with 82-100% of respondents strongly agreeing/agreeing that other research organizations were used as knowledge sources, compared to 55-73% of respondents strongly agreeing/agreeing that companies were used as knowledge sources).

In addition, companies seem to have a slightly stronger preferences for other companies in *different* industries (rather than their own) as sources of knowledge – with 46-79% of respondents strongly agreeing/agreeing that other companies in different industries were used as knowledge sources, compared to 42-67% of respondents strongly agreeing/agreeing that other companies within the same industry were used as knowledge sources.

The geographical location of external knowledge sources can be within the home country (local, national) or within other countries internationally (in the BSR or other international geographies). Geographical distance does not seem to make as big of a difference in knowledge sourcing patterns of research organizations as it does for companies. When looking at the preferred knowledge sources (other research organizations for research organizations, and other companies in different industries for companies), research organizations maintained quite strong external knowledge sourcing patterns despite greater geographical distance – whereas companies' knowledge sourcing patterns decreased more notably in connection with greater geographic distance.

Among research organizations, 100% of respondents strongly agreed/agreed that they used external knowledge sources from within their own country, compared to 82% for international knowledge sources. Among companies, 79% of respondents strongly agreed/agreed that they used external knowledge sources from within their own region, decreasing to 58% from within their own country or the BSR, and decreasing even further to 46% for knowledge sources elsewhere internationally.

Large/Medium vs. Small Companies – external knowledge sources

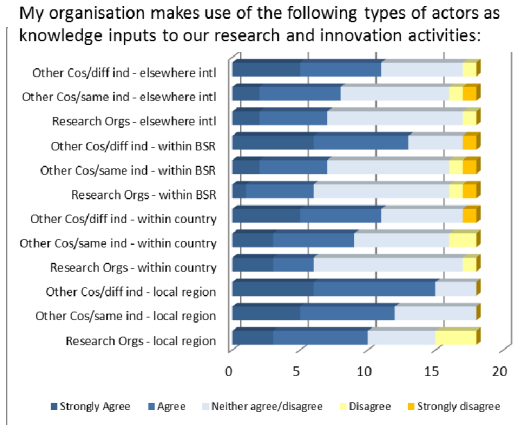
When examining the external knowledge sourcing patterns of large/medium vs. small companies, there are a number of interesting distinctions between these two groupings in level of activity in seeking external knowledge inputs, in type of external knowledge sources that are targeted, and in terms of geographical location of the knowledge source (see Figure 22 and Figure 23 below).

In terms of level of activity and geographical location of external knowledge sourcing activities, both large/medium and small companies have similar levels of knowledge sourcing from regional and national sources, yet small companies have notably lower levels of knowledge sourcing from international sources (27-50% of SME respondents strongly agree/agree on their use of knowledge sources from the BSR and elsewhere internationally, compared to 33-72% of large/medium-sized company respondents). This seems to reflect small companies' relatively higher barriers to engaging in international knowledge sourcing activities (a point that will be elaborated later).

For both large/medium and small companies, there is a slightly higher level of knowledge sourcing activity within the BSR than elsewhere internationally. This seems to reflect that geographical proximity is one of the factors that drive the level of external knowledge sourcing activity – i.e. that knowledge sources in nearer geographies are used a bit more than those located further away.

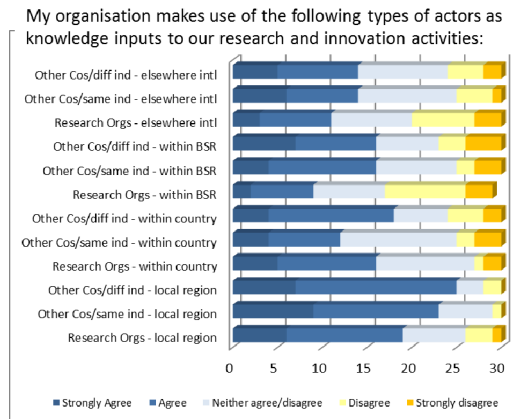
In terms of types of external knowledge sources, small companies have a stronger tendency to use research organisations within their country as knowledge sources compared to large/medium companies. This is likely driven by the fact that large/medium companies more often have in-house research departments (and are not as reliant on external research organizations) compared to small companies.

Figure 22: Types and Location of Knowledge Sources
(Medium and Large Companies)



Source: Survey

Figure 23: Types and Location of Knowledge Sources
(Small Companies)



Source: Survey

In addition, large/medium companies have a slightly stronger preference for using other companies in different industries as sources of knowledge compared to small companies – who have a stronger tendency to lever companies in the same industry (compared to larger companies) – particularly outside of their home country. These external knowledge sourcing patterns (from same vs. different industries) in relation to company size may be linked to factors of

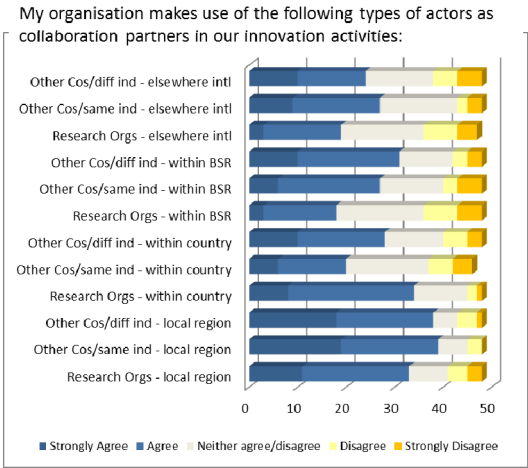
critical mass and competition. That is to say that smaller companies with lower critical mass may seek more similar partners in order to build critical mass. Whereas larger companies with greater critical mass may view similar companies as too close competitors – seeking companies in different (but related) industries to diversify and complement their own knowledge.

All companies – external collaboration on innovation

As described in earlier sections, companies report a high strategic importance (92% of respondents strongly agreed/agreed) on collaboration with partners outside their organization for innovation activities. Similar to the patterns of external knowledge sourcing (described above), patterns of innovation collaboration can be differentiated in terms of the type of collaboration partners that are targeted, as well as in terms of geography.

Types of external knowledge sources can be differentiated both by type of organization (i.e. research organizations or companies) and by industry (i.e. within the same or a different industry). Survey results highlighted that companies generally prefer other companies (over research organizations) as collaboration partners on innovation activities. However, within their own country, research organizations are preferred over other companies as collaboration partners (see Figure 24 below).

Figure 24: Types and Location of Cooperation (All Companies)



Source: Survey

Contrasted to the patterns of knowledge sourcing, companies' appear to seek collaboration partners both within the same industry and in different industries. Overall, there seems to be a slightly stronger preference for partners in different industries.

Companies exhibit some sensitivity to the geographical location of external innovation collaboration partners – responding that the strongest levels of innovation collaboration are with partners within the local region (with 67-79% of respondents strongly agreeing/agreeing), and weakest with partners elsewhere internationally (with 38-52% of respondents strongly agreeing/agreeing). It seems that companies find innovation collaboration partners in the BSR rather attractive. Companies responded that other companies in different industries in the BSR are highly-ranked collaboration partners (5th ranked overall after companies in local region, and research organizations within local region or country).

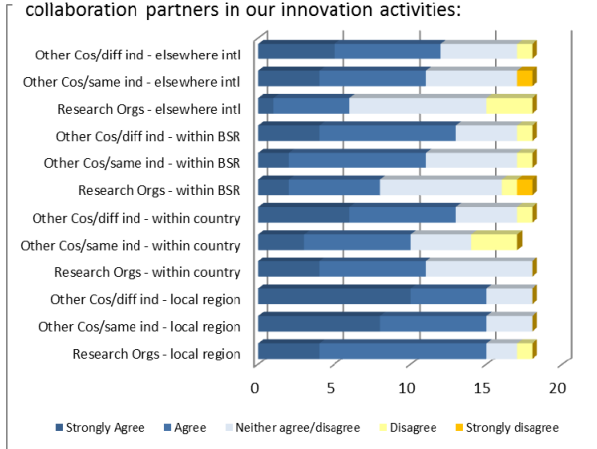
Large/Medium vs. Small Companies – external cooperation on innovation

When examining the external innovation collaboration patterns of large/medium vs. small companies, there are a number of interesting distinctions between these two groupings in terms of level of activity and geographical location of collaboration partners, and in terms of type of external collaboration partners that are targeted (see Figure 25 and Figure 26 below).

In terms of level of activity and geographical location of external innovation collaboration partners, small companies seem to be more challenged in conducting innovation collaboration with external partners than large/medium companies are – even in the local region. Whereas 83% of large/medium company respondents strongly agreed/agreed that they use (all types of) external partners in the local region for innovation collaboration activities, only 57-77% of small company responded similarly. In addition, although both large/medium and small companies have weaker levels of innovation collaboration as geographic distance increases, it seems that large/medium companies are less sensitive to geographic distance compared to small companies. As with external knowledge sourcing activities, this seems to reflect small companies' relatively higher barriers to engaging in international innovation collaboration activities (a point that will be elaborated later).

Figure 25: Types and Location of External Cooperation
(Medium and Large Companies)

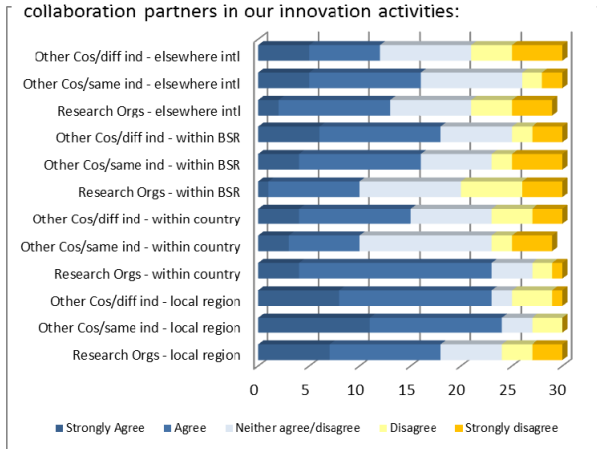
My organisation makes use of the following types of actors as collaboration partners in our innovation activities:



Source: Survey

Figure 26: Types and Location of External Cooperation
(Small Companies)

My organisation makes use of the following types of actors as collaboration partners in our innovation activities:



Source: Survey

In terms of types of innovation collaboration partners, large/medium companies and small companies have different priorities across geographies. Large/medium

companies consistently prefer other companies in a different industry (over other companies in the same industry or research organizations) as collaboration partners. In comparison, small companies have different priorities depending on the geography (prioritizing collaboration with companies in the same industry in their local region, with research organizations in the country, with companies in different industries in the BSR, and with companies in the same industry in other international geographies). Small companies' seemingly more random pattern in targeted collaboration partners may reflect small companies' more pragmatic approach to collaboration in innovation processes. That is to say that small companies seem to engage in collaborative activities as relevant opportunities present themselves, rather than targeting particular collaboration partners from the outset.

Overall, it can be observed that research organizations and companies have relatively high levels of external knowledge sourcing and innovation collaboration. Among companies, it appears that there are higher levels of activity with external cooperation on innovation compared to external knowledge sourcing. Geographical distance does seem to affect the level of external knowledge sourcing or innovation collaboration activities – but to varying degrees for different actor groups. Research organizations seem least affected by geographical distance, and small companies seem most affected by geographical distance. Both research organizations and companies have a tendency to source knowledge from and collaborate with similar organizations (i.e. research organizations with other research organizations, and companies with other companies). Among companies, it seems that large/medium companies consistently seek other companies in different industries (instead of within their same industry) as knowledge sources and collaboration partners. In comparison, small companies have more varied patterns of external knowledge sourcing and collaboration.

5.2.3. Engagement in international innovation processes are hindered by various barriers

Although innovation actors (i.e. companies and research organizations) experience a strong strategic importance of international knowledge sourcing and innovation collaboration – and currently engage in these international innovation activities, they face a number of barriers. Barriers include lack of information and competence, lack of access to relevant network contacts and

markets, and lack of funding and opportunities to take increased risk and experiment with international collaboration.

Lack of Information and Competence

Across innovation actor groups, a common barrier to initiating international innovation activities is a *lack of knowledge about the other country's innovation "eco-systems"*. An understanding of how things work in different geographies – which institutions, places and people/companies are most relevant for different industries is an important baseline to begin working within and with partners from “foreign” systems.

Another informational barrier that was more relevant for small companies was a limited understanding of end user needs in new markets. For large companies, access to such market information/market research is a typical “in-house” activity, or an activity that is pursued in collaboration with research organizations.

In terms of competence barriers, all actor groups mentioned a *lack of general open-mindedness and experience in working in international collaborations*. This barrier can encompass many areas from language skills and cultural awareness, to attitudes and capacity for initiating and implementing collaborative development projects.

Another competence barrier (which was most highlighted by SMEs) was a *lack of experience with defining one's own unique offering and communicating/demonstrating the value-added of international innovation activities* (including knowledge exchange and collaborative development activities...not just export). This was particularly highlighted by companies who worked with social innovations – i.e. products/services that improved services to society (like healthcare). For small companies who are not necessarily accustomed to communicating their specialized competencies and how they provide value in a collaborative context, the ability to communicate “business cases” in this manner is an important competence – particularly in international collaborative contexts.

A final competence barrier (also highlighted by SMEs – particularly “born globals”) was a *general lack of exposure to/experience with innovation activities* (from knowledge sourcing/exchange and collaborative development activities, to expansion/export in new markets) *in an international context*. For this actor group, mentorship/advisory support from experienced entrepreneurs was in

demand. This need for “born globals” to have network contacts has been highlighted in other literature as well (see, for example, Halldin 2012).

Lack of Access to Relevant Network Contacts and Markets

Although both companies and research organizations undertake international network-building activities as part of their normal day-to-day operations, they feel that they lack the access they need to relevant network contacts and markets.

One access barrier (highlighted by all companies) is the *lack of branding and legitimacy to stand out internationally*. With an increase in global competition, the need for local anchoring, good references, and active promotion activities has grown in importance.

Another access barrier is the *lack of proactive support to find the most relevant entry points/partners in new markets*. For research organizations, there are few barriers to finding other relevant research partners; rather, they are challenged to find relevant companies/business networks in foreign markets that can make use of research capabilities. For companies, there is a need to find the right “entry point” (e.g. procuring companies/agencies, distributors, etc.) into system solutions in other countries and the most well-positioned network partners with whom to collaborate. Smaller companies who lack internal capacity and resources to identify and access the most relevant partners are hindered from pursuing international ambitions without such proactive support.

Companies also feel international access is hindered by a *lack of exposure to new partners (in different sectors or fields of expertise) or partners with clear ideas for new collaboration opportunities*. Large companies use their own networks to search for new development or partnership activities, but experience that their own networks are not always as broad and diverse as they desire and seek exposure to “new matches”. Companies of all sizes have difficulties in monitoring new international collaboration opportunities and seek relevant platforms or networks that can continually expose them to concrete ideas in which they can become involved.

A final barrier related to accessing international markets is *lack of contact with and approval from appropriate governmental agencies*. For certain markets (in e.g. Asia) and industries (e.g. healthcare), access to governmental agencies (via comparable actors in home market) is imperative. Small companies, in particular, have difficulty navigating new international systems – getting access

to the right distribution channels or “system solutions”, influencing procurement requirements, etc.

Lack of Funding and Opportunities to Experiment

A third group of barriers (expressed by companies only) is lack of funding and opportunities to take increased risk and experiment with international collaboration. Despite recognition of the importance of international knowledge sourcing and collaboration for long-term competitiveness, many companies still consider international innovation activities to be more risky and not necessarily part of “core business”. This is primarily the view of small companies, as larger companies typically have better liquidity and more stable cash flow – allowing them to invest in riskier development activities (including international knowledge sourcing and collaboration projects) that are deemed important for longer-term strength. However, in current market conditions, even large companies have had to decrease their investments in international innovation activities.

Lack of dedicated resources (time and money) for international activities is considered a barrier for many SMEs. Funding to help cover costs and decrease perceived risk of taking resources away from other activities is desired. The level of financing that may be needed for international activities is driven, among other things, by the type of industry conditions (e.g. government-regulated or not), and the type of innovation in focus (i.e. completely new to market or incremental innovation). All companies perceive that more time should be dedicated to working with international innovation activities. Having the opportunity (and financial resources) to experiment operationally with collaborative activities is viewed as the most important ingredient to developing relationships (and trust) with new international partners.

Lack of financing to develop products/services and grow more quickly is another barrier highlighted by SMEs. Available funding for innovation activities (e.g. from regional/national business development and innovation agencies) often assumes strong liquidity, and requires companies to have enough cash available to initiate and execute the project before they can get (partially) reimbursed. This is particularly difficult for SMEs, but financing for international innovation activities can even be a problem for larger companies in the current market climate. In addition, SMEs in the Nordic countries highlight that a *lack of private equity* in their home country puts them at an unfair disadvantage when

they are competing against comparable small companies from larger markets (e.g. the US).

5.2.4. Innovation actors experience different capability gaps

As described in the section above, there are a number of barriers that hinder the internationalization of innovation processes. Each actor group (research organizations, large/medium companies, and small companies) experiences different “main barriers” or capability gaps – which drive differentiated needs for external support to their international innovation processes. This section will summarize the main capability gaps that are experienced by each of the three categories of innovation actors, affecting their needs for external support.

Research Organizations – capability gaps

Research organizations have global networks and are experienced in working with leading researchers in their specialized niche/research area. The main focus for many research organizations’ international activities is increasing company engagement in international research projects, and developing international “eco-systems” that support industry needs in their home country.

“Whereas previous international research projects focused mainly on fitting technology to users, current projects look more holistically at designing functional eco-systems that address needs in certain thematic areas (e.g. ageing, products in working/home environment, etc.) – and mobilizing the involvement of different stakeholder groups in these projects.” (Senior Research Scientist, Research Institute)

Research organizations are comprised of individuals with specialized knowledge and research expertise, but may lack individuals with an international perspective and experience. Such people (with the appropriate mindset, competence about foreign innovation systems, and the ability to communicate and “sell in” one’s own research expertise in other market environments) are needed in order for research organizations to take part in international projects. Research organizations may need support to develop an understanding of foreign innovation systems and market environments, or with developing competencies to work in international collaboration projects.

Research organizations may lack contacts or broader networks in the business world and need to team up with other actors (including intermediaries) to help them identify and develop collaboration with companies that can make use of their specialized knowledge.

Although research organizations are generally able to attract financial resources for collaborative research projects, they may have difficulties in securing other types of financing to support e.g. international mobility of researchers in connection with these projects. Thus, research organizations may desire external support to facilitate better mobility of researchers in connection with ongoing projects.

Large/Medium Companies – capability gaps

Larger companies (i.e. with more than 50 employees) generally have strong local anchoring and legitimacy, a big international network, as well as international presence. The main focus for larger companies' international activities is to maintain or strengthen their competitive position in order to provide return to shareholders.

Larger companies can leverage their infrastructure (test facilities, etc.), expertise, and networks assets to attract collaboration partners and gain access to external markets. Even so, larger companies seek broader/external networks (through e.g. intermediaries) to be exposed to new partners (e.g. from other markets, other industries, etc.) with new ideas or complementary expertise that can make their own offering more attractive and competitive.

“(Even though) the company uses its local offices across the globe to identify international opportunities, it still useful to work with intermediaries to highlight new market opportunities and new company/entrepreneur contacts with ideas for collaborative development projects.” (Head of Strategic Partnering, Large Company)

External networks and intermediary support are also used to identify relevant partners (SMEs are particularly interesting) and opportunities for joint development activities, and to establish collaboration with other major players internationally. Platforms/arenas that are facilitated by intermediaries are one example of a service offering where larger companies can be put in touch with a variety of relevant players (e.g. potential partners, investors, customers).

