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The Case of the Bothnian Arc (Finland-Sweden) – Regions and Innovation: Collaborating Across Borders

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R58

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ABSTRACT

The Bothnian Arc is a cross-border area on the border of Finland and Sweden that covers the most populated areas along the upper Bothnian Bay, spanning 800 kilometres. It has a population of around 710 000, across 55 000 km² with an economic output of USD 31 billion. The Bothnian Arc collaboration was initiated by local authorities, with strong commitment of the mayors of the cities of Oulu and Luleå (300 kilometres apart). Despite a peripheral location in all respects, some parts of the Bothnian Arc have shown a remarkable vitality, notably Oulu (Finland), driven by an innovation ecosystem that builds on the heritage of Nokia and the contribution of Oulu University. Luleå (Sweden) has recently attracted the European Facebook data centre. The area is looking to go beyond ad hoc projects for a more strategic approach to innovation-driven collaboration to be the dynamic hub of the north. This case study is part of the project *Regions and Innovation: Collaborating Across Borders*. A summary of this working paper appears in a report of the same name.

JEL classification: R11, R58, O14, O18, O38, L52, L53

Keywords: regional development, regional growth, innovation, regional innovation, science and technology, regional innovation strategy, cross-border, Finland, Sweden, Bothnian Arc, Oulu, Luleå

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EXECUTIVE SUMMARY

Strengths, weaknesses, opportunities and threats for cross-border innovation policy in the Bothnian Arc

Strengths and assets	Weaknesses and barriers
<ul style="list-style-type: none"> • Strong innovation assets and performance • “Oulu miracle” supporting the attractiveness of the area • Existing experimentations on joint projects to feed the cross-border innovation agenda • Important mobilisation of main higher education institutions around cross-border research and innovation • Climate of trust favourable for co-operation • Common areas of specialisation and opportunities for complementary expertise (example of ICT and big data, reinforced by the new Facebook data centre in Luleå and the ICT cluster in Oulu) 	<ul style="list-style-type: none"> • Geographical scale and accessibility issues within the area • Distance from large urban centres • Lack of information for actors on innovation potential over the border • Mainly driven by local authorities with limited innovation policy instruments • Insufficient involvement of firms in developing the cross-border vision and financing its actions • Lack of data to understand the potential and barriers for cross-border co-operation
Opportunities	Threats
<ul style="list-style-type: none"> • Increasing geostrategic importance of the location given global warming • Developing an internationally recognised brand as the technology hub of the north • Raising awareness and funding from regional and national sources not currently involved in the cross-border efforts 	<ul style="list-style-type: none"> • Greater attractiveness of other national and international locations for high-skilled talent • Mature industries unable to upgrade quickly enough • Declining relative competitiveness of high-tech sectors

The profile and relevance of the Bothnian Arc cross-border area for innovation

The Bothnian Arc gathers the most relevant areas in Northern Sweden and Finland for innovation potential, anchored by the two cities of Oulu and Luleå. The region is seeking to diversify from the traditional mining, forestry and metal sectors, and reduce dependence on large companies. The “Oulu exception” – a high-tech hub – provides credibility to the possibility of “success in the north”, contributing to the stronger innovation performance on the Finnish side that has nevertheless been challenged by Nokia’s downsizing. The arrival of Facebook in Luleå may signal new opportunities on the Swedish side. The knowledge potential linked to universities, applied research institutes and governmental research centres, as well as the presence of R&D-intensive companies in new sectors, provides a great opportunity to deepen this diversification process and maintain attractiveness and a skilled labour force.

The area cannot yet be considered functional with respect to innovation policy, but has clear potential. There is a lack of evidence on cross-border flows beyond border crossings at Haparanda-Tornio. Anecdotal evidence points towards some cross-border linkages in the higher education and business worlds, but there is no measure of the density and relative strengths of these links. While geographical, regulatory and cultural barriers do exist within the area, they do not seem to constitute insurmountable obstacles. Internal accessibility remains a challenge for reaping the benefits of proximity.

Driving force and key actors for the Bothnian Arc cross-border area

Economies of scale and complementarity are two levers for this cross-border region, but greater involvement of firms in particular, as well as knowledge institutions, is needed to reap such benefits. The driving force for the definition of a cross-border region is to be a dynamic competitive region in the northern periphery of Europe. This is a real challenge for a large area with only 700 000 inhabitants in

times where metropolitan areas are seen as a necessary ingredient to economic growth and competitiveness. Expanding Oulu's success by capitalising on a larger and proximate pool of assets, including the Swedish knowledge and business actors, is a priority for the actors driving the Bothnian Arc. The Bothnian Arc Association has a relatively young history, but can rely on a longer tradition of Nordic co-operation. While universities are important players, and companies active followers, they are not in the driving seat for developing Bothnian Arc collaboration at present.

Governance of the Bothnian Arc cross-border area

The governance of the Bothnian Arc area rests on the shoulders of the small Bothnian Arc Association which plays a limited co-ordination and facilitator role. The association's main public stakeholders are municipalities. National and regional authorities, that hold decision-making power and budgets in innovation matters, are not involved in the governance of the cross-border area. National and regional policy documents include generic interest in the cross-border dimension, but this interest is not translated into joint or aligned policy instruments. Knowledge institutions and firms are only involved in the Bothnian Arc initiative through concrete projects, but do not explicitly contribute to the vision or to the strategic plans for the cross-border area. This is especially problematic for small and medium-sized enterprises (SMEs), which can be the main engines for the industrial renewal towards new activities responding to societal challenges.