Larger companies also seek support for being profiled internationally as part of a broader context (e.g. a specialized node or eco-systems).

Small Companies – capability gaps

Small companies (i.e. with 50 or fewer employees) are typically characterized by competencies in a particular niche area and strong entrepreneurial drive. Small companies may have experience working in international environments, yet this is typically through export activities. Small companies who are not part of broader international networks or systems (such as supply networks or global value chains) generally lack experience in knowledge sourcing and innovation collaboration with international partners.

Although some small companies may have local anchoring and legitimacy (through e.g. organized cluster initiatives), many lack international recognition. Small companies also have limited human (both in terms of numbers of staff and competencies/experience) and financial resources – making investment in international knowledge sourcing/innovation collaboration very risky, as it takes time and costs a lot. The main focus for small companies is to maintain stable revenues and steady cash flow; therefore, international innovation activities are often not part of small companies’ “core business”.

Given the risks that small companies associate with international innovation activities and the capability gaps that they have (given their lack of experience), this is the actor group that experiences the most needs for various types of external support in order to catalyze their involvement in international knowledge sourcing and collaboration.

Small companies need support with information and competence building, including opportunities to learn about foreign innovation “eco-systems” (how they work and “who’s who”), and knowledge/deeper understanding of end user needs in relevant foreign markets.

“When considering expansion to new markets, it is very helpful to have support in ‘getting to know the eco-system abroad’ – including contacts with other entrepreneurs that one can learn from.” (COO, Small Company)

“External knowledge about market needs (in different markets), as well as structures (who are main actors – institutional and otherwise) is important to have.” (CEO, Small Company)

Small companies also need competence development in a number of areas – developing capabilities for partnering internationally (e.g. training on pitching ideas and communicating the business case, open-mindedness for new collaborative opportunities), and developing their strategic insights on how international innovation activities can strengthen their own strategic idea and offer growth opportunities. Receiving mentorship/advisory support from experienced entrepreneurs or larger companies are helpful services that can address small companies’ needs in this area.

Small companies also need support to access relevant network contacts and new markets. Being profiled/positioned as part of a broader context, having good references and other evidence of their own legitimacy/expertise are services that can help small companies market themselves internationally.

“(As a small company), getting knowledge and exposure to other (bigger) players and getting profiled internationally are important to engaging in international activities.” (CEO, Small Company)

“(Small companies) with new proposed solutions need legitimacy/acceptance from public sector bodies, etc. to enter new markets.” (Chairman of the Board, Small Company)

Different kinds of ‘boundary crossers’ (working with both political and operational levels) can be appropriate intermediaries to open doors and provide legitimacy in foreign markets (identifying distributors/entry points into ‘foreign systems’ and partners who companies can trust).

“Proactive support to find new contacts...to integrate our own specialized product in system solutions...is important.” (Director, Small Company)

Other support to networking and matchmaking with relevant players (tailored to the company’s areas of expertise and potential growth opportunities) are also services that can catalyse SMEs’ engagement in international innovation processes.

“We are interested in being exposed to a broader international network to investigate potential partnerships. We have previously tried matchmaking activities through the national trade council, but have found that focused events that are tailored to our own needs (that bring together the right players with multiple possibilities/complementary competencies) work faster and are cheaper.” (CEO, Small Company)

Finally, small companies need financing and opportunities to experiment (succeed or fail) with different collaborative activities). Financial support for demonstrating a potential solution that addresses needs in an international market can help to initiate new business opportunities abroad. Small companies need access to investors who invest not only capital but also their own expertise, network contacts, market access, etc. – helping SMEs to connect to new innovation systems internationally.

“It helps a lot to have someone to introduce you to new partners. We expect that investors provide more than money – that they get involved and help open doors within their networks and connect us with relevant partners in new markets.”
(COO, Small Company)

“We need support from organizations that are not out to make money themselves...and from organizations that understand how a business is run.”
(Chairman of the Board, Small Company)

5.2.5. Translating Driving Factors into Support Needs by Actor Group

The previous sections have presented an analysis of various factors that drive needs for support activities that can foster (more effective) international innovation processes. For each of the innovation actor groups (research organizations, large/medium firms and small firms), the analysis highlights existing strategic priorities and patterns of external knowledge sourcing and innovation collaboration, as well as barriers and capability gaps that are experienced.

In this section, a synthesis of the analysis of driving factors is used to develop a list of main needs for external support to international innovation processes for each actor group. Support needs are structured relative to the three “metanational capability” categories: sensing, mobilizing and operationalizing (as explained in section 2.5.1.).

Research Organizations – translating driving factors into support needs

Among the three actor groups, research organizations place the highest strategic importance on the internationalization of research and innovation (with 100% of survey respondents strongly agreeing/agreeing). Research organizations also

place a high importance on outside knowledge inputs for their research and innovation activities.

This high prioritization is reflected in their knowledge sourcing patterns – with 100% of research organizations strongly agreeing/agreeing that they used external knowledge sources within their country, and 82% of research organizations strongly agreeing/agreeing that they used international knowledge sources. Research organizations have a stronger tendency to use other research organizations (rather than companies) as sources of knowledge (with 82-100% of respondents strongly agreeing/agreeing that other research organizations were used as knowledge sources, compared to 55-73% of respondents strongly agreeing/agreeing that companies were used as knowledge sources).

Although research organizations have a natural tendency to conduct research with international partners and generally have strong international networks, they still face some challenges to engaging in international innovation processes. These are primarily related to identifying relevant opportunities for using their research expertise in foreign innovation systems/markets and increasing company engagement in international research/innovation projects.

Table 13: Research Organizations – overview of support needs

Metanational Capability Category	Needs for External Support
Sensing <i>(prospecting and accessing capabilities)</i>	<ul style="list-style-type: none"> - Understanding foreign innovation systems and market environments - Identifying and plugging-in to relevant company contacts in international markets
Mobilizing <i>(moving and melding capabilities)</i>	<ul style="list-style-type: none"> - Developing competencies to work in international environments/in international collaboration projects - Setting up international innovation projects that make use of specialized research capabilities - Facilitating better mobility of researchers in connection with innovation projects
Operationalizing <i>(relaying and leveraging capabilities)</i>	<ul style="list-style-type: none"> - Not relevant for research organizations

Source: Interviews

An overview of research organizations' main expressed needs for external support to international innovation processes (sorted according to metanational capability category) is presented in Table 13 above.

Large/medium companies – translating driving factors into support needs

Large and medium-sized companies also place a high strategic importance on the internationalization of research and innovation (with 95% of survey respondents strongly agreeing/agreeing). Large/medium companies place a particularly strong importance on outside knowledge inputs for innovation activities (with 100% of survey respondents strongly agreeing/agreeing). Collaboration with external partners for innovation activities, and outside knowledge inputs for research activities were also viewed as important (with 94% respectively 84% of survey respondents strongly agreeing/agreeing).

Although larger companies exhibit a relatively strong level of external knowledge sourcing activity (with a range of 33-83% of survey respondents strongly agreeing/agreeing), levels of actual knowledge sourcing activity do not appear to be as strong as the importance the same companies placed on it. External knowledge sourcing is strongest with other companies in different industries. Geographical distance does not seem to be much of a deterrent with these partners (as the range of respondents who strongly agree/agree is in the higher range – 61-83%). Knowledge sourcing from other companies in the same industry seems a bit more sensitive to geographical proximity (as the percentage of respondents who strongly agree/agree declines from 67% for the local region, to 39% for international geographies). External knowledge sourcing is lowest with research organizations (with a range of 33-56% of respondents who strongly agree/agree).

Large/medium companies exhibit the same level of activity with external innovation collaboration (with a range of 33-83% of survey respondents strongly agreeing/agreeing). This is also slightly below the level of importance placed on it. Similar to external knowledge sourcing, external innovation collaboration is strongest with other companies in different industries. Again, geographical distance does not seem to be much of a deterrent with these partners (as the range of respondents who strongly agree/agree is in the higher range – 67-83%). Innovation collaboration with other companies in the same industry is also quite strong and not very sensitive to geographical distance (with a range of 56-83% of survey respondents strongly agreeing/agreeing). Interestingly, collaboration with other companies in the same industry decreases

outside of the local region (within the same country), but increases again with greater geographical distance. (This may be a reflection of a stronger national competitive environment, or of a preference for international collaboration partners.) As with external knowledge sourcing, innovation collaboration is lowest with research organizations; however, collaboration with research organizations in the local region is as high as collaboration with other companies (in the same or in different industries).

Large/medium-sized companies generally have good competencies for working internationally, established channels for information on and entry to foreign markets, well-developed networks, and funding. Larger companies tend to naturally identify and pursue international innovation activities, yet they perceive a benefit of external support to broadening their network connections (particularly with small companies or entrepreneurs) with contacts they may not otherwise be exposed to (e.g. in other industries or markets).

An overview of large/medium companies' main expressed needs for external support to international innovation processes (sorted according to metanational capability category) is presented in Table 14 below.

Table 14: Large/Medium Companies – overview of support needs

Metanational Capability Category	Needs for External Support
Sensing <i>(prospecting and accessing capabilities)</i>	- Identifying relevant partners (SMEs particularly interesting) and opportunities for joint development activities/collaborative partnerships
Mobilizing <i>(moving and melding capabilities)</i>	- Being exposed to a broader international network and new partners/opportunities (e.g. through innovation platforms/arenas where can be put in touch with a variety of relevant players) - Being profiled internationally as part of a broader context (e.g. a specialized node or eco-systems)
Operationalizing <i>(relaying and leveraging capabilities)</i>	- No support needs expressed

Source: Interviews

Small companies – translating driving factors into support needs

Among the three actor groups, small companies placed the lowest strategic importance on the internationalization of research and innovation (with 77% of survey respondents strongly agreeing/agreeing). Small companies place a higher importance on outside knowledge inputs for innovation activities (with 93% of survey respondents strongly agreeing/agreeing). Collaboration with external partners for innovation activities, and outside knowledge inputs for research activities were also viewed as important (with 90% of survey respondents strongly agreeing/agreeing to each).

Small companies exhibit a relatively strong level of external knowledge sourcing activity (with a range of 27-83% of survey respondents strongly agreeing/agreeing). External knowledge sourcing is strongest with other companies, and other companies in different industries (vs. the same industry) are used more prevalently within companies' own country. Geographical proximity seems to matter, as the levels of survey respondents who strongly agree/agree to sourcing knowledge from other companies in different industries declines from 83% in the local region, to 57% within the country, to 50% within the BSR and 43% in other international geographies. External knowledge sourcing is lowest with research organizations (with a range of 27-63% of respondents who strongly agree/agree).

Small companies exhibit a similar level of activity with external innovation collaboration (with a range of 33-77% of survey respondents strongly agreeing/agreeing). Unlike more clear patterns with external knowledge sourcing, small companies have varying patterns with external innovation collaboration. In the local region, innovation collaboration is strongest with other companies in the same industry and weakest with research organizations. Within the country, innovation collaboration is strongest with research organizations and weakest with other companies in the same industry. Within the BSR, innovation collaboration is strongest with other companies in different industries and weakest with research organizations. Elsewhere internationally, innovation collaboration is strongest with other companies in the same industry and weakest with research organizations. Although geographical distance seems to affect the level of innovation collaboration activity, there is no clear pattern here either. As discussed earlier, small companies' seemingly more random patterns may reflect their more pragmatic approach to collaboration in innovation processes.

In contrast to large/medium-sized companies, small companies have fewer resources to leverage in the pursuit of international innovation activities. They generally have less knowledge of and experience working in foreign markets, lower international recognition, more limited network contacts and access points to engage in new collaborative projects, and more limited financial resources to invest in international opportunities. Whereas research organizations and larger companies may tend to naturally identify and pursue international innovation activities, small companies may perceive international innovation activities as too costly and time consuming (and thus too risky) to engage in. Thus, they may need various types of support to catalyze their interest and engagement in international innovation processes.

Table 15: Small Companies – overview of support needs

Metanational Capability Category	Needs for External Support
Sensing <i>(prospecting and accessing capabilities)</i>	<ul style="list-style-type: none"> - Providing opportunities to learn about innovation systems in relevant foreign markets - Developing insights on how international innovation activities can strengthen their own strategic idea and offer growth opportunities - Developing capabilities for partnering internationally; receiving mentorship/advisory support from experienced entrepreneurs
Mobilizing <i>(moving and melding capabilities)</i>	<ul style="list-style-type: none"> - Being profiled/positioned as part of a broader context (evidence of legitimacy/expertise) - Having someone to open doors/introduce you and provide legitimacy in foreign markets - Networking and matchmaking with relevant players that is tailored to own areas of expertise and potential growth
Operationalizing <i>(relaying and leveraging capabilities)</i>	<ul style="list-style-type: none"> - Attaining financing and engaging in opportunities to experiment internationally (e.g. demonstrating potential solutions in international markets) - Having access to investors who invest capital as well as own expertise, network contacts, market access, etc.

Source: Interviews

An overview of small companies’ main expressed needs for external support to international innovation processes (sorted according to metanational capability category) is presented in Table 15 above.

5.3. What support functions do innovation intermediaries fulfill?

This section presents an overview of the functions that innovation intermediaries fulfill in supporting international innovation processes – introducing the role that cluster organizations may play in fostering these processes. Next, an analysis of the overall usefulness of intermediaries' support, and how well innovation intermediary support functions address research organizations and companies' support needs is presented. This is followed by an analysis of the differentiated priorities for support functions across the five transnational innovation networks involved in this case study. In the final subsection, an overview of the most useful intermediary support functions is summarized for each actor group.

5.3.1. International innovation intermediaries and the role of cluster organizations

Innovation intermediaries are a part of the innovation support infrastructure – acting as agents and fulfilling a range of support functions between two or more parties in any aspect of the innovation process. As discussed in section 2.5.2., intermediary support functions are also seen in relation to international innovation processes.

Research organizations' and companies' needs for support to international innovation processes can be addressed by a range of intermediaries including investment and export promotion agencies, embassies and innovation centers abroad, innovation and business development agencies at home, local science and technology or business parks, and cluster organizations. It is important that innovation intermediaries understand the companies' particular field of business – and stage of development – of their “client” companies and research organizations. The intermediaries that are most often involved in supporting international innovation processes (e.g. trade councils and investment promotion agencies) offer services that may be perceived as too general (general analytical or networking/matchmaking services), or appropriate for larger, more established companies (rather than tailored to the needs of start-ups).

So who do companies and research organizations turn to in order to address their internationalization needs? What role do cluster organizations have among the sea of innovation intermediaries supporting internationalization?

Research organizations typically rely on their own international academic networks in order to get the information and new network contacts they desire. In some cases, intermediary organizations (such as cluster organizations) are used to provide broader network contacts with companies and other support services (see later sub-sections). Companies also make use of existing supply/value chain networks to e.g. gain insights on customer needs in new markets, make new connections, and pursue new development activities. Yet some companies (in particular small companies) may not have international networks that can be leveraged. For these companies, intermediaries can help facilitate companies' engagement in international innovation processes. Even companies with existing international networks may make use of intermediaries to support particular aspects – helping their international activities to be more effective.

Companies turn to different intermediaries for different services – and are most interested in support that is practical and tailored to their particular needs. While large companies actively seek out the external support they need, smaller companies are generally more focused on “core business” (see previous section) and may need more proactive external support.

Cluster organizations – as one particular type of innovation intermediary supporting international innovation processes – typically have a very good understanding of their “member” companies and research organizations (the field of business and stage of development), and can be proactive in offering services that are more relevant and tailored to the specific needs of their “client” companies and research organizations (often in collaboration with other intermediaries – e.g. trade councils). Cluster organizations act as a bridge between public authorities and companies, companies and research actors, etc. Cluster organizations can also provide a broader context and brand for the cluster's particular area of expertise, and can catalyse international activities by constantly scouting for and ‘filtering through’ relevant opportunities. In addition, cluster organizations' active facilitation helps mobilise and involve companies in practical international innovation activities as early as possible.

As presented in earlier sections, international collaboration on research and innovation activities is viewed as strongly important for the competitive strength of participating clusters. Follow-up interviews with various actor groups have

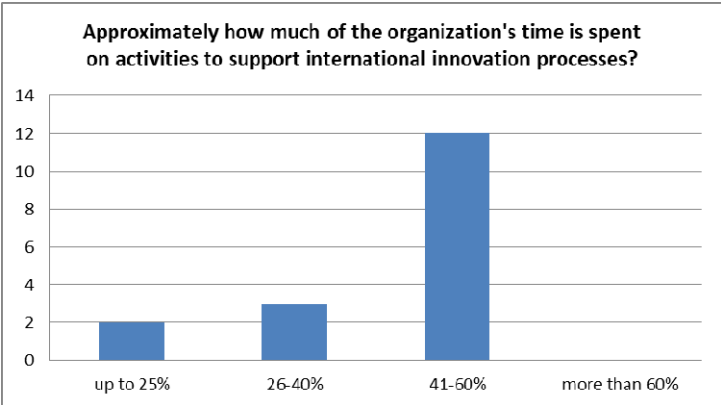
highlighted that internationalization of innovation activities is increasing in importance (see Figure 27 below). Global market pressure makes efficiency and international network positioning more important.

Figure 27: Trend in Importance of International Collaboration on Research and Innovation



Source: Interviews

Figure 28: Level of Organization's Time Spent Supporting International Innovation Processes



Source: Interviews

Cluster and research organizations⁸⁸ are also placing higher priority, and are spending more time with activities to support international innovation processes. Follow-up interviews highlighted that the large majority of intermediary organizations spend around half of their organization's human resources on supporting their members' international innovation processes (see Figure 28 above). Some examples of these support services include:

- branding, marketing and promotion activities
- study trips (with companies), networking and other learning activities
- developing test beds or other platforms that can facilitate joint business development and offerings to international customers (in e.g. healthcare)
- hosting international visits, conferences or other investment attraction activities
- participating in international collaboration projects and international networks (representing member organizations)
- finding new international partners (through e.g. matchmaking events) and sources of financing for relevant projects
- brokering/developing/facilitating new projects in demand by member companies and research organizations (serving as a "spider in the net")
- hosting external experts for member companies

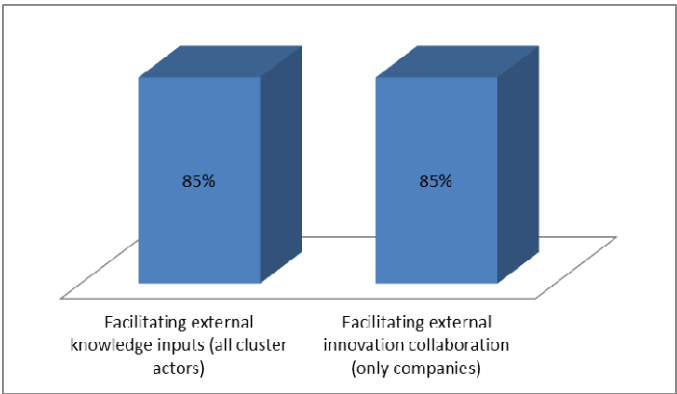
Given that cluster organizations' mandate is primarily focused on developing the local/regional innovation environment – and not on supporting international innovation processes – they may lack the skills and resources needed. Yet these organizations often have the best understanding of company and research organizations' needs. Therefore, cluster organizations team up with innovation centers abroad, trade councils, etc. to communicate needs and deliver services that are tailored to the needs of their members.

⁸⁸ Of the 17 organizations participating in the follow-up interviews, 13 were cluster organizations, and 4 were research organizations.

5.3.2. Usefulness of intermediaries' support

Innovation (or cluster) actors give high ratings of usefulness of intermediaries/cluster organizations in their role of facilitating external knowledge inputs and innovation collaboration (see Figure 29 below). This rather high rating may be (at least in part) a reflection of the process of selecting survey participants and the positive bias of these companies and research organizations toward “their” intermediary cluster organization.

Figure 29: Usefulness of Cluster Organization (CO)/Intermediary in Facilitating International Innovation Processes (% of respondents who strongly agree/agree)

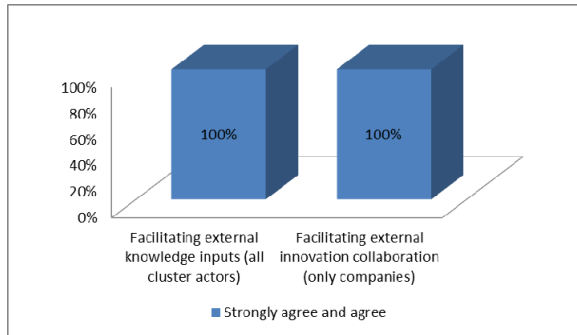


Source: Survey

Of the different innovation actors, research organizations seem more positive about the usefulness of intermediaries than companies, and large/medium companies seem more positive than smaller companies (see Figures 30-33 below). The lower ratings of usefulness given by small companies can be a reflection of their relatively higher need for (and expectations on) intermediary support – which may not be met to the degree that is desired.

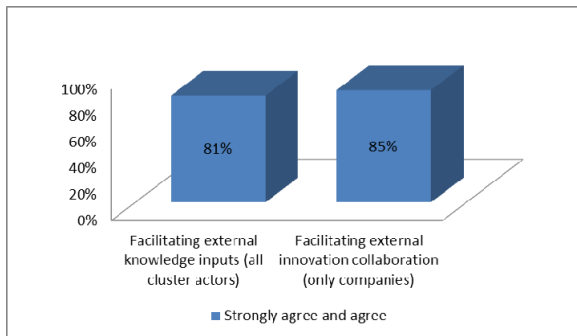
It can also be noted that companies (or rather small companies) view intermediaries' as more useful in their facilitation of innovation collaboration than their facilitation of external knowledge inputs. This may be a reflection of small companies' lack of experience with international innovation collaboration and stronger need for external support to identify opportunities, select partners and facilitate activities in this area.

Figure 30: Usefulness of Cluster Organization (CO)/Intermediary in Facilitating International Innovation Processes (% of research respondents who strongly agree/agree)



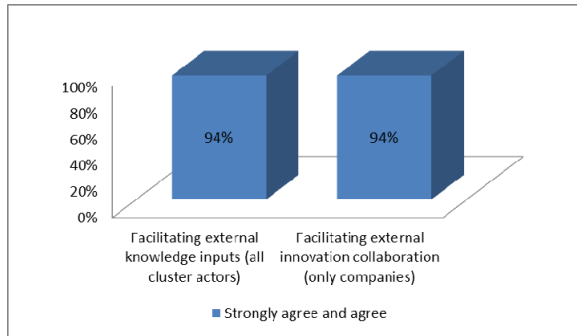
Source: Survey

Figure 31: Usefulness of Cluster Organization (CO)/Intermediary in Facilitating International Innovation Processes (% of company respondents who strongly agree/agree)



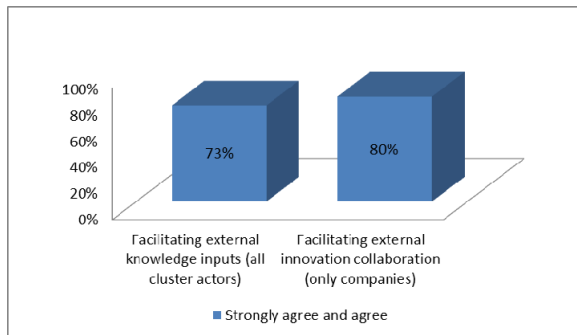
Source: Survey

Figure 32: Usefulness of Cluster Organization (CO)/Intermediary in Facilitating International Innovation Processes (% of lg/med company respondents who strongly agree/agree)



Source: Survey

Figure 33: Usefulness of Cluster Organization (CO)/Intermediary in Facilitating International Innovation Processes (% of small company respondents who strongly agree/agree)

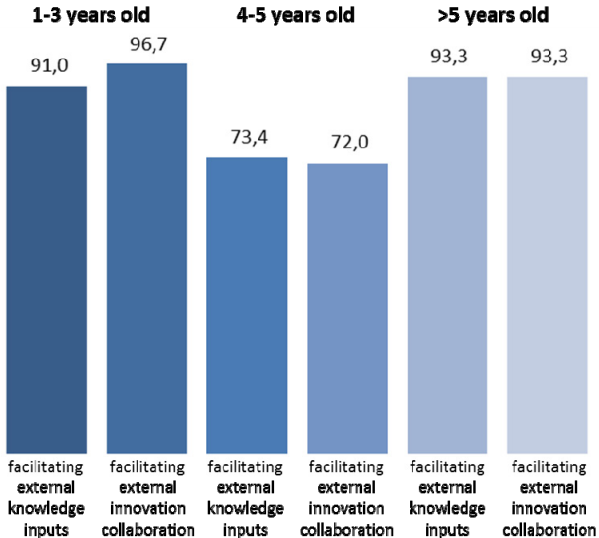


Source: Survey

A segmentation of the 14 intermediaries by organizational maturity (i.e. years since initiation of the organization) allows for an investigation of whether intermediaries' support functions are deemed more useful as the organization gains more experience in providing the support. The analysis does not necessarily confirm that more mature organizations are able to provide more useful support, but rather shows that the youngest and oldest organizations provide the most useful support (see Figure 34 below). The analysis also shows

mixed results on the relative usefulness of intermediaries' facilitation of external knowledge inputs vs. their facilitation of external innovation collaboration.

Figure 34: Usefulness of Cluster Organization (CO)/Intermediary in Facilitating International Innovation Processes by organizational maturity (% of respondents who strongly agree/agree)



Source: Survey

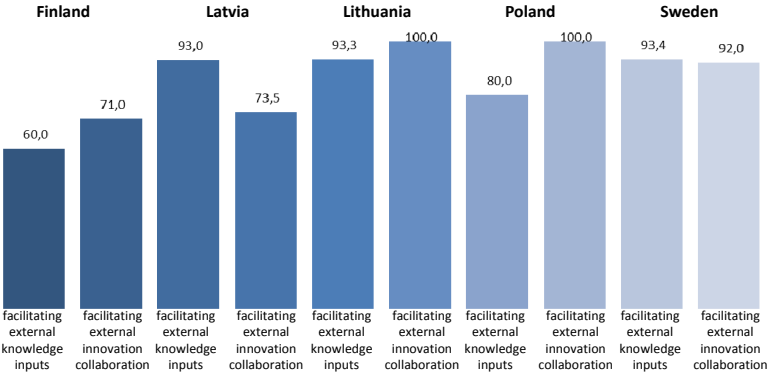
The high ratings of usefulness for the youngest intermediaries could reflect that organizations are most ambitious and work most closely with their research and company actors at the start. It could also be a reflection of the relatively higher prioritization of international innovation activities in recent years – i.e. that younger organizations have a clear mandate to support these activities, compared to slightly older organizations whose support is focused on other areas. The relatively higher ratings of usefulness for intermediaries' facilitation of external innovation collaboration could be a reflection of actors' prioritization of this type of support.

The high ratings of usefulness for the most mature intermediaries could be a confirmation of the hypothesis that intermediaries are able to provide more useful support as they gain more experience – that intermediaries know their research and company actors so well that they are able to provide support

functions that are most relevant and tailored to actors’ needs. The results could also be a reflection of an increasingly strong relationship (and thus positive bias) that innovation actors have toward “their” intermediary organization.

A segmentation of the 14 intermediaries by the intermediary’s country of origin provides some (limited) insights as to whether the regional or national context – i.e. the broader innovation system and innovation support norms and practices in that geography – may influence the perspectives on the usefulness of the intermediary.

Figure 35: Usefulness of Cluster Organization (CO)/Intermediary in Facilitating International Innovation Processes by intermediary’s country (% of respondents who strongly agree/agree)



Source: Survey

The analysis indeed highlights different perspectives on the usefulness of the intermediary by country – with intermediaries in Lithuania having the highest ratings of usefulness and intermediaries in Finland having the lowest ratings of usefulness (see Figure 35 above). However, these results are based on a very limited sample of intermediaries in each country (only 1 in Poland, 2 in Latvia, 3 each in Finland and Lithuania, and 5 in Sweden), and the process of selecting survey participants opens up for a possible (positive) bias of these companies and research organizations toward “their” intermediary cluster organization.

Thus, the results raise more questions than they answer. Future research could focus on a more thorough exploration of how the broader innovation system and innovation support norms and practices in various regional/national

geographies may influence the usefulness of intermediaries’ support (see Section 6.3).

5.3.3. Perspectives on intermediary functions by actor group

Based on the list of “international intermediation functions” developed as a part of the analytical framework in this research (see

Table 7 in Chapter 2), the intermediary cluster organizations were asked to describe what support services they provided, and innovation actors were asked to provide their perspectives on “which ways” the intermediary facilitated external knowledge inputs or external innovation collaboration⁸⁹. Different services/functions were listed for each of the two questions (see Table 16 below).

Table 16: Intermediaries’ Functions relating to International Innovation Processes

Intermediaries facilitate external knowledge inputs through...	Intermediaries facilitate external innovation collaboration through...
<ul style="list-style-type: none"> • Access to unique market information/intelligence • Access to benchmarking • Access to external knowledge sources (e.g. individuals or centers with specific skills/expertise, customer insights) • Access to external technology (e.g. patented R&D) • Access to external infrastructure (e.g. physical or virtual laboratories, demonstration or test facilities) • Access to new international contacts/cooperation partners 	<ul style="list-style-type: none"> • Access to new international contacts/cooperation partners • Access to funding for joint research and innovation activities • Access to new markets • Building a common identity; stronger international visibility and attraction of inward investment • Influencing government and policy

Source: Survey

⁸⁹ Only companies were asked to provide perspectives on “which ways” intermediaries facilitated external innovation collaboration.

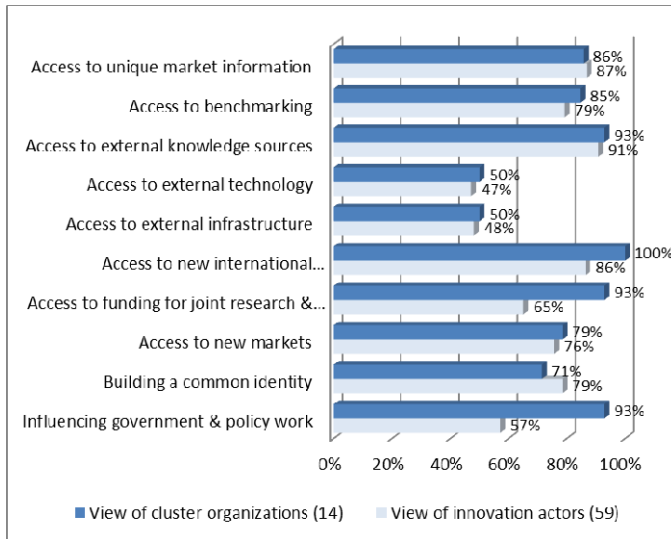
Overall – cluster organizations vs. innovation actors

Overall, cluster organizations report that they provide a broad range of support functions, rating the functions of providing access to people/new knowledge sources, funding and government influence most highly. Innovation actors, on the other hand, report that the functions they find most useful are access to people/new knowledge sources, market information, and new markets (see Figure 36 below).

Cluster organizations gave the highest ratings to the functions of “access to new international contacts and cooperation partners,” followed by “access to external knowledge sources,” “access to funding for joint research and innovation activities,” and “influencing government and policy work”. Innovation actors reported slightly different priorities, giving highest ratings of usefulness to “access to external knowledge sources,” followed by “access to unique market information,” access to new international contacts and cooperation partners,” “access to benchmarking” and “access to new markets”.

Of the functions listed above, the highest number of innovation actors (91%) strongly agreed/agreed that intermediaries’ role in “access to external knowledge sources” was useful. The views of innovation actors diverged from those of the cluster organizations on two functions: “access to funding for joint research and innovation activities” and “influencing government and policy”. The divergence in perspectives can be an indication either that intermediaries have misunderstood the needs of their actors, that actors don’t perceive the functions as useful, or that the actors don’t perceive that the intermediaries have been successful at fulfilling these two functions.

Figure 36: Functions of Cluster Organization (CO)/Intermediary in Facilitating International Innovation Processes (% of respondents who strongly agree/agree)



Source: Survey

In general, innovation actors are generally not aware of the relevance of working with *influencing government and policy work*, unless policies affect them negatively. The cluster organizations may need to explain the rationale for this work more clearly. Although cluster organizations report that they exert a lot of effort in providing *access to funding* (often through regional, national or EU projects or programmes), innovation actors do not perceive this as one of the most useful functions. Limited elaboration from the survey respondents explains that this diverging view is due to the limited relevance and high administrative burden of financed projects.

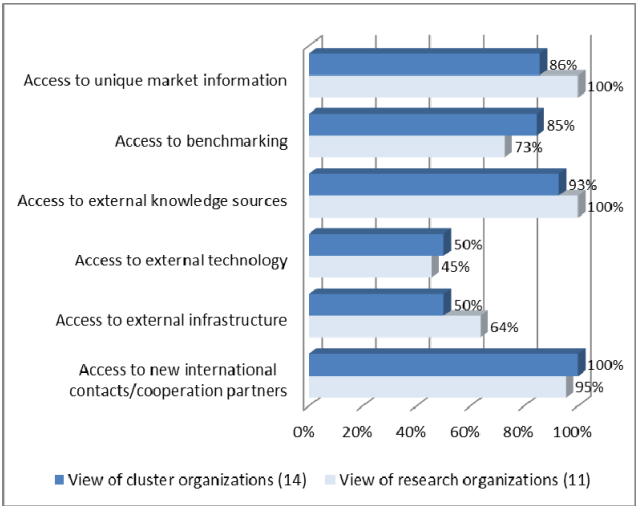
Research Organizations vs. Companies

Overall, these two actor groups had the same set of four most important functions (providing “access to external knowledge sources”, “access to new international contacts or cooperation partners”, “access to unique market information”, and “access to benchmarking”). Whereas research organizations seem to prioritize access to new knowledge and information most highly, companies seem to prioritize access to knowledge and people (or knowledge

embodied in people/centres of expertise) most highly (see Figure 37 and Figure 38 below).

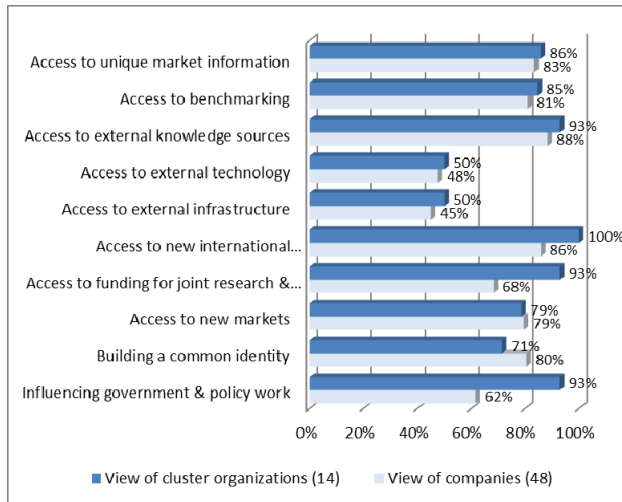
Interestingly, neither research organizations nor companies prioritized “access to external technology” or “access to infrastructure” very highly. One might think, for example, that companies would appreciate the opportunity to access expensive research/testing infrastructure located outside their own company. Or perhaps the low prioritization is due to the fact that this activity requires no intermediary support to address the need.

Figure 37: Functions of CO/Intermediary in Facilitating International Innovation Processes (% of research respondents who strongly agree/agree)



Source: Survey

Figure 38: Functions of CO/Intermediary in Facilitating International Innovation Processes
 (% of company respondents who strongly agree/agree)



Source: Survey

Large/Medium vs. Small Companies

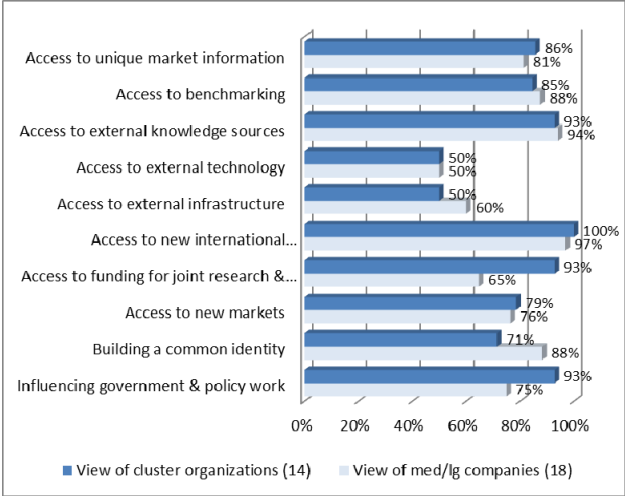
Large/medium companies and small companies had slightly different views on the most useful functions of the intermediary. Both large/medium and small companies prioritized new contacts/partners, sources of knowledge and market information. However, large/medium companies prioritized “building a common identity” more highly than small companies; and small companies prioritized “access to new markets” more highly than large/medium companies.

In order of priority, large/medium companies prioritized “access to new international contacts/cooperation partners,” “access to external knowledge sources,” “access to benchmarking,” “building a common identity” and “access to unique market information” as the most useful functions. In order of priority, small companies prioritized “access to external knowledge sources,” “access to unique market information,” “access to new markets,” “access to new international contacts and cooperation partners” and “access to benchmarking” as the most useful functions (see Figure 39 and Figure 40 below).

The differences in priorities (i.e. building a common identity for large/medium companies vs. access to new markets for small companies) is likely a reflection of

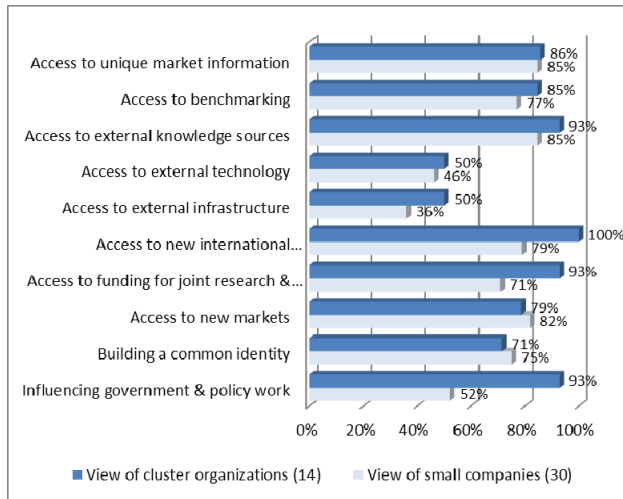
the fact that small companies are less able (than larger companies) to prioritize resources for internationalisation activities, and view the support functions of intermediaries as a useful catalyst. Larger companies, on the other hand, value the benefits provided by building a common identity/brand – a function that provides added-value to their own internationalization efforts.

Figure 39: Functions of CO/Intermediary in Facilitating International Innovation Processes
 (% of lg/med co. respondents who strongly agree/agree)



Source: Survey

Figure 40: Functions of CO/Intermediary in Facilitating International Innovation Processes
 (% of small co. respondents who strongly agree/agree)



Source: Survey

5.3.4. Perspectives on intermediary functions across the five transnational innovation networks

Innovation actors' (i.e. companies' and research organizations') support needs differ depending on the business sector or thematic area in which they operate. This is evidenced by the different prioritization of support functions that has been placed in each pilot project.