Some amount of public funding is necessary to pursue the area's strategic goals and develop the cross-border region institutionally, but there is a lack of private funding. Structural funding for the association is supported in part by the Nordic Council of Ministers. However, the foreseen decline of this source in the near future calls for alternative structural funding sources to complement the limited allocations from municipalities. The major source of public money for cross-border projects is European Territorial Co-operation (Interreg) funding, which has proven instrumental for raising awareness of the potential for cross-border co-operation, mostly for universities and large corporations. This funding source is, however, fraught with a number of weaknesses, notably that it tends to fund a collection of projects without much strategic capitalisation linked to regional development goals. Attracting more private funding into cross-border innovation projects is needed, in view of the fact that most of the initiatives implemented within the Bothnian Arc area seem to be unsustainable beyond the period of public funding. Availability of private funds is the best way to ensure a good match with market needs for innovation projects.

The Bothnian Arc cross-border innovation policy mix

There are interesting cross-border policy experiments but there is a need for more strategic and structural policy instruments to fulfil a common vision for the area's development. Cross-border co-operation in innovation in the Bothnian Arc evolves thanks to the promotional efforts of the Bothnian Arc Association and from a collection of European Territorial Co-operation projects. There are no dedicated policy instruments corresponding to the vision of the Bothnian Arc, but rather interesting experiments based on grassroots initiatives from key actors – mainly higher education institutions (HEIs) and local authorities. A main issue concerns the possibility to learn from these initiatives to drive the cross-border partnership in fruitful directions and address the barriers revealed by these projects. The key question faced today by actors of the Bothnian Arc is how to evolve from a situation of mutual exchange of information and a collection of externally funded projects, towards aligned projects with joint funding from the countries and regions involved, and ultimately the development of a joint strategy for the cross-border area.

Recommendations for cross-border innovation policies in the Bothnian Arc

The potential for cross-border co-operation in innovation in the Bothnian Arc is still under-exploited today. To grasp these opportunities, several new directions are recommended.

Cross-border area: Build on the two urban hubs, collect data and improve internal accessibility to support cross-border innovation potential

- Build on the main innovation hubs of Oulu and Luleå, while also connecting firms in more rural municipalities that have distinctly different industrial profiles.
- Collect cross-border statistics to help guide a potential strategy for the cross-border area, and document the main areas of expertise (public and private actors) in different sectors.
- Identify opportunities for improving internal accessibility within the cross-border area.

Governance: Develop a shared vision and strategy for the Bothnian Arc area, with greater involvement of firms and knowledge institutions

- Develop a joint strategy for the Bothnian Arc to drive cross-border innovation action.
- Seek the involvement of private actors and knowledge institutions (triple helix) in the development of cross-border activities.
- Connect regional and national authorities to the strategy.
- Increase resources to the Bothnian Arc Association to augment its capacity for supporting strategic cross-border development.

Innovation policies and instruments: Communicate more about cross-border area opportunities to support strategic programmes and instruments

- Communicate and diffuse information on the cross-border area's innovation potential and successes.
- Define strategic programmes and actions to increase cross-border, knowledge-based interactions, learning from other cross-border area experiences.

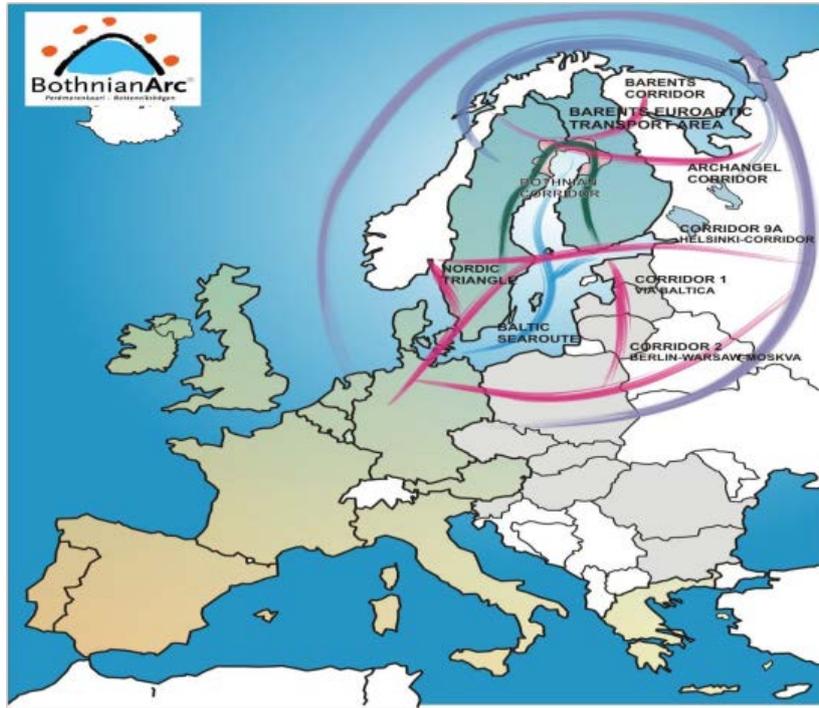
INTRODUCTION

The Bothnian Arc is a Swedish-Finnish cross-border area initiated by local authorities to support the peripheral region in becoming a dynamic hub in the north of Europe. This goal is expected to be achieved both through a macro perspective of the region as a “corridor” between larger economic areas with high economic potential (Figure 0.1), and a more micro approach – developing synergies through the exploitation of business and innovation opportunities across the knowledge-intensive cross-border region (Figure 0.2).