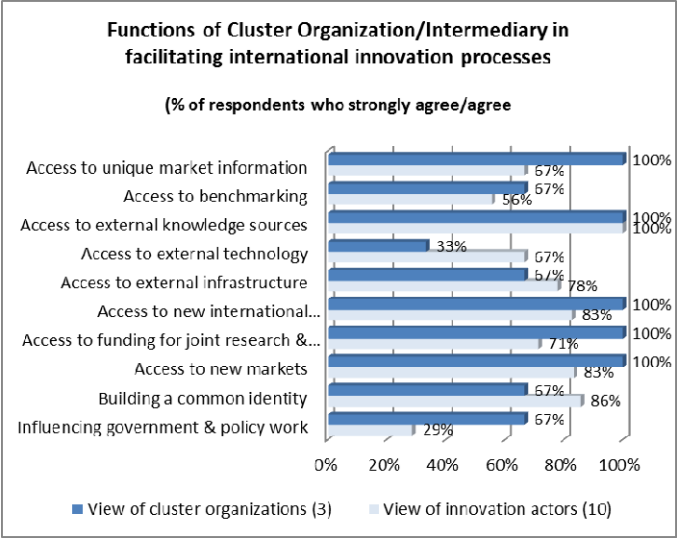
Active for Life (wellbeing and health)

For innovation actors within Active for Life, functions that were prioritized most highly include: access to external knowledge sources, building a common identity, access to new international cooperation partners, access to new markets, and access to external infrastructure (see Figure 41 below).

The relatively higher prioritization of access to external infrastructure and building a common identity diverges from StarDust overall (see Figure 36). This may highlight innovation actors in Active for Life's particular needs for support

with e.g. accessing test beds or having “stamps of legitimacy” from home markets to enable testing health solutions in new markets.

Figure 41: Perspectives on Intermediary Functions – Active for Life

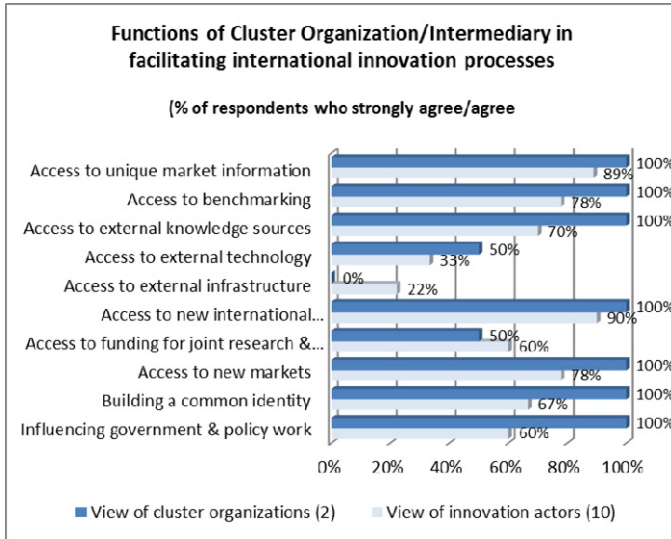


Source: Survey

Clean Water (cleantech and future energy)

For innovation actors within Clean Water, functions that were prioritized most highly include: access to new international cooperation partners, access to unique market information, access to benchmarking, and access to new markets (see Figure 42 below).

Figure 42: Perspectives on Intermediary Functions – Clean Water



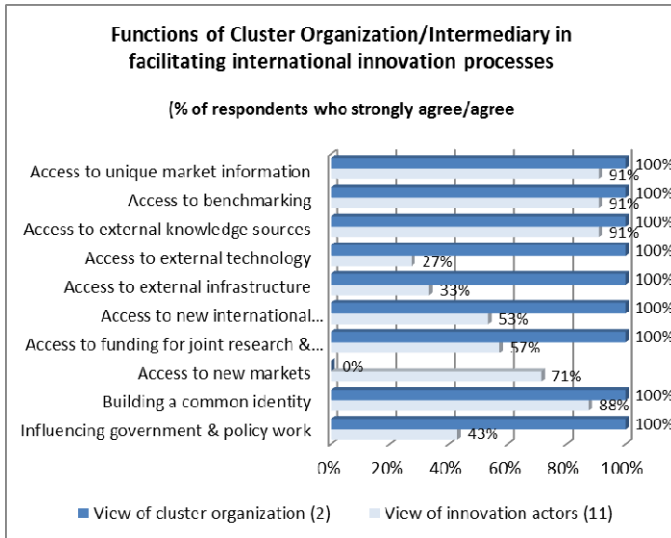
Source: Survey

The high prioritization of unique market information and access to new cooperation partners may highlight innovation actors in Clean Water’s particular needs for support with understanding how innovation systems function (including regulations, who is responsible for what) in foreign markets and support with gaining access to the most relevant players in new markets. These results may also be driven by the fact that innovation actors in Clean Water are primarily small companies (who – as an actor group – place relatively higher priority on access to unique market information, benchmarking and new markets).

Comfort in Living (living spaces for an ageing population)

For innovation actors within Comfort in Living, functions that were prioritized most highly include: access to unique market information, access to benchmarking, access to external knowledge sources, and building a common identity. Innovation actors had a relatively lower prioritization of support to accessing new international cooperation partners (see Figure 43 below) relative to StarDust overall (see Figure 36).

Figure 43: Perspectives on Intermediary Functions – Comfort in Living



Source: Survey

This may highlight Comfort in Living’s focus on a relatively undefined market niche – i.e. living spaces for an ageing population. Innovation actors have particular needs for understanding market needs and new opportunities for leveraging their complementary competencies before initiating collaborative activities. These results may also be driven by the fact that innovation actors in Comfort in Living are primarily small companies (who – as an actor group – place relatively higher priority on access to unique market information, benchmarking and new markets).

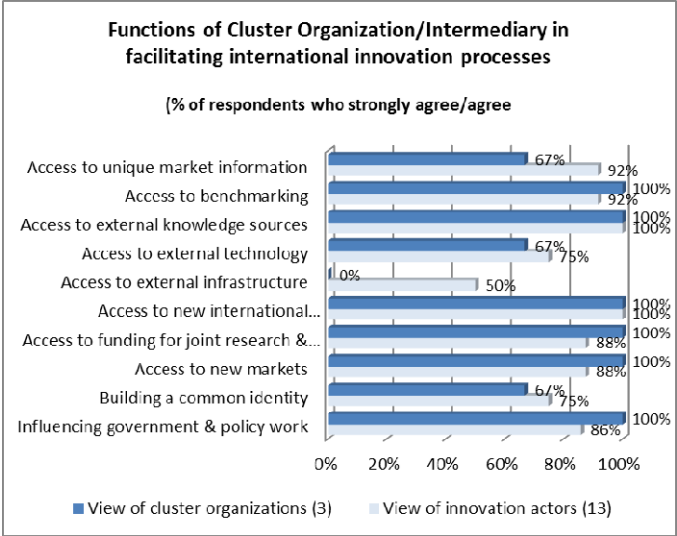
MarChain (future transport)

For innovation actors within MarChain, functions that were prioritized most highly include: access to new international cooperation partners, access to external knowledge sources, access to unique market information, access to benchmarking, access to new markets, and access to funding for joint research and innovation activities (see Figure 44 below).

The relatively higher prioritization of access to funding for joint research and innovation activities diverges from StarDust overall (see Figure 36). This may

highlight innovation actors in MarChain’s particular need for investments to undertake internationally-collaborative innovation activities.

Figure 44: Perspectives on Intermediary Functions – MarChain



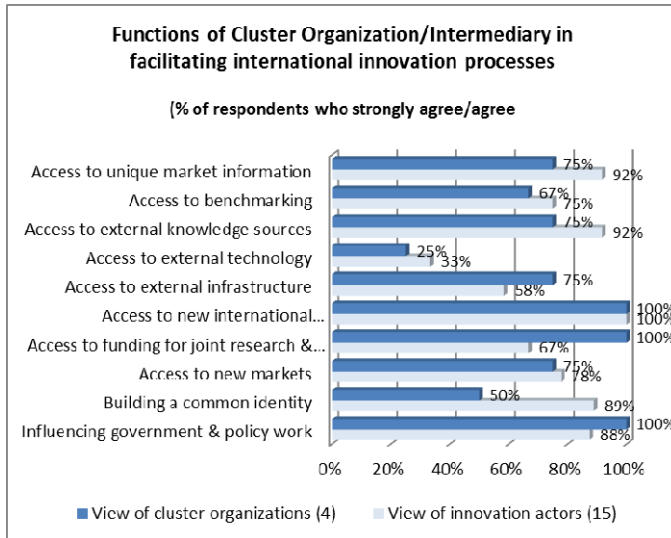
Source: Survey

Mobile Vikings (digital business and services)

For innovation actors within Mobile Vikings, functions that were prioritized most highly include: access to new international cooperation partners, access to external knowledge sources, access to unique market information, building a common identity, and influencing government and policy work (see Figure 45 below).

The relatively higher prioritization of influencing government and policy work diverges from StarDust overall (see Figure 36). This may highlight innovation actors in Mobile Viking’s particular need for influencing and relating to market standards in communication technologies.

Figure 45: Perspectives on Intermediary Functions – Mobile Vikings



Source: Survey

5.3.5. Overview of Intermediary Support Functions/Activities by Actor Group

The previous sections have presented an analysis of the functions that innovation intermediaries fulfil to foster international innovation processes, and how well the different support functions address the needs of companies and research organizations. For each of the innovation actor groups (research organizations, large/medium firms and small firms), the analysis highlights perceptions on the overall usefulness of innovation intermediaries' support, the most useful (or prioritized) support functions, and identifies any gaps that may exist between the functions that actors find most useful and the functions that intermediaries prioritize in their support offering.

In this section, a synthesis of the analysis is used to develop a list of intermediary functions and activities that are viewed as most useful in supporting international innovation processes for each actor group. Support activities are structured relative to the three categories of main innovation intermediary functions: intelligence and innovation initiation, network composition and

knowledge transformation, and innovation process management and commercialization (as explained in section 2.5.2.).

Research Organizations – most useful support activities

Among the three actor groups, research organizations gave the highest ratings of usefulness of intermediaries’ support to international innovation processes. 100% of survey respondents strongly agreed/agreed to the usefulness of intermediaries in facilitating external knowledge inputs, as well as to facilitating external innovation collaboration.

Of the support activities relevant for research organizations,⁹⁰ three were prioritized most highly: access to unique market information, access to external knowledge sources, and access to new international contacts/cooperation partners. Research organizations also perceived access to benchmarking as relatively useful. Access to external technology and access to external infrastructure were the two intermediary support activities that research organizations found least useful.

Table 17: Research Organizations – most useful support activities

Innovation Intermediary Function Category	Support Activities
Intelligence and innovation initiation	<ul style="list-style-type: none"> - Providing access to unique market information - Providing access to external knowledge sources (e.g. individuals or centres with specific skills/expertise, customer insights) - (Providing access to benchmarking)
Network composition and knowledge transformation	<ul style="list-style-type: none"> - Providing access to new international contacts/collaboration partners
Innovation process management and commercialization	<ul style="list-style-type: none"> - Not relevant for research organizations

Source: Surveys

⁹⁰ Research organizations were asked their views on the usefulness of the six functions related to facilitating external knowledge sourcing, but not the five functions related to facilitating external innovation collaboration.

An overview of the intermediary activities that research organizations perceive as most useful to support international innovation processes (sorted according to the three main categories of innovation intermediary functions) is presented in Table 17 above.

Large/medium companies – most useful support activities

Large/medium-sized companies also gave high ratings of usefulness of intermediaries' support to international innovation processes. 94% of survey respondents strongly agreed/agreed to the usefulness of intermediaries in facilitating external knowledge inputs, as well as to facilitating external innovation collaboration.

Of the range of support activities, large/medium companies prioritized access to new international contacts/cooperation partners and access to external knowledge sources most highly. These were followed by access to benchmarking, building a common identity, and access to unique market information. Large/medium companies also perceived access to new markets and influencing government and policy work as relatively useful. Access to external technology and access to external infrastructure were the two intermediary support activities that large/medium-sized companies found least useful. There was a relatively large difference between the priority large/medium companies and the intermediaries placed on the support activity "facilitating access to funding for joint research and innovation activities". This difference of perspectives is likely a reflection of the interview process – where intermediaries were asked to provide information on the support activities they provided (without specifying particular actor groups).

An overview of the intermediary activities that research organizations' perceive as most useful to support international innovation processes (sorted according to the three main categories of innovation intermediary functions) is presented in Table 18 below.

Table 18: Large/medium companies – most useful support activities

Innovation Intermediary Function Category	Support Activities
Intelligence and innovation initiation	<ul style="list-style-type: none"> - Providing access to external knowledge sources (e.g. individuals or centres with specific skills/expertise, customer insights) - Providing access to benchmarking - Providing access to unique market information
Network composition and knowledge transformation	<ul style="list-style-type: none"> - Providing access to new international contacts/collaboration partners - Building a common identity and stronger international visibility - (Providing access to new markets)
Innovation process management and commercialization	<ul style="list-style-type: none"> - (Influencing government and policy work)

Source: Surveys

Small companies – most useful support activities

Among the three actor groups, small companies gave the lowest ratings of usefulness of intermediaries’ support to international innovation processes. 73% of survey respondents strongly agreed/agreed to the usefulness of intermediaries in facilitating external knowledge inputs. 80% of survey respondents strongly agreed/agreed to the usefulness of intermediaries in facilitating external innovation collaboration.

Of the range of support activities, small companies prioritized access to unique market information, access to external knowledge sources, and access to new markets most highly. These were followed by access to new international contacts/cooperation partners and access to benchmarking. Small companies also perceived building a common identity, and facilitating access to funding for joint research and innovation activities as relatively useful. Access to external infrastructure and access to external technology were the two intermediary support activities that small companies found least useful. There was a relatively large difference between the priority small companies and the intermediaries placed on the support activity “influencing government and policy work”. This difference of perspectives is likely a reflection of the interview process – where

intermediaries were asked to provide information on the support activities they provided (without specifying particular actor groups).

An overview of the intermediary activities that small companies perceive as most useful to support international innovation processes (sorted according to the three main categories of innovation intermediary functions) is presented in Table 19 below.

Table 19: Small companies – most useful support activities

Innovation Intermediary Function Category	Support Activities
Intelligence and innovation initiation	<ul style="list-style-type: none"> - Providing access to external knowledge sources (e.g. individuals or centres with specific skills/expertise, customer insights) - Providing access to unique market information - Providing access to benchmarking
Network composition and knowledge transformation	<ul style="list-style-type: none"> - Providing access to new markets - Providing access to new international contacts/collaboration partners - (Building a common identity and stronger international visibility)
Innovation process management and commercialization	<ul style="list-style-type: none"> - (Facilitating access to funding for joint research and innovation activities)

Source: Surveys

Overall – most useful support activities

All actor groups had similar perspectives on the usefulness of intelligence and innovation initiation support activities (providing access to unique market information, benchmarking and external knowledge sources). All actor groups also prioritized the support activity providing access to new international contacts and collaboration partners.

Large/medium companies prioritized “building a common identity” and “influencing government and policy work” more highly than small companies, while small companies prioritized “access to new markets” and “facilitating access to funding” more highly than large/medium companies. This difference is likely a reflection of the fact that small companies are less able (than larger

companies) to prioritize resources for internationalization activities, and view the support functions of intermediaries as a useful catalyst. Larger companies, on the other hand, value the benefits provided by group efforts to build a common identity/brand and influence government policy – activities that provide added-value to their own (individual) internationalization efforts.

The analysis also highlighted that innovation actors' (i.e. companies' and research organizations') support needs differ depending on the business sector or thematic area in which they operate. In some sectors (such as wellbeing and health), building a common identity as a transnational innovation network is key. In other sectors (such as ICT), influencing government and policy work has relatively higher importance.

5.4. Support Needs and Support Functions – from the actors' perspective

This final section presents a summary of analytical results, directly relating to the analytical framework of support needs and intermediary support functions – from the perspective of the different groupings of innovation actors. For each actor group, a summary view of support needs and most useful innovation intermediary support functions will be presented – highlighting how intermediaries' support to international innovation processes address actors' needs. This is followed by a summary of overall results.

5.4.1. Research Organizations

Research organizations have a very clear mandate (and very strong strategic prioritization) for engaging in international research projects. Whereas access to other research organizations across the globe is part of their normal mode of operations, access to and engagement of companies is less natural (particularly in more distant geographies).

Initiating and managing international innovation projects is a newer, but increasing part of “normal business operations” within research organizations – and thus an area where external support is most needed. This is particularly relevant for those research organizations who have limited contacts with

companies in their own region (for whom networking with companies is a generally underdeveloped capability).

As research organizations have little relation to operationalizing/commercialization phases of innovation processes, support in this phase is not so relevant. However, financing to enable ongoing researcher mobility (in the context of innovation projects) could help to strengthen transnational collaboration.

Table 20: Research Organizations: Support Needs and Intermediary Support Functions⁹¹

Needs for External Support	Intermediary Support Functions
<p>Sensing</p> <ul style="list-style-type: none"> - Understanding foreign systems of innovation and market environments - Identifying and plugging-in to relevant company contacts in international markets 	<p>Intelligence and innovation initiation</p> <ul style="list-style-type: none"> - Providing access to unique market information - Providing access to external knowledge sources (e.g. individuals or centres with specific skills/expertise, customer insights)
<p>Mobilizing</p> <ul style="list-style-type: none"> - Developing competencies to work in international innovation environments/ international collaboration projects - Setting up international innovation projects that make use of specialized research capabilities (to solve a shared problem) - Facilitating better international researcher mobility and collaboration with companies (in connection with innovation projects) 	<p>Network composition and knowledge transformation</p> <ul style="list-style-type: none"> - Providing access to new international contacts/collaboration partners
<p>Operationalizing</p>	<p>Innovation process management and commercialization</p>

Source: Interviews and Survey

⁹¹ The darker the shading, the stronger the expressed support need

Innovation intermediaries' main role in fostering research organizations' engagement in international innovation processes is to provide links to companies, in the context of relevant projects that leverage their research expertise.

5.4.2. Large/Medium Companies

Larger companies (i.e. those with >50 employees) place very high strategic importance on internationalization of research and innovation activities – in particular on outside knowledge inputs for innovation activities. Larger companies tend to turn to other companies in different industrial areas for these external knowledge inputs and for innovation collaboration. External research organizations (except those in the local region) are used much less.

With strong legitimacy and international networks, larger companies' are still in need of exposure to a broader range of potential partners (in other markets, industries, etc.) with complementary expertise or ideas that can help the larger companies to strengthen their own offering and improve their competitive position. Larger companies also appreciate (neutral) intermediary support in being profiled internationally as part of a broader specialized node or innovation eco-system.

Larger companies do not express a need for external support during operationalization/commercialization phases.

Innovation intermediaries' main role in fostering larger companies' international innovation processes is to facilitate exposure to a broader range of collaboration opportunities and new partners with complementary expertise or ideas for strengthening existing offerings.