Global warming brings the perspective of opening an arctic sea route that could change the context for the Bothnian Arc. The Northern Sea Route would significantly reduce the distance between northern Europe and the People’s Republic of China, as the new route would only be 40% of the shipping time of the traditional southern route through the Suez Canal. The opening of this route, together with increased possibilities for exploitation of ice-free oil and gas fields, may have dramatic effects on the economy of the Arctic Barents Sea region. More land traffic is expected between European countries and the northern harbours in Norway (Kirkenes) and the Russian Federation (Murmansk). The construction of an Arctic railway, connecting the Bothnian Arc with the northern shores of the Barents Sea, is under study. Increased traffic of oil, ores and other goods is expected on this route. Huge investments in mining and energy are planned in the region. This creates new potential for the Gulf of Bothnia, at the interface between the Baltic Sea region and the Barents Sea.

The Bothnian Arc Association seeks to foster co-operation between actors on both sides of the border in the coastal zone at the northern end of the Gulf of Bothnia. Such co-operation concerns new business development, innovation, education, training and R&D. The association was founded in 2002. As this is relatively recent for promoting cross-border innovation activities, the task of developing strong, knowledge-based linkages across the cross-border area is still under development. This case study focuses on identifying the opportunities for innovation-driven development with a cross-border dimension, as there is not sufficient history of active collaboration for an assessment of prior experiences.

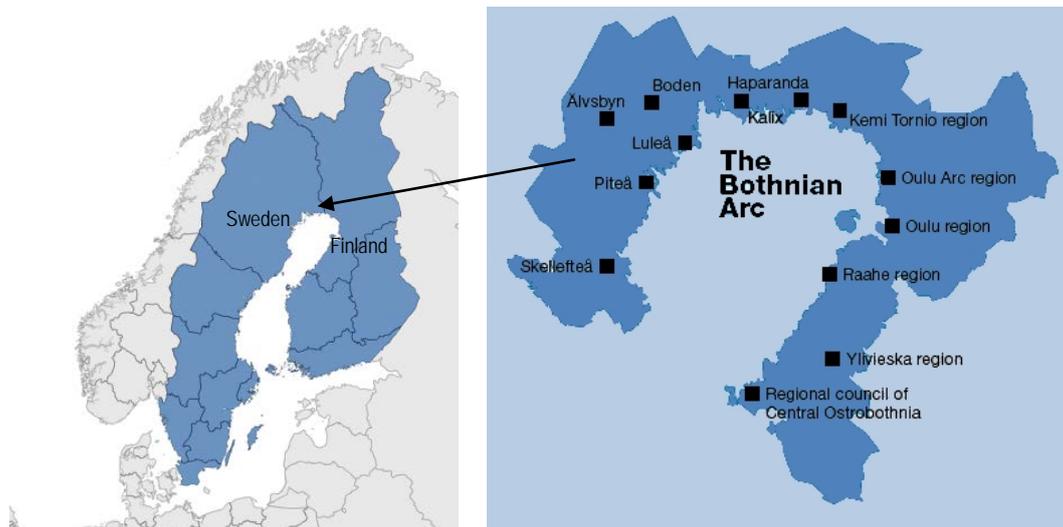
Figure 0.1. The Bothnian Arc cross-border area in context



Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Source: www.bothnianarc.net.

Figure 0.2. The Bothnian Arc cross-border area



Note: These maps are for illustrative purposes and are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Sources: OECD (2013), OECD eXplorer, www.oecd.org/gov/regional-policy/oecdexplorer.htm (accessed 15 October 2013); and www.bothnianarc.net (right).

CHAPTER 1

THE BOTHNIAN ARC CROSS-BORDER AREA AS A FUNCTIONAL REGION

Table 1.1. **Snapshot of the functional region for innovation**

(Bothnian Arc in bold)

Characteristic	Specification	Comments
Region settlement patterns	Metropolitan area Network of small and medium-sized cities Sparsely populated with small cities/towns	The Bothnian Arc is composed of predominantly rural areas, with two main medium/small cities: Oulu (Finland) and Luleå (Sweden).
Internal accessibility and flows (geographic proximity)	Strong Moderate Weak	The Bothnian Arc region spans over a large territorial scale with limited infrastructure connections (no direct flights between the main cities that are more than 3 hours away by motorway, 800 kilometres from tip to tip).
Industrial and knowledge specialisations (cognitive proximity)	Similar with complementarities Same Different	Both sides of the border are specialised in the following sectors: forestry/wood and pulp, mining and ICT. There are opportunities to seek complementarities in these fields.
Socio-cultural context (social proximity)	Very similar Somewhat similar Different	Cultural and language barriers seem limited on both sides, but increase with distance from the border. Swedish is an official language in Finland, even if it is not spoken by everyone.
Innovation system interactions	Pervasive Hub-to-hub On the border	Some business-related interactions occur at the border (Haparanda-Tornio). The main potential for innovation linkages is between the two main cities of Luleå and Oulu.
Level of innovation development across border	Balanced, strong Balanced, weak Unbalanced	Both sides of the Bothnian Arc are relatively advanced regions in terms of innovation performance. The Finnish side appears to be slightly more advanced thanks mainly to assets around Oulu.