Table 21: Large/Medium Companies: Support Needs and Intermediary Support Functions⁹²

Needs for External Support	(Most Useful) Intermediary Support Functions
<p>Sensing</p> <ul style="list-style-type: none"> - Identifying relevant partners (SMEs particularly interesting) and opportunities for joint development activities/collaborative partnerships 	<p>Intelligence and innovation initiation</p> <ul style="list-style-type: none"> - Providing access to external knowledge sources (e.g. individuals or centres with specific skills/expertise, customer insights) - Providing access to benchmarking - Providing access to unique market information
<p>Mobilizing</p> <ul style="list-style-type: none"> - Being exposed to a broader international network and new partners/opportunities (e.g. through innovation platforms/arenas where can be put in touch with a variety of relevant players) - Being profiled internationally as part of a broader context (e.g. a specialized node or eco-systems) 	<p>Network composition and knowledge transformation</p> <ul style="list-style-type: none"> - Providing access to new international contacts/collaboration partners - Building a common identity and stronger international visibility - (Providing access to new markets)
<p>Operationalizing</p>	<p>Innovation process management and commercialization</p> <ul style="list-style-type: none"> - (Influencing government and policy work)

Source: Interviews and Survey

⁹² The darker the shading, the stronger the expressed support need

5.4.3. Small Companies

Small companies (i.e. those with 50 or fewer employees) place a (relatively) low strategic importance on the internationalization of research and innovation activities – not because they believe it has no importance, but rather because small companies experience too many barriers (lack of time, financial resources, competence, experience, etc.) to engaging in international innovation processes. For small companies, international transactions (i.e. exports) are more often the norm; whereas longer-term innovation collaboration is generally considered too risky an endeavour (and is thus given a lower strategic prioritization).

In comparison to larger companies, smaller companies have a tendency to rely on knowledge sources and collaboration partners that are geographically closer. Smaller companies also tend to turn to other companies in the same (vs. different) industry more often than larger companies.

Given more localized knowledge sourcing and collaboration patterns and more notable barriers and capability gaps, small companies express a broad range of support needs to foster their engagement in international innovation processes. These support needs range from competence-building and exposure to new innovation systems abroad, to international profiling and facilitating engagement in concrete innovation activities (tailored to the company's own expertise and growth opportunities).

In addition, smaller companies express a need for financing (enabling operational experimentation) and partners who can commit both capital and expertise to collaborative endeavours.

Innovation intermediaries' main role in fostering small companies' engagement in international innovation processes is to engage small companies in concrete international activities (in the short-term), and mobilize the right "system linkages" to help small companies continue to place higher strategic priority on international innovation processes in the longer-term.

Table 22: Small Companies: Support Needs and Intermediary Support Functions⁹³

Needs for External Support	(Most Useful) Intermediary Support Functions
<p>Sensing</p> <ul style="list-style-type: none"> - providing opportunities to learn about innovation systems in relevant foreign markets, and needs/opportunities there - developing insights on how international innovation activities can strengthen own strategic idea - developing capabilities for partnering internationally (e.g. mentorship or advisory support from experienced entrepreneurs) 	<p>Intelligence and innovation initiation</p> <ul style="list-style-type: none"> - Providing access to external knowledge sources (e.g. individuals or centres with specific skills/expertise, customer insights) - Providing access to unique market information - Providing access to benchmarking
<p>Mobilizing</p> <ul style="list-style-type: none"> - providing contextual legitimacy (and branding) of actors' areas of specialized expertise - helping to open the "relevant doors" in foreign markets - proactive networking and matchmaking with relevant players (tailored to own areas of expertise and potential growth) 	<p>Network composition and knowledge transformation</p> <ul style="list-style-type: none"> - Providing access to new markets - Providing access to new international contacts/collaboration partners - (Building a common identity and stronger international visibility)
<p>Operationalizing</p> <ul style="list-style-type: none"> - Attaining financing to enable engagement in collaboration opportunities internationally - Enabling access to partners who can invest both capital and expertise in the collaboration 	<p>Innovation process management and commercialization</p> <ul style="list-style-type: none"> - (Facilitating access to funding for joint research and innovation activities)

Source: Interviews and Survey

⁹³ The darker the shading, the stronger the expressed support need

5.4.4. Overall Results

As described and illustrated above, small companies have the most need for external support to engaging in international innovation processes. Reaching out to international sources of knowledge or establishing collaboration with international partners is not a prioritized part of their daily business. Small companies lack the time, financial resources and, often, the skills to pursue international innovation processes on their own. Innovation intermediaries provide useful functions at all phases – intelligence and innovation initiation, network composition and knowledge transformation, and innovation process management.

Although research organizations and larger companies have high strategic priority and internal capabilities for externally sourcing knowledge and engaging in collaborative innovation processes, they use innovation intermediaries as a complement to their normal operating practices. Innovation intermediaries are particularly useful in network composition and knowledge transformation – providing access to broader networks and potential partners, strengthening legitimacy and international recognition, and coordinating collaborative action in joint innovation projects.

6. Conclusions

The more globalized landscape of knowledge and innovation brings with it possibilities for renewal and increased competitive strength. Yet the process of identifying relevant opportunities, accessing new knowledge sources, initiating interaction, developing collaboration, and managing geographically dispersed, internationally-interdependent innovation processes is complex. For some innovation actors, the time, skills, resources and increased risk that international innovation processes entail prevent them from pursuing the possibilities.

Given the benefits that international knowledge sourcing and collaboration has been shown to provide, this is an area where innovation policymakers have placed growing attention. Policy support is provided not only for exploiting national innovations on international markets and generating new knowledge through joint research initiatives. Policy support also targets the pooling of internationally dispersed resources to address a common problem or opportunity – in what can be called global techno-scientific collaborations (Archibugi and Iammarino 1999) or transnational innovation networks (Coe and Bunnell 2003).

Whereas academic literature has documented the role innovation intermediaries play within a regional or national innovation system by providing information, brokering transactions, facilitating collaboration, and helping to find funding for the innovation outcomes of such collaborations (Howells 2006, Kleinbaum and Tushman 2007, Kirkels and Duysters 2010) – their role in international innovation processes is more of a black box. As policymakers seek ways to facilitate international innovation linkages, one can wonder what role innovation intermediaries could play in connecting local nodes to global knowledge pipelines. Is there a need for service stations and a person at the pump?

The overall research question that has been addressed in this thesis is: **How do innovation intermediaries foster firms' and research organizations' transnational innovation processes?** This question has been explored by

analyzing the factors driving companies' and research actors' need for external support, as well as the functions that innovation intermediaries provide to support globalized innovation processes. The aim of this thesis has not been to evaluate whether intermediaries should be used to support international innovation processes, or to evaluate the relative success/benefits of their support. Rather, based on the observation that innovation intermediaries are involved in fostering transnational innovation processes, the aim of this thesis is to develop a better understanding of innovation actors' interests in external support and perspectives on the usefulness of the functions that innovation intermediaries provide. These areas are explored in order to gain insights on how innovation intermediaries could be leveraged in policy support to globalized (i.e. internationally-interdependent) innovation processes.

This exploratory-research aim has been addressed through a case study with two embedded units of analysis: innovation actors and innovation intermediaries. The innovation actors and intermediaries involved in this study were part of five transnational innovation networks, all within the shared context of the StarDust project.

The StarDust case is a policy initiative to foster transnational collaboration between specialized research and innovation nodes in the Baltic Sea Region, and involves innovation intermediaries as representatives of specialized innovation nodes. This implies that the case is based on a premise that international interaction between different actors is positive, and that leveraging innovation intermediaries to achieve this aim is positive. It also implies that the embedded units of analysis in this case have been part of a "constructed" context – and that the analysis has been focused on a particular set of innovation actors and innovation intermediaries. This may have resulted in a positive bias in some of the data collected.

The StarDust case was chosen as it provided an example of the typical goals and internationally-interdependent structures of transnational innovation networks. The case also provided access to both innovation intermediaries and innovation actors – enabling a comparative analysis of the needs and support interests innovation actors have, relative to the support functions that innovation intermediaries provide. In addition, the case provided the opportunity to group the embedded units in different constellations – allowing comparison of support needs and support functions across different types of innovation actors (i.e. research organizations, large/medium companies and small companies), and across business sectors.

Data on drivers of support needs (of innovation actors), and support functions (of innovation intermediaries) was collected through interviews, surveys and participant observation in two main phases. Data on innovation actors' support needs was structured according to three innovation actor groups (i.e. research organizations, large/medium companies, and small companies) and compared to data on the support functions that innovation intermediaries provided.

The analysis of results provides a number of insights on the support interests in most demand across actor groups, on the actor group that has the most need for external support, and on the expanding role that intermediaries take on in relation to international innovation processes.

In this chapter, I take a step back from the results of the case study research and reflect on what I think it all means. First, I discuss the research findings – highlighting three key conclusions and areas where questions still remain. Then, I present some thoughts on what implications these conclusions may have on innovation policy. Finally, I highlight a number of areas for future research.

6.1. Discussion of Key Conclusions from Research Findings

This thesis has aimed at improving understanding of how innovation intermediaries are used (by companies and research organizations) as an instrument to foster international innovation processes. The research has provided insights on what drives companies' and research actors' need for external support to engaging in international innovation processes, what needs different actor groups (e.g. small companies, medium/large companies, and research organizations) have, as well as what functions innovation intermediaries fulfill to address support needs of different actor groups.

As highlighted earlier, the research has not focused on evaluating the pros and cons of innovation intermediaries, nor the relative success of their existence. Rather, the research has explored what needs for external support innovation actors may have, and (in situations where innovation intermediaries are used) which functions are viewed as most useful. The research aims at furthering our understanding of the potential role of service stations along global knowledge pipelines, and the most needed functions for the “person at the pump”.

Three key conclusions can be drawn from the research results. First, transnational (or internationally-interdependent) innovation processes drive a relatively stronger demand for external support to “mobilizing” knowledge. In other words, innovation actors express a relatively stronger need for support to bringing dispersed knowledge sources together in collaborative development of innovative solutions. Second, innovation actors’ differentiated interests for external support imply a need for tailored support functions, and highlight the possibilities for leveraging the “system” in support delivery. Third, research results point to the expanding role that innovation intermediaries take on to foster transnational innovation processes – without necessarily having corresponding mandates or skills.

The three key conclusions point to the use of innovation intermediaries as one possible alternative to mobilize actors (particularly small companies) in transnational innovation processes. Yet innovation intermediaries may not have the mandate, the organizational stability, or appropriate capabilities to take on this function. These factors are dependent on the particular context of the innovation systems in which the innovation actors and intermediaries operate. If intermediaries should be leveraged in policy support to transnational innovation processes, a validation of their relevance is important.

A discussion of the three key conclusions, and accompanying questions they each raise, follows below.

6.1.1. External support to “mobilize” dispersed knowledge is most in demand

Research results highlighted innovation actors’ needs for external support across capability areas (i.e. sensing, mobilizing and operationalizing). However, the strongest interest in external support (across all actor groups) was expressed in the area of “mobilizing” knowledge. “Mobilizing” knowledge encompasses the capabilities to attract and move globally dispersed sources of knowledge into collaborative problem-solving processes, as well as the capability to meld the combined knowledge into innovative integrated solutions (Doz *et al.* 2001). Actor groups expressed needs for external support to being profiled internationally to increase awareness and attractiveness, to providing opportunities (e.g. events, projects, platforms) to access new knowledge sources/collaboration partners, and to enabling the collaborative process of

melding specialized knowledge into “integrated systems solutions”. Whereas research organizations were mainly interested in support to identifying and setting up innovation projects with companies, companies expressed interests in support to promoting their expertise as part of a broader innovation node (as well as accessing new innovation collaboration partners).

With an increasingly global knowledge and innovation landscape (see section 2.2.1.), we experience an increase in innovation processes characterized by systems integration and networking (“the fifth generation of innovation processes” described in Rothwell 1994) – on an international level. Transnational innovation processes present challenges not only in identifying and accessing relevant knowledge sources and opportunities for collaboration, but also in marshalling these dispersed resources around a common goal and melding the individual nodes of the network into a more cohesive, collaborative partnership that can transform dispersed complex knowledge into integrated solutions. When these dispersed nodes are comprised of groups of actors or clusters, the moving and melding – or “mobilizing” – activities get increasingly complex. This appears to motivate a relatively higher demand for external support.

The research identified a number of functions that innovation actors needed to support the mobilization phase of activities:

- Promoting innovation system embeddedness and legitimacy – enabling a stronger network position
- Providing connections/door-opening, and identification and filtering of relevant opportunities
- Facilitating the integration of different knowledge sources/actors into one collaborative ‘system’

These research findings confirm existing internationalization strategy and innovation systems literature which highlights the importance of leveraging local strengths, network relationships and system embeddedness to develop trust, create new knowledge, and construct stronger regional advantage (Bathelt *et al.* 2004, Cooke and Leydesdorff 2006, Johansson and Vahlne 2009, Prange and Verdier 2011). The findings also confirm existing literature which points to the

need for “system integrators” to manage the coordination and learning activities between dispersed knowledge hubs (Malecki 2010).⁹⁴

This research provides a new contribution to the field by providing additional elaboration to an existing theoretical framework (Doz *et al.* 2001) – highlighting the relatively stronger interest in external support to activities related to marshalling dispersed knowledge in related specialized areas into collaborative systems that can deliver innovative integrated solutions (i.e. the “mobilizing” phase of activities).

The research also contributes by providing more detailed insights on the type of support that may be useful during this phase of internationally-interdependent innovation processes. Support during the “mobilizing” phase encompasses activities that provide legitimacy and quality control, foster interaction and trust-building over time, and aim at integrating the parts into one collaborative system. This implies an approach that aims at building relations (vs. securing transactions), and at developing dynamic partnerships that have the capability to deliver integrated solutions to complex problems (vs. establishing project consortia that can deliver answers to particular, pre-defined questions).

This research conclusion provides a new perspective for viewing existing policy support to transnational innovation processes, and raises the question as to whether existing policy instruments address actors’ expressed need for support to mobilization of dispersed knowledge.

As discussed in section 2.4., Archibugi and Michie (1995) established a taxonomy with three main categories of the globalization of innovation (international exploitation of nationally-produced innovations, global generation of innovations, and global techno-scientific collaborations). The focus of this thesis is on internationally-interdependent innovation processes – which correspond to transnationally-structured “global techno-scientific collaborations” in Archibugi and Michie’s taxonomy.

Based on the examples of policy instruments or support activities to globalization of innovation that are provided in existing literature (Archibugi and Iammarino 1999, Boekholt *et al.* 2009), it can be observed that the most

⁹⁴ It should be noted, however, that the existing literature establishes a need for system integration capabilities, but not of innovation actors’ need for external support for this function.

commonly used policy actions are focused on the international exploitation of nationally-produced innovations (through e.g. trade and investment promotion) or global exploration and generation of knowledge (through e.g. promoting international research collaboration, joint funding of research infrastructure and student/researcher mobility). These instruments are well-established in most countries – including specific organizations with mandates to achieve concrete targets, and regular benchmarks of set indicators of progress.

Policy instruments to support global techno-scientific collaborations (e.g. information and brokerage services abroad, infrastructures and institutions to attract and facilitate linkages with others internationally, and specific innovation collaboration programmes) also exist in many countries, yet are relatively less well-established – without particular targets, mandates to specific organizations, or clear indicators of progress. And within this set of instruments, there are fewer examples of policy instruments that move beyond information and brokerage services (support to “sensing”) and attempt to catalyze dynamic interactions (over time) between related specialized knowledge hubs (support to “mobilizing”). The use of innovation intermediaries as system integrators and process facilitators is one possible support activity which could be used. (Long-term international mobility or ambassador programmes, international innovation collaboration programmes, and the development of open innovation platforms are other approaches.)

It is understandable that policy activities to support “mobilizing” are not the norm – as the development of collaborative learning processes within transnational innovation networks is both complex and time consuming. At the same time, it has been shown that international collaboration is conducive to more (and more radical) innovations (Fitjar and Rodríguez-Pose 2011 and Fillipetti *et al.* 2009). And, as this research shows, innovation actors perceive that this is an area where external support is most useful. It is therefore important to study how innovation actors’ needs are translated into intermediaries’ support functions – i.e. how innovation agents with a transnational focus are being set up, how they operate, and how they identify and work with target groups. Possible policy implications of this observation are discussed in section 6.2.1.

6.1.2. Differentiated support interests call for tailored support functions and delivery

In addition to highlighting a particular set (or phase) of activities where external support is most needed, research results have clearly highlighted that external support needs are differentiated by actor group. To say the least, small companies are those with the most interests for external support, whereas larger companies and research organizations are more agnostic. Depending on innovation actors' normal modes of operation and resulting prioritization of international activities, capabilities for action differ – driving different needs for external support functions and methods of delivery. Support needs also differ slightly depending on innovation actors' business sector or thematic area of operation.

Research results have highlighted that all actor groups experience some barriers or capability gaps that drive their interests in external support – yet (not surprisingly) small companies stand out as the actor group with the strongest interest in external support to engage in international innovation processes. Results have also highlighted that small companies' may need a more *proactive* approach to support delivery to encourage their integration into international innovation processes – helping them to become a part of transnational innovation networks. In addition, research results highlight the opportunity for leveraging linkages with other actors (locally or internationally) in the delivery of support functions – raising the question of the relevance of the local innovation node and of the particular innovation intermediary in support delivery.

Research organizations and larger companies are better equipped for “self-service”

Research organizations and larger companies (with >50 employees) place higher strategic priority on and engage in international innovation processes as part of normal operations. If in need of external support, they generally seek and procure the support needed – based on normal market mechanisms. Even though these organizations are well-equipped for managing transnational innovation processes on their own, they express interest in the following dimensions of intermediary support: information on foreign innovation systems and market environments, identification of new opportunities and relevant collaboration partners, and being profiled internationally as part of a specialized innovation node.

Research organizations and larger companies generally manage international innovation processes with in-house capacity, yet engage in programmes entailing additional support from innovation intermediaries – primarily to connect with new knowledge sources or partners to whom they don't have access within their own networks. For research organizations, innovation intermediaries provide connections to companies who can make use of their specialized competencies. For larger companies, innovation intermediaries can provide exposure to a number of new potential partners – companies with complementary ideas or operational flexibility who are “not the usual suspects” that larger companies meet within their existing networks.

Research organizations and larger companies have their own path-dependent ways of acquiring knowledge and establishing collaborative networks – which often does not involve support from innovation intermediaries. However, these actor groups may respond to policy initiatives that leverage intermediary support if the intermediary is deemed relevant (i.e. with right motives/mandate, knowledge of actors' needs and capabilities), and if the support offered is deemed to provide “added value” – i.e. a function they could not fulfill for themselves, or procure on the market at lower cost.

Proactive facilitation can catalyze small companies' engagement in transnational innovation networks

With limited human and financial resources and focus on maintaining stable cash flow in the short term (over strategic investments that may foster a longer-term competitive position), small companies cannot be expected to prioritize investigating and taking advantage of opportunities for knowledge sourcing and collaboration with international partners. Even small companies that are “born global” need strong international networks to succeed (see, for example, Andersson and Wictor 2003).

Small companies have particular support needs to catalyze their engagement in international innovation processes. They need support in understanding how international activities can strengthen their own strategic idea and offer growth opportunities, and in receiving mentorship and advisory support from experienced companies. They need support in understanding and “opening the right doors” in foreign innovation systems, in providing legitimacy in foreign markets, and in mobilizing and coordinating collaborative activities. And small companies need support in attaining financing (or other approaches) to lower

the risk due to lost time and lower liquidity – fostering their engagement in international knowledge sourcing and collaboration opportunities.

There are alternative paths to internationalization for small companies. Small companies can source knowledge internationally or develop new international collaborations by leveraging existing linkages in their own value chain – e.g. through accessing international networks of their buyers or suppliers. If small companies do not have the capacity, resources or network contacts to pursue internationalization on their own, they may seek support from intermediaries.

Intermediaries that have regular contact with small companies and who are familiar with the competitive landscape and the particular firm's business strategy, are better positioned to provide support. These intermediaries can proactively highlight relevant opportunities and collaboration partners, and engage small companies in international activities. This initial (proactive) mobilization in relevant (low-risk) activities may help catalyze small companies' engagement in follow-on international activities.

Of course, small companies can act on their own – without intermediary support in the process. The main benefit of intermediaries' support is that it can speed up the process.