1.1. Spatial definition of the cross-border area

The Bothnian Arc is defined as the coastal area that extends along the northern end of the Gulf of Bothnia, from Skellefteå in Sweden to Kokkola in Finland (Figure 0.2). On the Swedish side, the area includes seven municipalities (Haparanda, Kalix, Luleå, Boden, Älvsbyn, Piteå and Skellefteå) which are part of the Västerbotten and Norrbotten NUTS 3 Swedish regions.¹ The Finnish side contains five sub-regional areas (Kemi-Tornio, Oulu Arc, Oulu, Raahe and Ylivieska) and one regional council (NUTS 3 Central Ostrobothnia), and covers the latter NUTS 3 region as well as parts of the NUTS 3 regions of Northern Ostrobothnia and Lapland.² The Bothnian Arc is defined by local authorities, but does not follow traditional regional administrative boundaries.³ It gathers the most densely populated parts of the five NUTS 3 regions that comprise the area.

The Bothnian Arc is nested in a complex set of cross-border areas among Nordic countries (Figure 1.1). There are 12 committees funded by the Nordic Council of Ministers, corresponding to cross-border areas involving Nordic countries. Several of these areas have the ambition, like the Bothnian Arc, to rely on knowledge-based cross-border co-operation to secure their economic development. The most well-known is that of the Oresund area between Sweden and Denmark (with 3.7 million inhabitants). Others, such as the Kvarken Council, focus on other matters, typically transport and communication

infrastructures. Like the Bothnian Arc, the Nordic co-operation committees have a formal existence due to the Nordic Council of Ministers support, and benefit from European Territorial Co-operation funding programmes (see Chapter 3).

There are several smaller scale cross-border initiatives that overlap with the Bothnian Arc:

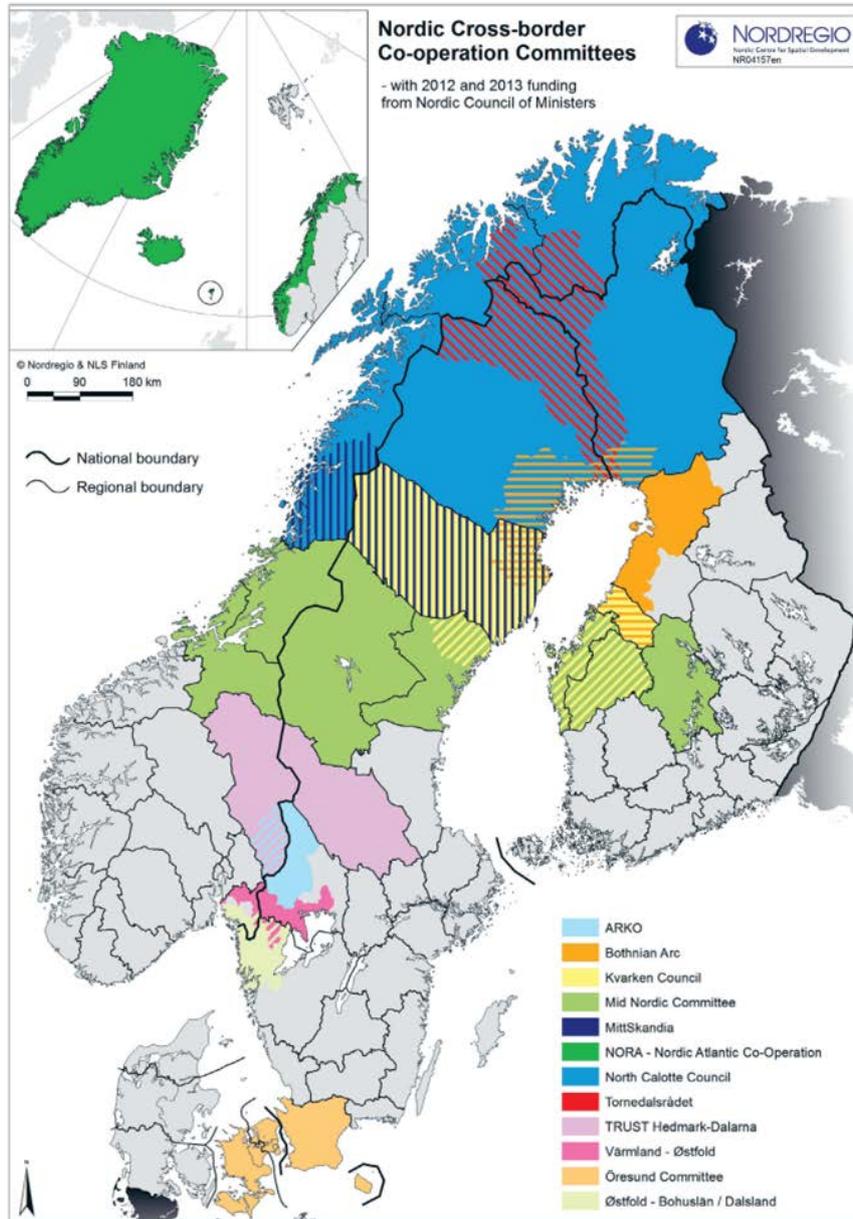
- **Haparanda-Tornio:** Co-operation takes place between two municipalities, Tornio (Finland) and Haparanda (Sweden) at the Swedish-Finnish border along the gulf. It focuses on physical planning, joint infrastructure and services (schools, fire and rescue services, district heating, etc.). This area is fully included into the Bothnian Arc area.
- **Torne Valley:** This cross-border area gathers the 21 border municipalities and 80 000 inhabitants at the intersection of the Swedish-Finnish border to the north of the Bothnian Gulf. The focus of the co-operation is on cross-border labour mobility and business interactions. It overlaps with a small part of the Bothnian Arc.
- **North Calotte Council:** This area includes the northernmost regions of Finland, Sweden and Norway. It overlaps with the Bothnian Arc, mainly on the Swedish side, and excludes Oulu on the Finnish side.