Companies in different business sectors may have different prioritized support needs

Even though the patterns of support needs seem quite related to the innovation actor group (i.e. research organizations, large/medium or small companies), companies' and research organizations' support needs also differ depending on the business sector or thematic area in which they operate. In some sectors (such as wellbeing and health), building a common identity as a transnational innovation network is key; whereas in other sectors (such as ICT), influencing government and policy work has relatively higher importance.

As discussed in section 6.1.1., all actor groups appear to find value in intermediary support to establishing links with new knowledge sources and network contacts, as well as providing visibility and positioning within a broader specialized innovation system. In addition to these “common needs”, innovation intermediaries can provide tailored support that addresses the priorities of particular sectors or particular actor groups.

Yet the use of intermediaries may have negative spillovers such as time consumption and administrative red tape. Indeed, the use of innovation intermediaries is not the only alternative to engaging in transnational innovation

processes. Companies and research actors can also leverage their existing networks (without outside facilitation) or pursue independent activities to engage in transnational innovation processes. The choice of leveraging support from innovation intermediaries is driven by the particular intermediary's motives, knowledge and capabilities – relative to the alternatives that the company or research organization has. Innovation actors may choose to leverage support from intermediaries if it is deemed less expensive, faster, or more effective than pursuing alternative approaches. For some actors (e.g. small/micro companies without broad international experience and networks), support from innovation intermediaries may be the only way to engage in transnational innovation processes.

These research findings confirm and build on existing literature exploring barriers to and capabilities needed for the internationalization of innovation (see, for example, Chetty and Campbell-Hunt 2003, Knight and Cavusgil 2004, Reinstaller *et al.* 2010, Doz and Wilson 2012), as well as on existing literature related to policy support to internationalization of innovation (including Archibugi and Iammarino 1999, Bell *et al.* 2003, Carlsson 2006). This research provides a new contribution to the research in this field by providing a comparative perspective of barriers and support needs between actor groups, as well as a comparative perspective of demand (i.e. needs of innovation actors) and supply (i.e. functions of innovation intermediaries) of support to internationalization of innovation. By providing such a comparative perspective, the research has not only provided additional insights on the differentiated support needs of innovation actors, but has also provided insights on the need for tailoring support delivery. Support delivery should be tailored not only to the needs of specific actor groups (see next section on policy implications) or business/research fields, but should also be tailored based on the conditions of the specific innovation node and capacities of the intermediary organization.

Although this case study research points to the “usefulness” of innovation intermediaries as one of the possible means to foster transnational innovation processes, it also highlights the importance of various other factors that play a role in determining whether support provided actually addresses companies' and research organizations' interests. The potential match between innovation actors' support needs and support functions provided by innovation intermediaries is determined in part by the particular intermediary's motives, knowledge of actors' needs, and capabilities to provide useful service (further elaborated in the

next sub-section) – and in part by the context of the local innovation node and its broader innovation system.

In this case, it appears that intermediaries with a mandate for facilitating linkages and strengthening interactive learning processes for a specific group of actors (without a separate fee) tend to have a closer contact with and a better understanding of “their” actors’ needs and are more skilled at leveraging other actors in the system in the delivery of support. It is these intermediaries who are viewed as providing “more useful” support – i.e. support that is better tailored to the actor’s particular needs. In contrast, intermediaries with a more neutral relation (or distant connection) to the actors are perceived as providing standardized support that sometimes “misses the mark” in addressing specific needs and is therefore viewed as less useful.

This raises a question on what relevance the local innovation node (i.e. the context of the innovation support system in which the particular innovation intermediary operates) has on the delivery of support.

The research results highlight that certain needs for support to international innovation activities may best be met by delivering support using a “systemic approach”. That is to say that intermediaries acting within a local innovation node (as existed in this case study) may already have the role of bridging gaps in the local system (e.g. between research organizations and companies, between large and small companies) in order to strengthen the effectiveness of the system. Intermediaries help develop common projects between research organizations and companies, provide opportunities for large companies to interact with small companies holding relevant knowledge/ideas, and small companies gain legitimacy and mentorship by being part of a larger context.

The intermediaries studied in this case represent an ideal typical construct – driven by the rationale of the BSR Stars programme and the StarDust project. Thus, the role that the intermediaries play in this case portray the much more complex nature of setting up and implementing such a scheme with actors with multiple motives and limited information. On the other hand, the results of this case highlight the possibilities of leveraging intermediaries that are embedded in local innovation nodes. These intermediaries are able to build on existing linkages and collaborative practices in the local system in order to establish new linkages and collaborative practices internationally.

As discussed above, small companies have the strongest interests for external support to enable their engagement in international innovation processes. Many

of the support needs can best be addressed by being a part of a broader context – e.g. local innovation node/cluster, a national network of related actors, or a global value chain. SMEs’ need for contextual legitimacy and branding of competencies (enabling recognition and access to international markets) is much more relevant to address for the innovation node as a whole (vs. for the individual company). In addition, the need for advisory support and mentorship from experienced entrepreneurs can be matched with larger companies’ need for being exposed to new partners/ideas (particularly from small companies).

It seems that many of the needs for support to international knowledge sourcing and innovation collaboration are most relevant when viewed in the context of the broader innovation system (in terms of geography, sector or other systemic linkages), rather than as a separate service transaction from an intermediary “outside” of the system. As highlighted in Carlsson (2006: 64), “the function of the relevant institutions at both the national and technology-specific levels is primarily to enhance the ability of entities within the system to learn from the leaders in the field regardless of location.”

The delivery of support functions should leverage the various actors in the innovation node to help each other gain experience, increase visibility, expand networks, and engage in global innovation processes. In these situations, the innovation intermediary has a role of broker and facilitator of the support delivery rather than the primary supplier of support services. An example of leveraging the actors in the local innovation node to foster transnational innovation processes comes from Uppsala BIO, who used the international networks of large companies in the cluster to facilitate new, validated international contacts for its start-ups and SMEs.⁹⁵

This observation points to additional questions about which innovation intermediaries best understand the needs of particular innovation actor, and which innovation intermediaries have the mandate and competency to deliver support functions in a way that leverages the context of the local innovation node. These questions are discussed further in the following sections.

⁹⁵ See <http://www.uppsalabio.com/DynPage.aspx?id=82552&mpath=6311,6372,6374>

6.1.3. Innovation intermediaries are increasingly engaged in transnational innovation networks

Related to the second conclusion (highlighting the relevance of intermediaries' leveraging of existing linkages and collaborative practices in the local innovation node to deliver more tailored and useful support to international innovation processes), a third conclusion highlighted by the research results is the expanding role that (certain types of) innovation intermediaries have taken on in transnational innovation networks.

Research results demonstrated that innovation actors acknowledge the strategic importance of accessing knowledge from international sources and collaborating with international partners in order to maintain and strengthen their own market position. These international linkages allow them to contribute to delivering integrated solutions to complex societal challenges. Research results also demonstrated that innovation actors found intermediaries to provide useful support to their international innovation processes. Innovation intermediaries foster international innovation processes by providing information on new market opportunities, facilitating access to external knowledge sources and new partners, and providing a "legitimate" contextual reference and identity. As discussed in the previous sub-section, support from innovation intermediaries is one alternative to foster actors' engagement in transnational innovation processes. Innovation actors may choose to leverage support from intermediaries if it is deemed less expensive, faster, or more effective than pursuing alternative approaches.

Research results also demonstrated the expanding role (in terms of time and types of support functions) that cluster organizations – a particular kind of innovation intermediary – are assuming in fostering transnational innovation networks. As cluster organizations work closely and continuously with developing collaboration among companies and research organizations within a particular innovation node, they understand support needs both of the individual actor, and of the innovation node as such. Cluster organizations (with a mandate for developing collaboration locally) are spending increasing amounts of time to develop and orchestrate collaboration internationally (driven by needs of "own actors").

As explained at the beginning of Chapter 5, the innovation intermediaries studied in this case are examples of institutions for collaboration (Porter and Emmons 2003, Sölvell *et al.* 2003) – established to facilitate linkages and

collaborative activities that strengthen competitiveness of firms and the effectiveness of a particular local/regional innovation system. These organizations are typically financed by a majority share of public funding, with private funding in the form of membership fees or sales of services (Lindqvist *et al.* 2013: 24). This implies that the intermediaries have a specific mandate to facilitate collaborative linkages – although this may not encompass a mandate (or expertise) to facilitate international linkages and the effectiveness of transnational innovation networks. Research results suggest that these intermediaries are moving beyond the core mandate for which they were established, and are now fulfilling functions to foster transnational innovation processes. This leads one to question what (or who) lies behind this expanded role (innovation actors’ interests, policy-driven assignment, or the possibility of a new funding stream?), and whether these intermediaries are truly suited to take on this role.

Interview responses seem to suggest that cluster organizations provide support to internationalization that these innovation actors were not getting elsewhere. It was reported that (some) cluster organizations have regular contact with “member” companies’ and research organizations – giving cluster organizations a good understanding of their actors’ particular needs. Thus, cluster organizations are able to provide proactive support that is more relevant and “tailored” to these needs – continuously scouting for and filtering through relevant opportunities. As cluster organizations typically act as part of the broader regional innovation system – representing a particular area of specialization and regional priority, cluster organizations can also provide the “broader context and brand” needed internationally, and have the capacity to mobilize financing in order to initiate international collaborative activities. Given their experience in facilitating complex collaborative activities within local innovation nodes, cluster organizations may also be suited to support the orchestration of collaborative innovation activities between innovation nodes (i.e. transnational innovation networks). Yet innovation actors’ choice of leveraging support from cluster organizations (and innovation intermediaries more generally) is driven by the particular intermediary’s motives, knowledge and capabilities – relative to other alternatives that the company or research organization has to address their support interests.

The broader context of the “home” innovation system also plays a role. As presented in Section 5.3.2., a preliminary analysis highlights different perspectives on the usefulness of the intermediary by country. The innovation

support norms and practices in various regional/national geographies seem to influence the usefulness of intermediaries' support.

This research builds on existing theory on functions of innovation intermediaries (Howells 2006) – exploring aspects related to internationalization (Coe and Bunnell 2003, Bathelt *et al.* 2004, Carlsson 2006) and network orchestration (Wallin 2006, Batterink *et al.* 2010, Doz and Wilson 2012). The research develops the list of innovation intermediary functions presented in Howells (2006) – outlining specific activities that are relevant to international innovation processes, and grouping these activities into three main categories of intermediary functions (i.e. intelligence and innovation initiation, network composition and knowledge transformation, and innovation process management and commercialization).

The research findings confirm that innovation intermediaries play a role in fostering transnational innovation processes. Given the project mandate that innovation intermediaries had in this case, this is not a revolutionary conclusion. One new element resulting from this research is the substantiation of particular functions that intermediaries fulfill to foster transnational innovation processes. The second new element resulting from this research is highlighting the particular role that innovation intermediaries can play in facilitating linkages at “home” and with others internationally – fostering global techno-scientific collaboration (Archibugi and Iammarino 1999). That is to say that this research has shown that innovation intermediaries are not only useful constructs to facilitate interactive learning processes within a local/regional innovation system (already substantiated in existing literature), but that they can also be leveraged to foster linkages and interactive learning processes between innovation ecosystems internationally. This research thus takes a first step to substantiating the role (and particular functions) of innovation intermediaries in transnational innovation processes.

Going back to the beginning, the “systemic problem” that this research aimed to explore was how internationalized, collaborative, and open innovation models could be supported – an important field of innovation policy where there is relatively less experience. This case study has confirmed that innovation intermediaries can be used to foster international innovation linkages – and could thus be considered as an element in the design of policy support in this area.

The conclusion that innovation intermediaries – in particular cluster organizations – are increasingly engaged in fostering international innovation processes raises a number of questions about their potential role within the innovation system more broadly:

- Which innovation intermediaries are most relevant support suppliers? What factors are important determinants of the usefulness of innovation intermediaries' support to international innovation processes?
- How might the observed role that cluster organizations play in fostering international innovation processes change the way that policy instruments are designed and implemented in the future?

As introduced in section 5.3., international innovation processes can be supported by a range of different intermediaries including investment and export promotion agencies, embassies and innovation centers abroad, innovation and business development agencies at home, local science and technology or business parks, and cluster organizations. Given the broad range of service stations and different “people at the pump”, where should innovation actors turn? And which innovation intermediaries may be relevant channels to leverage in the implementation of policy support?

The usefulness of cluster organizations – and innovation intermediaries more generally – seems to be dependent on a number of factors:

- **The context of the innovation actor (company or research organization)** – including the capacity, resources and broader network connections (through subsidiaries, value chains or other networks) they have available to engage in international activities on their own.
- **The context of the local innovation node and the broader regional/national innovation system** – including innovation support structures (organizations, institutional mechanisms, and norms or practices) that exist in both the public and private spheres.
- **The relevance of the particular innovation intermediary** – including their motives (for profit, or part of their mandate), their knowledge of the actors' business context and needs, and their capacity to deliver support to international innovation processes (in terms of e.g. experience, contacts, etc.).

As described above, research organizations typically have capacity, resources and their own international academic networks that allow them to engage in international activities on their own. In some cases, intermediary organizations (such as cluster organizations) are used to facilitate linkages between research organizations and companies. If, however, linkages with companies are facilitated through other means (e.g. innovation programmes, mobility schemes, etc.), the demand for intermediary support is low. In situations when research organizations leverage intermediary support, the innovation intermediaries that are viewed as most relevant are likely those that operate closest to research organizations – e.g. university technology transfer offices, incubators, or science and business parks.

Larger companies also often have in-house capacity, resources and networks to enable their engagement in international innovation processes. Yet they seek intermediary support to complement their own capacity. Larger companies turn to different intermediaries for different services – and are most interested in support that is practical and tailored to their particular needs. In situations when larger companies leverage intermediary support, the innovation intermediaries that are viewed as most relevant are likely those with a clear (and advertised) mandate, recognized legitimacy, a reasonable business proposition for the particular service offered, organizational capacity and experience. Larger companies are likely to consider investment and export promotion agencies, embassies and innovation centers abroad, as well as private actors (such as consultancies) as most relevant. If these companies are already involved in a cluster initiative, cluster organizations may also be viewed as relevant intermediaries.

While large companies have in-house capacity and actively seek out complementary external support, small companies (particularly micro companies with fewer than 10 employees) are generally more focused on “core business” and have limited capacity and financial resources to engage in international innovation processes on their own. Small companies are probably more likely (than larger companies) to view intermediary support that is close to home as most relevant, as these intermediaries are more likely to know the company’s business. Cost may also be an important factor for small companies. Regional business development offices, investment and export promotion agencies, science and business parks and cluster organizations are different types of innovation intermediaries that small companies may find relevant.

The “right” intermediary to support international innovation processes is dependent on the context of the innovation actor and the broader innovation system, as well as the relevance of the particular innovation intermediary. As introduced above, innovation actors have a very broad range of alternative innovation intermediaries to choose from, and it is not clear which of these may be most relevant to provide support to each actor group.

Whereas tailored innovation support is most in demand (and probably the most efficient) from the recipient’s point of view, the supply of such tailored support is complicated to arrange from a policy-administrative perspective. The “right” innovation support would combine an in-depth knowledge of actors’ needs and the business sector, with an internationally-recognized legitimacy and general capability for supporting international interaction. In most cases, these characteristics are spread over many different intermediary organizations – which implies a need for inter-organizational collaboration on the supply of innovation support. Investigating how different regions/countries approach this issue is a topic which could be explored in future research (see section 6.3).

6.2. Possible Implications for Innovation Policy

The case study of the StarDust project has provided a number of insights about the support interests that companies and research organizations have, and the role that innovation intermediaries play in supporting these actors’ engagement in international innovation processes. Reflections on the three key research conclusions highlight a number of possible implications for innovation policy.

First, innovation actors express a relatively stronger demand for external support to mobilizing dispersed knowledge sources – an area where there is relatively less experience with policy instruments or support activities. More attention could be given to the development of instruments that promote international innovation linkages.

Second, innovation actors’ differentiated interests for support imply a need for tailored support functions and delivery, leveraging the various actors in the innovation node. Innovation intermediaries could serve as brokers/facilitators of support processes.

Third, despite the apparent useful and expanding role of innovation intermediaries in fostering transnational innovation processes, there seem to be inconsistencies in intermediaries' mandates, organizational capacities, and knowledge of actors' needs. Regional and national policymakers could strengthen "innovation support infrastructure" by providing clearer mandates.

6.2.1. Continue the development of instruments focused on building international innovation linkages

As discussed in section 6.1.1. above, policy instruments to foster the globalization of science, technology and innovation can be placed into three different categories: instruments to foster exploitation of existing knowledge (e.g. export promotion), instruments to foster knowledge transfer, build human resources and attractiveness (e.g. research collaboration), and instruments to foster global techno-scientific collaboration – opening the door both ways (Archibugi and Iammarino 1999, Edler and Boekholt 2001). Instruments in the first two categories are part of the "narrow paradigm" (Boekholt *et al.* 2009) – categories where target groups (i.e. multinational firms and research organizations) are clear, and expected results are quite straightforward.

However, instruments to foster global techno-scientific collaboration are more complex. The target group includes both companies (multinationals, as well as small companies and entrepreneurs) and research organizations – often in interdependent collaborative consortia. And the expected results (corresponding to the policy objective) are also more difficult to pin down, as aims of achieving "related variety," better "absorptive capacity," and "strengthened collaboration between specialized innovation nodes" are not particularly concrete.

Whereas there is considerably more experience with implementing policy instruments to foster exploitation of knowledge and knowledge transfer, there is relatively less experience with implementing policy instruments to foster international innovation linkages. Instruments that may help foster longer-term collaborative partnerships (moving and melding) could include:

- Mobility programmes/exchanges between professionals on a regular basis over a longer period of time
- Ambassador programmes where ambassadors represent and provide visibility of their "home" innovation node, as well as establish new collaboration activities between actors in home and international nodes

- Operational innovation camps or other events where hands-on concept or solutions development is done between international partners in a collaborative environment
- Development of open innovation platforms (e.g. physical platforms such as demonstrators or test beds, or digital platforms) with supporting services to attract and engage international partners
- International innovation collaboration programmes

And given the role that innovation intermediaries currently seem to play in international innovation processes (as highlighted in this thesis), it seems that they can be viewed as another possible instrument, or as a component of the various instruments above (providing system integration and process facilitation functions).

6.2.2. Use intermediaries as a channel for support delivery – targeting the needs of small companies in particular

As discussed earlier, small companies have particular barriers and support needs in relation to internationalization of innovation processes. Even those companies who are “born global” are not always “born” with the capital (financial, and sometimes human) or network connections that are needed in order to quickly engage on international markets. Small companies experience particularly high levels of risk associated with internationally-interdependent innovation processes. The time (and market intelligence) needed to identify relevant opportunities and appropriate partners; the “stamps of legitimacy” and branding of capabilities in relation to a broader context (of greater critical mass and importance); and the financial resources to invest in activities which may or may not yield commercial results in the near term are all barriers to small companies’ engagement in international processes.

With such high levels of perceived risk and more limited interactions with larger firms and research organizations internationally, many small companies do not take steps toward developing longer-term internationally-collaborative innovation processes on their own. They may instead wait for opportunities with lower perceived risk – i.e. meeting new actors or entering new markets as part of a larger partnership or integrated solution, or using other actors with stronger capacity to represent their interests and identify relevant knowledge sources and collaboration opportunities abroad.

Small companies' lack of interaction with other companies and research organizations internationally can be considered a system failure, motivating a policy response. Policy support can be provided directly to small companies (e.g. grants or vouchers for internationalization activities). Internationalization checks, piloted within the Enterprise Europe Network in Sweden⁹⁶, are one example of this kind of support.