In addition, three large EU-supported macro-regions are relevant for the Bothnian Arc actors. These regions, falling under the European Territorial Co-operation objective, address geo-strategic, transport infrastructure and environmental objectives. They include:

- **The Barents Euro-Arctic Region:** This area includes the following regions: in Finland: Kainuu, Lapland and Oulu Region (North Karelia was granted observer status in 2008); in Norway: Finnmark, Nordland and Troms; in the Russian Federation: Arkhangelsk, Karelia, Komi, Murmansk and Nenets; and in Sweden: Norrbotten and Västerbotten. The majority (75%) of the population of the cross-border area lives in the Russian Federation.
- **Baltic Sea Region:** This macro-region covers Belarus, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Norway, Poland, Sweden and Northwest Russia. The co-operation concerns spatial planning, infrastructure and the environment.
- **Northern Periphery area:** This very large geographical area includes parts of Finland, Ireland, Sweden and the United Kingdom (Scotland and Northern Ireland) – in co-operation with the Faroe Islands, Iceland, Greenland and Norway. The whole of the Bothnian Arc is contained in this initiative. The Northern Periphery is part of the European Territorial Co-operation programme aimed at supporting transnational co-operation among regions in northern Europe. In the next programming period, its successor programme will be entitled Northern Periphery and Arctic 2014-2020.

Figure 1.1. Nordic cross-border co-operation committees

With funding from the Nordic Council of Ministers 2012-13



Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Source: Hörnström, L. and A. Tepecik Diş (2013), "Crossing borders: Linkages between EU policy for territorial cooperation and Nordic cross-border cooperation", *Nordregio Working paper*, No. 2:2013.

1.2. Key economic characteristics of the cross-border area

The Bothnian Arc is a relatively wide and low populated area of 700 000 inhabitants (Table 1.2). The area includes the most densely populated parts of Northern Sweden and Finland, and is located just south of the big wilderness areas, home to the Sámi people. Most of the area can be considered as rural, with two small/medium-sized cities acting as hubs: Oulu in Finland is the main city with close to 140 000

inhabitants (200 000 for the Oulu Region) and the secondary hub is Luleå in Sweden, with half the population of Oulu.

Table 1.2. **Socio-economic overview of the cross-border area**

Variable	Bothnian Arc	Finland area	Sweden area
Population (2011)	710 000	460 000	250 000
Km ²	55 000	29 000	26 000
Population density (inhabitants/km ²)	12.9	15.8	9.6
Main cities		137 000 (Oulu)	74 426 (Luleå)
Unemployment rate (2011)	7.0	8.3	4.0
GDP per capita (2009) (USD PPP constant prices 2005)	--	Pohjois-Suomi 25 264 Finland 30 574	Övre Norrland 28 474 Sweden 32 322

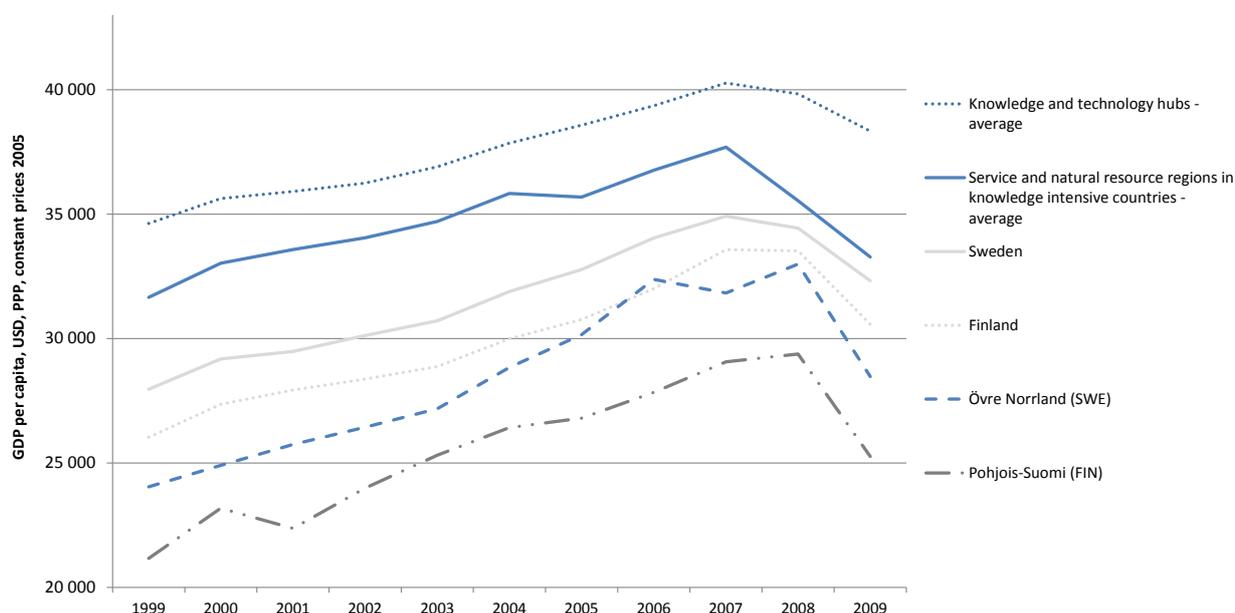
Sources: OECD (2013), *OECD Regional Statistics* (database), doi: 10.1787/region-data-en; Launonen, M., K. Launonen, H. Sundvall and M. Lindqvist (2013), "Background report for OECD study on cross-border regional innovation policies: Bothnian Arc", Bothnian Arc, January.