Policy support can also be provided via other channels, such as innovation intermediaries, in order to mobilize and leverage capabilities from a broader range of actors. As discussed in this thesis, it seems that cluster organizations (one particular kind of innovation intermediary) can play a role in involving SMEs which have more difficulties to develop international cooperation. They can also help them identify relevant partners to initiate trust-building processes and generate market impact. The new innovation support mechanism "cluster facilitated projects for new industrial value chains" in Horizon2020,⁹⁷ is one example of this kind of support. The mechanism uses cluster organizations and other intermediary organizations "to coordinate and facilitate systemic approaches that combine different resources, tools and instruments" to support SMEs' cross-border and cross-sectoral collaboration.

6.2.3. Provide clear mandates across "supporting institutions" within innovation systems

This thesis has established that innovation intermediaries currently fulfill a number of functions in support of international innovation processes. This thesis did not explore how well these functions are fulfilled, nor which (or how many) innovation intermediaries are active in supporting international innovation processes. Through the research process, it became evident that each regional/national innovation system has a range of innovation intermediaries that fulfill different functions in support of companies' and research

⁹⁶ See <http://www.almi.se/Skane/Projekt/Internationaliseringscheckar-for-skanska-smaforetag/> (in Swedish only)

⁹⁷ See http://ec.europa.eu/research/horizon2020/pdf/work-programmes/innovation_in_sme_draft_work_programme.pdf

organizations' successful internationalization (as discussed in section 6.1.3. above).

In the context of this case, a number of specific cluster organizations (or other innovation intermediaries) had a project-constructed mandate to foster "their" actors' engagement in transnational innovation processes. There were, however, no checks to confirm the relevance (i.e. their mandate, knowledge of actors' needs and organizational capacity) of the particular intermediary in providing such support, nor of the context of the innovation actors or broader innovation systems that the support activities were meant to benefit. Without defining ways to make these initial checks on the broader context (and needs of innovation actors) and relevance of the particular innovation intermediary, there is a lower likelihood that intermediaries' support to international innovation activities is useful and sustainable.

This lesson can be applied outside of this particular case as well. Without initial checks on contextual factors (including needs and support being provided by other actors in the system), there is a risk of duplicating or providing ineffective support. Without initial checks on the relevance of the intermediary providing support, there is a risk of wasting resources and creating ineffective innovation support systems.

Among innovation actors and policymakers, it seems that there is a general acceptance that transnational innovation processes are more of a norm, and that there is an increased strategic prioritization on improving how these processes function. As a result, there are many intermediaries that currently "have a stake" in helping out. Given these various innovation intermediaries exist, and assuming that they do indeed fulfill useful functions to support (and speed up) internationally-collaborative innovation processes, it seems imperative that any "system failures" that may exist are addressed (e.g. through more clear mandates and division of responsibilities) so that the innovation support system functions most effectively.

In particular, if cluster organizations are deemed relevant intermediaries to facilitate collaboration in international constellations, then their mandates need to be updated to reflect this. The current role of cluster organizations within national innovation systems is to facilitate collaboration within their local innovation nodes. If international collaboration should be added to the mix, this should be reflected in advisory board/strategic priorities, budgets, time allocation, staff competencies, etc.

6.3. Future Research

This case study has pointed to innovation actors' interest in intermediary support to transnational innovation processes, and highlighted the relatively stronger interest in intermediary support to mobilizing functions (i.e. bringing dispersed knowledge sources together in the collaborative development of new solutions). The research has also pointed to the expanding role that certain types of innovation intermediaries have taken on in transnational innovation networks – building on their role as local “system integrator” and fostering new international linkages. The research findings have also led to a number of additional questions regarding the overall value-added of intermediary support to transnational innovation processes, and the relevance of particular innovation intermediaries. These are among the potential areas for future exploration, elaborated below.

One area of future exploration would be further testing of the analytical framework used in this thesis on a broader population of innovation actors, innovation intermediaries and innovation networks. The case study in this research was comprised of “policy constructed” transnational innovation networks, where participating innovation intermediaries had an existing prioritization of providing support to international innovation processes, and where participating innovation actors were only those who were formally part of the innovation nodes where these intermediaries had a project-constructed mandate.

Future research could explore support needs of a broader population of innovation actors (both those who are formally part of organized innovation nodes and not), investigating the use of intermediary support to international innovation processes (or alternatives to intermediary involvement), as well as the relative importance that different innovation actor groups (i.e. research organizations and companies of different sizes) place on the different categories of international intermediary support functions that has been proposed in this thesis. The research could also investigate which support functions are provided by different types of innovation intermediaries (including cluster organizations and other types of localized innovation eco-systems) operating in different types of innovation nodes and networks (including those that are spread geographically within a country, transnational innovation networks, and more globalized networks). This could both test (and possibly elaborate on) the list of “international innovation intermediary functions” proposed in this thesis, and

confirm (or disprove) the relative importance of support activities to “move and meld” knowledge in relation to geographically dispersed innovation processes.

Related to the investigation of support functions provided by different types of innovation intermediaries, a second area for future research is analyzing the innovation support system in different regions in order to understand the relevance and roles of innovation intermediaries in different geographies. This case study has used cluster organizations (or similar) as a proxy for the broader range of intermediaries that support international innovation processes. Future research could employ comparative case studies of particular regional/national innovation systems to explore the differentiated roles of various types of innovation intermediaries supporting transnational innovation processes (e.g. cluster organizations, science and technology parks, regional and national development agencies, trade councils, etc.) in order to investigate how various intermediaries in a particular system complement (or overlap) each other. The research could also investigate how different factors (i.e. the context of the firm/research organization, context of the regional innovation systems, and organizational capacity) affect the choice of which intermediary is used for different support activities.

A third area for potential future research is exploring benefits and drawbacks of alternative approaches to foster the internationalization of innovation processes for small companies. This thesis has highlighted the particular challenges that small companies have, and their resulting stronger interest in external support to engage in international innovation processes. This thesis has also highlighted the potential opportunity to address support needs through a systemic approach to support delivery. Future research could employ comparative case studies of different policy instruments (i.e. those providing direct support to companies vs. those that provide systemic support leveraging innovation intermediaries) to investigate the benefits, drawbacks and relative success in achieving policy objectives.

7. References

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Appendix I: Interview Guide for Pilot Lead

Introduction

As a starting point for the research/learning activities of the StarDust project, it is important to understand the background and overall objectives/expectations of each of the five pilot projects. Therefore, in-depth interviews will be conducted with each of the five pilot leads.

At the same time, the pilot leads will be interviewed regarding cluster dynamics (within and between the various nodes of the network), and the importance of the transnational pilot for their individual node (question set #2).

Questions

1. How were the lead partner and driving concept of network determined?
2. How were partners identified in different countries, and what were drivers of bringing together?
3. What do the different partners bring to the table?
4. What are the concrete objectives of the network (pilot)?
5. What are your expectations for the transnational pilot activities within StarDust?
6. Which pilot partners (max 3) would you recommend be included in the learning activities? (Please provide name of cluster initiative, contact name and email address)

Appendix II: Interview Guide for Pilot (Transnational Network) Partners

Purpose

This questionnaire has two objectives:

1. understanding the importance of and motives for internationalization activities for the individual cluster initiative/innovation node
2. understanding the level of cluster dynamics/social capital both within the individual cluster initiative/innovation node, and between the pilots partners/innovation nodes

The questions on cluster dynamics are based on the dynamic loop model (Smith and Brown 2009) which seeks to give a rationale for understanding the behaviour of actual and potential clusters over time. From an analysis of the different typical behaviours (positive, negative, immature and integrative) the series of questions will be useful for:

- a) Taking stock cluster performance by an adviser or development agency
- b) As a template for consideration of high leverage policy interventions
- c) As a self questionnaire for a firm taking stock of its situation
- d) As a discussion tool for a group of firms seeking to raise their game in global markets
- e) As a hypothesis for further research and investigation

Format

The questionnaire is divided into three parts. The first part focuses on general information about the cluster initiative/innovation node. The second part focuses on the internationalisation activities of the cluster initiative/innovation node. The third part focuses on the cluster dynamics both within the cluster initiative/innovation node and between the various nodes of the StarDust pilot. This part is divided into five sections addressing key observational questions around behaviour associated with each of the five loops in the model (both within the particular cluster, and between the clusters/innovation nodes of the network).

The answers are rated on a five point scale, the meaning of which varies slightly depending on the question. However, the general pattern is that higher score indicate greater systemic strength and hence performance potential. Lower scores indicate weaknesses which might be addressed by a variety of initiatives.

The questions are based on basic behaviours. However, there are many more detailed aspects that can be examined as a second level investigation.

THE QUESTIONS

Part I: General information about the cluster initiative/innovation node

1. Date
2. Name and title of respondent
3. Email address
4. Name of cluster initiative
5. In which technological/industrial area are the cluster actors mainly active (multiple answers possible):
 - Life Science/Biotechnology
 - Health Care/Medical Technologies
 - Micro/Nano/Opto
 - New Materials/Production
 - ICT/Embedded Systems
 - Energy & Environment
 - Transport & Logistics
 - Other (please describe): _____
6. Please indicate the number of members of the cluster initiative:
 - Less than 25
 - 26-50
 - 51-100
 - More than 100
7. Please indicate the age of the cluster initiative (time since cluster organization was founded):
 - Less than one year
 - 1-3 years
 - 3-5 years
 - More than 5 years

Part II: Internationalization activities for the individual cluster initiative/innovation node

IMPORTANCE OF INTERNATIONALIZATION	Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree
Questions					
International collaboration on research and innovation is important to the competitive strength of our cluster (i.e. the companies/research actors in the cluster). Please elaborate.					
Our cluster initiative has an elaborated internationalisation strategy					
Our cluster organisation supports access to and exploitation of knowledge internationally, through the following activities/services to our cluster actors:					
Access to unique market information					
Access to benchmarking					
Access to external knowledge sources (e.g. individuals or centres with specific skills/expertise, customer insights)					
Access to external technology (e.g. patented R&D)					
Access to external infrastructure (e.g. physical or virtual laboratories, demonstration or test facilities)					
Access to new international contacts/cooperation partners					
Access to funding for joint research and innovation activities					
Access to new markets					
Building a common identity; Stronger international visibility and attraction of inward investment					
Influencing government and policy					
Other (please write in)					

IMPORTANCE OF INTERNATIONALIZATION	Yes, a lot	Yes, a little	Trying, but no results yet	Not currently, but considering for the future	Not at all
Questions					
Within the last two years, our cluster initiative has established cooperation:					
With other clusters/innovation nodes in the country in the same technological/industrial area					
With other clusters/innovation nodes in the country in a different technological/industrial area					
With other clusters/innovation nodes in Europe in the same technological/industrial area					
With other clusters/innovation nodes in Europe in a different technological/industrial area					
With other clusters/innovation nodes outside Europe in the same technological/industrial area					
With other clusters/innovation nodes outside Europe in a different technological/industrial area					
Please explain how cooperation was established:					
How do you scan cooperation possibilities? (Do you look for other cluster organizations, or do you look for a specific company or research institution, or do you look for a strong region in that sector in general – and then try to find an appropriate speaking partner?)					
Why did you choose the partners you did (e.g. access to a particular market)?					
How do you evaluate cooperation possibilities that come to you?					
What do you see as your role (as a cluster organization) in establishing international cooperation (e.g. actively searching for partners, facilitation connections, funding connections, other)?					

IMPORTANCE OF INTERNATIONALIZATION	Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree
Questions					
In our opinion, the main barriers that hinder international cooperation for actors in my cluster:					
Potential partners are competitors					
Lack of mutual trust between potential partners					
Lack of financing or other financial resources* (see follow-on question)					
Lack of time or capacity					
Lack of a common technological or competitive basis					
No common interest or ideas to do joint business					
Geographic distance					
Language barriers					
Not a priority for member companies					
Other (please write in)					
For those agreeing that financing or other financial resources are a barrier, please explain the reasons:					
No financial resources?					
Too long 'time to grant'?					
Etc.					

Part III: Cluster dynamics both within the cluster initiative/innovation node and between the various nodes of the StarDust pilot

L1 INTER-FIRM RIVALRY	Very Strong	Strong	Medium	Weak	Absent
Questions regarding cluster dynamics within the cluster initiative/innovation node					
To what extent does competitive pressure drive innovation, improvement and change?					
To what extent do companies respond to global as well as local competition?					
What is the level of competition between businesses within this group?					
To what extent is it essential for businesses to be part of an international supply/value chain?					
How well is this group of businesses recognised internationally as a concentration of expertise and competence?					
Questions regarding cluster dynamics between the various nodes of the StarDust pilot (or other international innovation network)					
What is the level of competition between businesses within other members of the StarDust pilot?					
How well are other members of the pilot recognised internationally?					
Totals					
L2 INTER-FIRM CO-OPERATION	Very Strong	Strong	Medium	Weak	Absent
Questions regarding cluster dynamics within the cluster initiative/innovation node					
To what extent is there a recognition of common identity among the group of businesses?					
To what extent is there a shared tackling of common issues?					
How far is networking amongst businesses and their staff seen as a positive factor?					
To what extent is business benefit generated through presenting a joint identity?					
To what extent is co-operation between firms proven to be beneficial and established as common business practice?					
How effectively is research and innovation supportive of and linked to business issues and market needs?					
Questions regarding cluster dynamics between the various nodes of the StarDust pilot (or other international innovation network)					

						Very Strong	Strong	Medium	Weak	Absent
Has there been a history of cooperation with other partners within the StarDust pilot? At cluster organisation level? At firm level? Please elaborate:										
To what extent has cooperation between nodes in the pilot proven to be beneficial for the firms in your cluster?										
To what extent has the pilot (i.e. the network of clusters/innovation nodes) adopted a common identity?										
Totals										
L3 COLLABORATIVE ADVANTAGE										
Questions regarding cluster dynamics within the cluster initiative/innovation node										
Is there a common vision of a next level of competitive success?										
To what extent are businesses willing to share core knowledge?										
To what extent have firms embarked on a longer term collaborative strategy?										
To what extent has this widened beyond a small number of critical firms?										
To what extent has longer term collaborative strategy allowed the group to respond to demand placed by government, external shock or societal challenges?										
How far has trading core knowledge proved to be successful in achieving the next level of success?										
Questions regarding cluster dynamics between the various nodes of the StarDust pilot (or other international innovation network)										
Is there a common vision of a next level of competitive success (for the pilot network)?										
To what extent are businesses (within the pilot network) willing to share core knowledge?										
To what extent have firms (within the pilot network) embarked on a longer term collaborative strategy?										
To what extent has this widened beyond a small number of critical firms (within the pilot network)?										
To what extent has longer term collaborative strategy allowed the pilot network to respond to demand placed by government, external shock or societal challenges?										
How far has trading core knowledge (within the pilot network) proved to be successful in achieving the next level of success?										
Totals										

L4 VENTURE ATTRACTIVENESS					
Questions regarding cluster dynamics within the cluster initiative/innovation node	Very Strong	Strong	Medium	Weak	Absent
To what extent has this become a prime place to invest in for this sector?					
To what extent is this group of firms seen as globally important in this sector?					
To what extent has the shared activity attracted intermediaries, supply chain and other infrastructural support?					
To what extent has the shared activity attracted corporate venturing and joint ventures?					
To what extent has the shared activity attracted research collaborations?					
To what extent does this collaboration attract new players and talent?					
Questions regarding cluster dynamics between the various nodes of the StarDust pilot (or other international innovation network)					
To what extent is the pilot/network seen as globally important in this field?					
(During follow-up measurement) To what extent has this networked collaboration attracted new players (including investors, new partners, new talent)? Please elaborate.					
(During follow-up measurement) To what extent has this networked collaboration attracted new research collaborations? Please elaborate.					
Totals					
L5 Future focus and Securing Long Term success	Very Strong	Strong	Medium	Weak	Absent
Questions regarding cluster dynamics within the cluster initiative/innovation node					
To what extent is there a shared pursuit of future breakthroughs?					
To what extent is the group jointly focused on the search and exploitation of new ideas?					
To what extent do members of the group hold leading edge knowledge in some crucial area?					
How well is the process of transforming ideas into business success put into practice?					
How well aligned are the research and business agendas for achieving long term business success?					
Questions regarding cluster dynamics between the various nodes of the StarDust pilot (or other international innovation network)					
To what extent is there a shared pursuit of solutions to societal challenges (within the pilot network)?					
To what extent do members of the pilot network hold leading edge knowledge in some crucial area?					

How well is the process of transforming ideas into business success put into practice within the pilot network?						
To what extent has international collaboration on research and innovation in the field contributed to competitive strength of the network of clusters/innovation nodes?						
Totals						

Finally, please provide a list of companies and research organisations involved in your cluster initiative, highlighting the 5 (companies or research organisations) you recommend involving in the learning activities.

Many thanks for your involvement!

Appendix III: List of Interviews of Pilot (Transnational Network) Partners

Pilot/Node/Org Name	Type of Node ⁹⁸	Person Interviewed	Date of Interview (in 2011)
ACTIVE FOR LIFE			
Culminatum Innovation Oy Ltd	I + PL	Leena Silvennoinen	8 March
Cluster of Sustainable City	CO	Vytautas Ratkevicius and Aiste Cerniauskaite	18 March
Department of Health Science and Technology, Aalborg University	R	Ole Hejlesen	12 April
New Tools for Health	CO	Anders Carlsson	5-6 April
CLEAN WATER			
Lahti Business and Science Park	I + PL	Saija Tillgren (replacing Teija Laakso)	8 March
Sustainable Sweden Southeast AB	CO	Ann-Christin Bayard	18 March
Institute of Oceanology of Polish Academy of Science	R	Mirosław Darecki	11 May
Kaunas University of Technology	R	Jolanta Dvarionienė	28 April
COMFORT IN LIVING			
IDC West Sweden AB	CO + PL	Anders Wisth	1 April
Faculty of Wood Technology, Poznan University of Life Science	R	Beata Fabisiak	11 May
Art Academy of Latvia	R	Janis Gailitis	27 April

⁹⁸ PL=pilot lead; CO=cluster organization; I=other intermediary organization; R=research organization

Business Cooperation Center of Southern Lithuania	CO	Dalia Matukiene	28 April
MARCHAIN			
Klaipeda Science and Technology Park	I + PL	Andrius Sutnikas and Roma Stubriene	17 March
Swedish Marine Technology Forum	CO	Kerstin Hindrum	12 April
Turku University	R	Antti Saurama	14 April
Latvian Supply Chain Cluster	CO	Andris Spulis	27 April
MOBILE VIKINGS			
Mobile Heights	CO + PL	Emily Xu and Bengt Stavenow	16 Feb
Hermia Competence Cluster for Ubiquitous Computing	I	Karen Thorburn	17 March
Latvian ICT Cluster	CO	Lilita Sparane	18 March
Wielkopolska ICT Cluster	CO	Adam Olszewski	11 May

Appendix IV: Overview of Targeted Survey Participants

Pilot - Innovation Intermediary	Survey Participants per Respondent Category				Total # of Targeted Survey Participants
	Research Orgs	Large Co's (>250 employees)	Medium Co's (51-249 employees)	Small Co's (< 50 employees)	
Active for Life					16
- <u>Helsinki Health and Wellbeing (FI)</u>	1	0	0	5	6
- Cluster of Sustainable City (LT)	1	1	1	2	5
- New Tools for Health (SE)	1	0	0	4	5
- <i>Dept of Health Science and Tech (DK)</i>					
Clean Water					11
- <u>Lahti Cleantech (FI)</u>	0	1	1	3	5
- Sustainable Sweden Southeast (SE)	0	2	0	4	6
- <i>Institute of Oceanology, PAoS (PL)</i>					
- <i>Kaunas University of Technology (LT)</i>					
Comfort in Living					11
- <u>IDC West (SE)</u>	1	0	0	5	6
- Modern House Creation Cluster (LT)	1	0	2	2	5
- <i>Faculty of Wood Tech, Poznan U. (PL)</i>					
- <i>Art Academy of Latvia (LV)</i>					
Marchain					18
- <u>Klaipeda Science and Tech Park (LT)</u>	1	2	2	0	5
- Swedish Marine Tech Forum (SE)	2	2	0	2	6
- Latvian Logistics Association (LV)	2	0	1	4	7
- <i>Turku University (FI)</i>					
Mobile Vikings					17
- <u>Mobile Heights (SE)</u>	1	1	0	1	3
- Hermia CC for Ubiquitous Comptg (FI)	1	0	0	3	4
- Latvian ICT Cluster (LV)	2	1	1	1	5
- Wielkopolska ICT Cluster (PL)	1	0	2	2	5

Appendix V: Survey of Innovation Actors (companies and research organizations)

Introduction and Purpose

Your organisation has been identified as being directly or indirectly engaged in the activities of the (xx) cluster initiative. Among its activities, (xx) works to foster the internationalisation of research and innovation activities of company and research actors.