There is a concern about maintaining population in this peripheral cross-border area, particularly on the Swedish side. Fighting depopulation, especially of the younger and most qualified workers, requires not only the creation of good economic opportunities, but also strong framework conditions: good schools, universities, culture, and a vibrant environment attractive to young people. This challenge is especially acute in the Luleå region (Norrbotten County) which represents 24% of the country's territory but only 2.7% of the population. As a consequence, labour force shortages are threatening the vitality of the region. On the Finnish side, the Oulu area has experienced population growth during the last decades (over 10% between 1990 and 2009). Anchoring Luleå's regional economy to the dynamic hub on the other side of the gulf is part of the strategy to retain population.

The Bothnian Arc lies in two countries with very high standards of living and economic growth, even if constituent regions are not leading in their countries. Both regions have a GDP per capita well above the OECD average (Figure 1.2). However, in Northern Finland, GDP per capita is significantly lower and unemployment significantly higher, than the country average. The same is true when compared to OECD peer regions,⁴ whereby the two parts of the Bothnian Arc show weaker economic performance over the last decade (lower GDP per capita and higher unemployment rates). These figures indicate that on both sides of the Bothnian Arc, regions are challenged to find sources of growth and employment. It is likely that these figures would be more favourable had the indicators been calculated on the Bothnian Arc area only, which includes the denser, more developed parts of the two NUTS 2 regions for which data is available. For example, GDP growth in Oulu from 1994-2008 was the third highest of 70 NUTS 4 areas in Finland (Simonen, 2013).

There is a strong contrast between activities in the rural areas of the region – where agriculture, forestry, energy and tourism are strong – and the activities in the urban centres (Table 1.3). Oulu hosts a strong concentration in ICT and high-tech manufacturing activities, being the second out of 70 NUTS 4 areas in Finland in terms of location quotient in both 1994 and 2008, attesting to the strong ability for the city to maintain its high-tech strengths (Simonen, 2013). Other small cities, notably Luleå, are home to high-tech manufacturing and services. In employment terms though, the biggest companies on both sides of the border are active in steel, mining and iron. The only notable exceptions are the ICT companies Nokia (see Box 1.1), Nokia-Siemens and Itella in Finland and Teliasonera in Sweden.

Figure 1.2. Evolution of GDP per capita in the Bothnian Arc



Note: Övre Norrland belongs to the “Service and natural resource regions in knowledge-intensive countries” category of innovative regions and Pohjois-Suomi to the “Knowledge and technology hubs” category. For further information see Ajmone Marsan and Maguire (2011).

Source: OECD (2013), *OECD Regional Statistics* (database), doi: 10.1787/region-data-en.

Table 1.3. Location of economic specialisations and main companies in the Bothnian Arc

Sectors	Finnish side	Swedish side
ICT	Oulu (Nokia and Nokia Siemens)	Luleå (Telisonera)
High-tech industries	Oulu	Luleå
Knowledge-intensive services	Oulu	Luleå
Creative industries	Oulu	Luleå
Life science	Oulu	
Chemical industry	Central Ostrobothnia and lithium cluster (OMG, Boliden and Kemfine)	Piteå (Swerea SICOMP)
Metalworking, steel industry	Kemi-Tornio, Raahe	Luleå (Swerea MEFOS, SSAB)
Mining	Kemi-Tornio (Outokumpu), Raahe	Luleå (mining company LKAB) Skellefteå (Boliden)
Agriculture, agrifood	Oulu Arc, Ylivieska, Central Ostrobothnia	Haparanda, Kalix, Boden and Älvsbyn (Polarbröd)
Forestry	Kemi-Tornio, Ylivieska	Piteå
Wood processing	Oulu Arc, Ylivieska	
Pulp and paper industry	Kemi-Tornio (Stora Enso, Metsä-Botnia)	Kalix (Billerud), Piteå
Energy	Raahe, Ylivieska	
Tourism	Oulu Arc	

Sources: Launonen, M., K. Launonen, H. Sundvall and M. Lindqvist (2013), “Background report for OECD study on cross-border regional innovation policies: Bothnian Arc”, Bothnian Arc, January.

Box 1.1. Nokia: Connecting people

The Nokia Corporation is a Finnish multinational company in the field of ICT and telecommunications. The company's headquarters are located in the Espoo (Helsinki area) in Finland. Nokia has more than 100 000 employees in 120 countries worldwide and from 1998 to 2012 it was the world first mobile phone seller. From 1998 to 2007, Nokia contributed to a quarter of Finnish GDP growth. Over the same period, Nokia's investments in R&D corresponded to 30% of the total Finnish R&D expenditure and the company was paying around 23% of all Finnish corporate tax. In 2000, Nokia alone represented around 4% of Finnish GDP.

In 1986, Nokia created the Nokia Research Center, the company's R&D arm, where researchers, scientists and engineers located not only in Finland but also in other advanced and emerging economies like the United States, the United Kingdom, China, India and Kenya contribute to developing innovative solutions. The Nokia Research Center has formal research agreements with some of the leading university worldwide: from Aalto and Tampere Universities in Finland to Berkeley, Stanford and MIT in the United States; Cambridge in the United Kingdom; and BUPT and Tsinghua in China.

Today, the company is experiencing troubled times. Nokia started losing market shares in 2007, mainly due to the emergence of touch-screen technologies and Smartphone usage and in 2012 Samsung overtook Nokia as the world's largest mobile phone maker. Since 2007, Nokia's share price has fallen dramatically and the company is now looking for a reconversion path in the field of telecom technology, in particular by developing and creating web mapping platforms and services.

Source: www.research.nokia.com; www.bbc.co.uk; www.economist.com.

1.3. Innovation potential of the cross-border area

Within the European landscape, the Bothnian Arc regions are among the innovation leaders, and on an OECD-wide basis they are also among the top-ranked peer groups. Northern Sweden (Övre Norrland) and Northern Finland (Pohjois-Suomi) are both in the “innovation leaders” category (top of four) of regions according to the 2012 EU Regional Innovation Index. According to the OECD classification,⁵ the R&D intensity of Northern Finland helps drive the region's performance of the OECD innovation leaders in the “Knowledge and technology hubs” group. The Swedish side of the Bothnian Arc is in the “Service and natural resource regions in knowledge-intensive countries” category, together with other advanced regions in northern Europe, Canada and Korea.

Table 1.4. Innovation overview of the cross-border area

Variable	Finland	Pohjois-Suomi (FIN)	Övre Norrland (SWE)	Sweden	OECD peer average Knowledge and tech hubs	OECD peer average Service and natural resource in knowledge-intensive countries
Tertiary educational attainment (2008) (as a % of labour force)	40.0	32.2	28.5	34.2	30.8	29.8
R&D personnel (2009) (as a % of total employment)	3.3	3.7	2.7	2.6	2.7	2.0
Share of employment in high-tech manufacturing (2008) (%)	39.9	26.2	37.6	42.9	49.2	32.4
Share of employment in knowledge-intensive services (2008) (%)	58.5	60.0	64.6	62.8	56.7	57.6
Total R&D expenditure as a % of GDP (2009)	3.78	6.58	2.82	3.37	3.91	1.79
Business R&D expenditure as a % of GDP (2009)	2.81	5.31	0.67	2.53	--	--
Share of R&D by private sector (%)	74	80	23	75	--	--
PCT patents per million inhabitants (2008-10 average)	281	251	159	310	260	103

Note: Peer regions' average: average of the clusters "Knowledge and technology hubs" and "Service and natural resources in knowledge-intensive countries". For further information see Ajmone Marsan and Maguire (2011). Data are missing for Canada and Korea for tertiary education attainment; some data are missing for Korean and some US regions for HTM/KIS. Data are missing for France for R&D personnel.

Source: Eurostat; OECD (2013), *OECD Regional Statistics* (database), doi: 10.1787/region-data-en.

In many respects, the Finnish side of the Arc is stronger with respect to innovation potential and performance. The more detailed calculations for the Regional Innovation Index, repeated in 2007, 2009 and 2011, show better performance on the Finnish side of the Bothnian Arc. Both sides have continued to improve their performance: Övre Norrland has moved over the years from a position of "follower-low" to "leader-low" and Pohjois-Suomi from "leader-low" to "leader-medium". Another difference between the two regions is that Pohjois-Suomi has a more balanced performance score on the EU Regional Innovation Index, i.e. enablers (human resources, quality of research systems and public R&D expenditures and venture capital), firm activities (private R&D and innovation expenditures, collaborating SMEs and public-private partnerships, patents) and outputs (innovation outputs, share of employment in knowledge-intensive activities) are all strong in the region, while Övre Norrland is stronger on the enabler's side, but less so on firm activities and innovation outputs (European Commission, 2012).

The share of the labour force with tertiary education is high with respect to the OECD average, even if it is significantly lower than country averages on both sides of the border. Northern Finland, despite having a population with a lower education level than the national average, stands out for its higher education level in comparison with peer regions from the "Knowledge and technology hubs" category. This can be attributed in part to an "Oulu effect", given the University of Oulu and the high-tech activities in this city that train, retain and attract highly qualified workers.