As part of its internationalisation activities, (xx) is involved in a transnational innovation network called (xx), which is a pilot of the Baltic Sea Region StarDust project. The StarDust project aims to foster transnational linkages between specialised research and innovation nodes in the Baltic Sea Region through five pilots.

The StarDust project coordinator at VINNOVA in Sweden is conducting research to better understand the role of cluster organisations in strengthening international knowledge and innovation linkages among company and research actors.

As part of this research, your organisation is being asked to respond to the following questionnaire, which has the objective of understanding the importance of internationalisation for your organisation, what international knowledge and innovation activities that your organisation pursues, and the usefulness of the cluster organisation in this regard.

Format

The questionnaire is divided into three parts. The first part focuses on general information about your company/research organisation. The second part focuses on the internationalisation activities of your company/research organisation (and

innovation performance). The third part (only for those who are/may be engaged in the activities of (xx) focuses on the expectations that your company/research organisation has for the StarDust pilots.

Most answers are rated on a five point scale – from Strongly Agree to Strongly Disagree.

All responses will be reported collectively (rather than as individual companies or research organisation), and will thus be made anonymous in all reports.

THE QUESTIONS

Part I: General information about the company/research organization

1. Date
2. Name and title of respondent
3. Email address
4. Organization and Address
5. Is your organization (check one):
 - a. A research actor (university or research institute)
 - b. A small company (less than 100 employees)
 - c. A medium-sized company (between 100-250 employees)
 - d. A large company (more than 250 employees)
6. Do you wish to receive results of the analysis? (Yes/No)

Part II: Internationalization activities and innovation performance⁹⁹

INTERNATIONALIZATION ACTIVITIES	Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree
Questions					
1. (BOTH) Internationalization of research and innovation activities are important to the strategy of my organisation.					
2. Knowledge inputs from outside my organisation are important to:					
a. (BOTH) our research activities					
b. (COMPANIES) our innovation activities					
3a. (COMPANIES) My organisation makes use of the following types of actors as knowledge inputs to our research and innovation activities:					
- Universities/research actors in my region					
- Suppliers, customers or firms in the <i>same</i> industry in my local region					
- Suppliers, customers or firms in a <i>different</i> industry in my local region					
- Universities/research actors in my country					
- Suppliers, customers or firms in the <i>same</i> industry in my country					
- Suppliers, customers or firms in a <i>different</i> industry in my country					

⁹⁹ Innovation performance question (#8) should be answered by companies only

- Universities/research actors within the Baltic Sea Region (Nordic and Baltic countries, northern Germany and Poland, NW Russia)					
- Suppliers, customers or firms in the <i>same</i> industry within the Baltic Sea Region (Nordic and Baltic countries, northern Germany and Poland, NW Russia)					
- Suppliers, customers or firms in a <i>different</i> industry within the Baltic Sea Region (Nordic and Baltic countries, northern Germany and Poland, NW Russia)					
- Universities/research actors within the Baltic Sea Region elsewhere internationally					
- Suppliers, customers or firms in the <i>same</i> industry elsewhere internationally					
- Suppliers, customers or firms in a <i>different</i> industry elsewhere internationally					
3b. (RESEARCH ACTORS) My organisation collaborates with the following types of actors to enhance our knowledge inputs:					
- Other universities/research actors in my region					
- Companies in my region					
- Other universities/research actors in my country					
- Companies in my country					
- Other universities/research actors within the Baltic Sea Region (Nordic and Baltic countries, northern Germany and Poland, NW Russia)					
- Companies within the Baltic Sea Region (Nordic and Baltic countries, northern Germany and Poland, NW Russia)					
- Other universities/research actors elsewhere internationally					
- Companies elsewhere internationally					
Additional comments:					

4. (BOTH) The innovation intermediary (cluster organisation or innovation network coordinator) with which my organisation is involved is useful to facilitating knowledge inputs from outside my organisation												
5. (BOTH) In which ways?												
<ul style="list-style-type: none"> • Access to unique market information 												
<ul style="list-style-type: none"> • Access to benchmarking 												
<ul style="list-style-type: none"> • Access to external knowledge sources (e.g. individuals or centres with specific skills/expertise, customer insights) 												
<ul style="list-style-type: none"> • Access to external technology (e.g. patented R&D) 												
<ul style="list-style-type: none"> • Access to external infrastructure (e.g. physical or virtual laboratories, demonstration or test facilities) 												
<ul style="list-style-type: none"> • Access to new international contacts/cooperation partners 												
<ul style="list-style-type: none"> • Other (please write in) 												
6. (COMPANIES) Collaboration with partners outside my organisation is important to our innovation activities (to make use of knowledge inputs)												
7. (COMPANIES) My organisation makes use of the following types of actors as collaboration partners to our innovation activities:												
- Universities/research actors in my region												
- Suppliers, customers or firms in the <i>same</i> industry in my local region												
- Suppliers, customers or firms in a <i>different</i> industry in my local region												
- Universities/research actors in my country												
- Suppliers, customers or firms in the <i>same</i> industry in my country												

- Suppliers, customers or firms in a <i>different</i> industry in my country						
- Universities/research actors within the Baltic Sea Region (Nordic and Baltic countries, northern Germany and Poland, NW Russia)						
- Suppliers, customers or firms in the <i>same</i> industry within the Baltic Sea Region (Nordic and Baltic countries, northern Germany and Poland, NW Russia)						
- Suppliers, customers or firms in a <i>different</i> industry within the Baltic Sea Region (Nordic and Baltic countries, northern Germany and Poland, NW Russia)						
- Universities/research actors within the Baltic Sea Region elsewhere internationally						
- Suppliers, customers or firms in the <i>same</i> industry elsewhere internationally						
- Suppliers, customers or firms in a <i>different</i> industry elsewhere internationally						
8. (COMPANIES) The cluster organisation/innovation network in which my organisation is involved is useful to facilitating collaboration with partners from outside my organisation (to make use of knowledge inputs)						
9. (COMPANIES) In which ways:						
• Access to new international contacts/cooperation partners						
• Access to funding for joint research and innovation activities						
• Access to new markets						
• Building a common identity; Stronger international visibility and attraction of inward investment						
• Influencing government and policy						
• Other (please write in)						

INNOVATION PERFORMANCE (COMPANIES ONLY)		Yes	No
Questions			
10. Has the firm carried out the following changes in the last two years?			
-	Introduced new or significantly improved products/services on the market		
-	Made use of new or significantly improved production processes, components or materials		
-	Carried out new or significantly improved strategy		
-	Carried out new or significantly improved organizational structures		
-	Considerably improved market concept/business model		

Thank you!

Thank you for your participation in the questionnaire. Results will be used as input to pilots in their strategy development process, as well as input to policymakers in the continued activities to promote transnational innovation collaboration (within the framework of the BSR Stars flagship programme).

If you have any questions or comments on the survey, please contact Emily Wise (email: emily.wise@vinnova.se or mobile telephone: +46 73 101 1426).

Appendix VI: Overview of Survey Respondents

Pilot	Node	#Sent	#Reponses	Response Rate
Active for Life	Helsinki Health and Wellbeing CoE (FI)	6	2	33%
	Cluster of Sustainable City (LT)	5	5	100%
	New Tools for Health (SE)	5	3	60%
	Dept of Health Science and Tech (DK)			
	Total:	16	10	63%
Clean Water	Lahti Cleantech (FI)	5	5	100%
	Sustainable Sweden Southeast (SE)	6	5	83%
	Institute of Oceanology, PAoS (PL)			
	Kaunas University of Technology (LT)			
	Total:	11	10	91%
Comfort in Living	IDC West (SE)	6	6	100%
	Modern House Creation Cluster (LT)	5	5	100%
	Faculty of Wood Tech, Poznan Univ of Life Sc (PL)			
	Art Academy of Latvia (LV)			
	Total:	11	11	100%
Marchain	Klaipeda Science and Technology Park (LT)	5	3	60%
	Swedish Marine Technology Forum (SE)	6	3	50%
	Latvian Logistics Association (LV)	7	7	100%
	Turku University			
	Total:	18	13	72%
Mobile Vikings	Mobile Heights (SE)	3	2	67%
	Hermia Comp. Centre for Ubiquitous Computg (FI)	4	4	100%
	Latvian ICT Cluster (LV)	5	4	80%
	Wielkopolska ICT Cluster (PL)	5	5	100%
	Total:	17	15	88%
	TOTAL	73	59	81%

Appendix VII: Interview Guide for Follow-up Interviews with Survey Respondents

Introduction and Purpose

Your organisation was identified as being directly or indirectly engaged in the activities of the (xx) cluster initiative, who is participating in a transnational innovation network called (xx) as part of the Baltic Sea Region StarDust project. The StarDust project coordinator at VINNOVA in Sweden is conducting research to better understand the role of cluster organizations in strengthening international knowledge and innovation linkages among company and research actors.

More than a year ago, your organisation participated in a survey aimed at understanding the importance of internationalization for your organization, what international knowledge and innovation activities that your organization pursues, and the usefulness of the cluster organization in this regard.

As part of the research activities, we are now following-up with some of the survey respondents to confirm our interpretation of your responses, and gain a deeper understanding of your priorities for internationalization, any challenges or barriers to internationalization that you experience, and what capabilities you feel may be lacking – where you feel external support facilitates your internationalization activities.

Format

The interview is structured in two parts. The first part focuses on gaining a deeper understanding of your organization's priorities for internationalization (i.e. why international activities are important for your innovation processes) and what challenges or barriers to internationalization that you experience. The second part focuses on understanding your perspectives on the capabilities that are necessary to internationalize, how you view your organization's capabilities in relation to these, and what

areas/functions you feel external support would facilitate your organizations' international innovation activities.

The questions request descriptive, open responses.

All responses will be reported collectively (rather than as individual companies or research organisation), and will thus be made anonymous in all reports.

INTERVIEW GUIDE

Date:

Name and title of respondent:

Email address:

Organization and Address:

Part I: Priorities and barriers for internationalization

1. In the survey, your organization was asked to rate the overall strategic importance of internationalization of research and innovation, the importance of knowledge inputs from outside your organization, and the importance of collaboration with partners from outside your organization (for research and innovation activities). Could you please elaborate on why your organization prioritizes internationalization of research and innovation, and how your organization addresses this priority?
2. What do you experience to be the main barriers that hinder your organization from undertaking international research and innovation activities (e.g. lack of time, financing, internal capabilities, etc.)? If lack of financing was mentioned as a barrier, please elaborate on this.

Part II: Capabilities and support needs for international innovation activities

3. What capabilities (skills and activities) are important for your organization in order to engage in international innovation activities (e.g. identifying new opportunities, accessing new knowledge, integrating knowledge from different sources, developing new operational models, managing collaborative processes, etc.)?
4. Do you feel your organization has adequate capabilities "in-house", or are there certain areas where your organization is in need of external support in order to engage in international innovation activities?
5. For the areas in which you feel that your organization is in need of external support, please elaborate on particular functions/activities that are needed.
6. Where can you turn to get the external support your organization needs?

Appendix VIII: List of Follow-up Interviews with Survey Respondents

Pilot/Cluster Initiative Node with whom related	Name of Company or Research Organization	Person Interviewed	Date of Interview (in 2013)
ACTIVE FOR LIFE			
Culminatum Innovation Oy Ltd	Audience First (small co.; participated in survey as Audio Riders)	Arvo Laitinen, Chairman of the Board and Eija Lämsä, Service Manager for Sound Vitamins	28 February
New Tools for Health	PharmaCell AB (small co.)	Ingemar Hägerbro, Director	15 February
MOBILE VIKINGS			
Mobile Heights	TeliaSonera (large co.)	Roger Bengtsson Head of Strategic Partnering & Venture Mgmt., Mobility Services	28 January
Mobile Heights	Amanzi Tel (small co.), now part of DingLi Com	Ian Vernon, CEO	28 January
Hermia Competence Cluster for Ubiquitous Computing	GreyCrunch (small co.)	Harri Honko, CEO	21 February (tel. interview)
Hermia Competence Cluster for Ubiquitous Computing	Ovelin (small co.)	Mikko Kaipainen, COO	22 February (tel. interview)
Hermia Competence Cluster for Ubiquitous Computing	VTT (research org.)	Veikko Ikonen, Senior Research Scientist	22 February

Appendix IX: Interview Guide for Follow-up with Pilot (Transnational Network) Partners

Purpose

This questionnaire has three objectives:

1. understanding the level of cluster dynamics/social capital both within the individual cluster initiative/innovation node, and between the pilots partners/innovation nodes (after 2 years of network collaboration)
2. understanding what activities/actions that have helped to:
 - a) strengthen collaboration between the nodes of the transnational network, and
 - b) support the internationalisation of “member” companies and research organisations
3. understanding which/how many and the level of company/research organisation engagement and interest in international collaboration in the BSR in the future

Format

The questionnaire is divided into three parts. The first part focuses on the cluster dynamics both within the cluster initiative/innovation node and between the various nodes of the StarDust pilot. This part is divided into five sections addressing key observational questions around behaviour associated with each of the five loops in the model (both within the particular cluster, and between the clusters/innovation nodes of the network). This part is a repeat of the cluster dynamics questions posed at the beginning of the StarDust project – and will

again be discussed only with the pilot partners who are cluster initiatives/innovation intermediaries.

The questions on cluster dynamics are based on the dynamic loop model which seeks to give a rationale for understanding the behaviour of actual and potential clusters over time. The answers are rated on a five point scale, the meaning of which varies slightly depending on the question. However, the general pattern is that higher score indicate greater systemic strength and hence performance potential. Lower scores indicate weaknesses which might be addressed by a variety of initiatives.

The second part focuses on activities/actions that have been taken to strengthen collaboration within the StarDust pilot, as well as to engage member companies/research organisations and support their internationalisation needs. The third part focuses on understanding how “member” company/research organisations have been engaged in the StarDust pilot activities, as well as understanding what interest they have in collaboration in the BSR in the future.

Most questions in parts II and III request descriptive, open responses. Some questions will only be discussed with pilot partners who are cluster initiatives/innovation intermediaries.

INTERVIEW GUIDE

Date:	
Name and title of respondent:	
Email address:	
Organization and Address:	

Part I: Cluster dynamics both within the cluster initiative/innovation node and between the various nodes of the StarDust pilot

The same cluster dynamics questions used in the initial interviews with pilot partners (see Appendix II, Part III) were repeated.

Part II: KSFs/support activities to strengthen collaboration within the StarDust pilot, as well as to engage member companies/research organisations and support their internationalisation needs

<p>1. How has “the importance of international collaboration on research and innovation activities for the competitive strength of our cluster/organization” changed since the baseline interview (refer to previous interview)?</p> <ul style="list-style-type: none"> - More, less or same importance? - Spending more, less, or same amount of time on international activities? 	
<p>2. Approximately how much time (% of organization’s total resources) is spent on activities to support international collaboration of research and innovation? Please provide examples of activities.</p>	
<p>3. Overall, what activities or characteristics (like clear vision, strong leadership, etc.) have you found to be most important for strengthening collaboration between the nodes of the transnational innovation network?</p>	
<p>4. The StarDust project has provided various support tools/activities to strengthen collaboration between the nodes of the transnational network. Please provide your perspective on the helpfulness of these support tools (most/least helpful; would have appreciated more/less of xxx; different timing xxx):</p> <ul style="list-style-type: none"> • Management/coordination of the five networks (regular information, meetings, etc.) • Communication support (common website, marketing/branding analysis, storytelling workshop, etc.) • Coaching/facilitation (ongoing process support from lead partner) • Strategy development tools (signal sessions, various “camps”, business model canvas exercise, etc.) • Knowledge sharing/matchmaking tools (knowledge sharing workshop/Tobias Ley, company database/matchmaking support, etc.) • Access to finance (information on programmes and consultancy support to find right mechanisms) • Learning/evaluation activities (baseline/SWOT analysis, external coaching/evaluation sessions related to SAPs, etc.) 	

<ul style="list-style-type: none"> • General comments:
5. How has your “innovation node” worked with engaging companies/research organisations in the StarDust network’s activities? How do you generally support companies/research organisations’ internationalization needs?
6. In your opinion, what are the key success factors and activities needed to support companies’/research organisations’ successful collaboration within transnational innovation networks?
7. What is the role of the cluster organization/intermediary in relation to this?

Part III: Engagement of “member” company/research organisations in the StarDust pilot activities, and interest in research/innovation collaboration within the BSR in the future

1. What level of engagement have your “member” company/research organisations had in StarDust pilot activities?
2. What is your opinion of companies’/research organisations’ demand for/interest in research/innovation collaboration within the BSR in the future?

Many thanks for your involvement!

Appendix X: List of Follow-up Interviews with Pilot (Transnational Network) Partners

Pilot/Node/Org Name	Type of Node ¹⁰⁰	Person Interviewed	Date of Interview (in 2013)
ACTIVE FOR LIFE			
Culminatium Innovation Oy Ltd	I + PL	Hugo Goncalves	27 February
New Tools for Health	CO	Anders Carlsson	5 April (telephone)
CLEAN WATER			
Lahti Development Company (LADEC Oy)	I + PL	Johanna Kilpi-Koski	20 February
Sustainable Sweden Southeast AB	CO	Ann-Christin Bayard	19 February
Institute of Oceanology of Polish Academy of Science	R	Beata Szymczycha	18 February
Kaunas University of Technology	R	Jolanta Dvarionienė	20 February
COMFORT IN LIVING			
IDC West Sweden AB	CO + PL	Lotten Svensson	8 April
Faculty of Wood Technology, Poznan University of Life Science	R	Beata Fabisiak	30 April (telephone)
Business Cooperation Center of Southern Lithuania	CO	Dalia Matukiene	6 May (Skype)
MARCHAIN			
Klaipeda Science and Technology Park	I + PL	Andrius Sutnikas	9 and 26 April

¹⁰⁰ PL=pilot lead; CO=cluster organization; I=other intermediary organization; R=research organization

SP Technical Research Institute of Sweden	R + I	Kerstin Hindrum	25 April (telephone)
Turku University	R	Tapio Karvonen	29 April (Skype)
Latvian Supply Chain Cluster	CO	Andris Spulis	2 May (Skype)
MOBILE VIKINGS			
Mobile Heights	CO + PL	Henrik Lundblad	2 April
Hermia Competence Cluster for Ubiquitous Computing	I	Karen Thorburn	21 February
Latvian ICT Cluster	CO	Lilita Sparane	19 April (Skype)
Wielkopolska ICT Cluster	CO	Adam Olszewski	17 June (emailed responses)