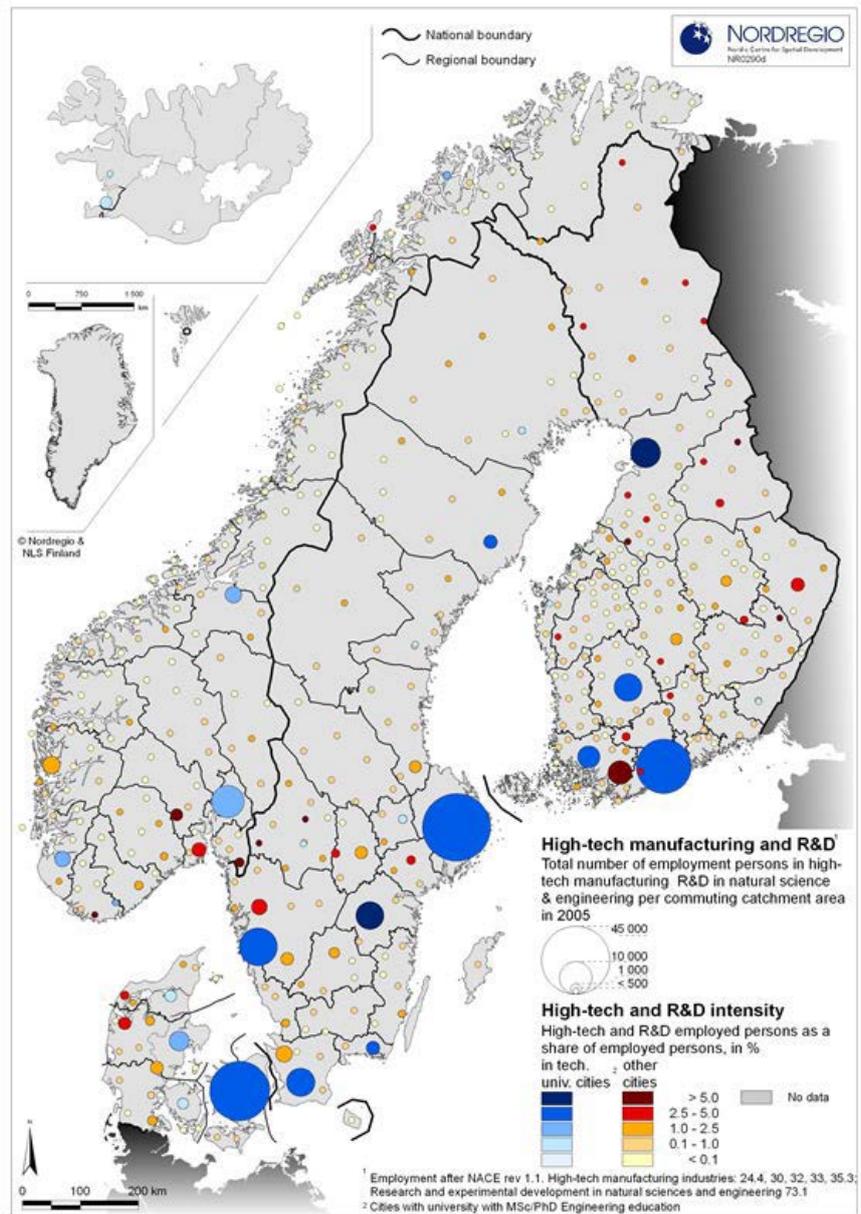
R&D and patenting performance in Northern Finland are strikingly high. Total R&D expenditures on GDP, as well as the share of R&D personnel in employment, are extremely high in Pohjois-Suomi, well above EU and country averages and peer group regions' values, while Övre Norrland performs well in EU and peer group perspectives, but not in a national comparison (Table 1.4). The

strength of private R&D in the Northern Finnish region stands out and explains much of the difference in performance between the two sides of the Arc, with 5.3% of R&D (as a percent of GDP, 2009) conducted by the private sector, well above the EU-27 average of 1.25%. This strength is concentrated in the NUTS 3 Pohjois-Pohjanmaa region of Oulu, and the 2000-07 growth rate of private R&D in Oulu was also stronger than the national average (Technopolis, 2012b). Patenting rates are higher than the OECD average (but lower than national values) in both parts of the Bothnian Arc, and significantly more patents are issued on the Finnish side, mainly in ICT and electrical engineering.

However, both Pohjois-Suomi and Övre Norrland appear as relatively under-specialised in future-oriented manufacturing sectors, compared to national and peer region averages. This reflects the strong developments in basic industries, such as mining. Data computed on the more restricted areas of the Bothnian Arc, where the ICT companies are located – and notably in Oulu – would show a higher concentration in high-tech manufacturing (Figure 1.3, Figure 1.4). The high employment in sectors such as mining, forestry, pulp and paper, steel and metal working industries in the Bothnian Arc regions outside of Oulu and Luleå explains the results at NUTS 2 level. On the other hand, the two regions show a favourable situation in knowledge-intensive services, both compared to national and peer region averages.

There has been a shift from ICT manufacturing towards knowledge-based service activities, particularly in Oulu. Such activities include: computers and software, but also architectural and engineering activities, technical consultancy, testing and analysis. This is visible in detailed data gathered for the Oulu area (Figure 1.4). The knowledge-based service industries have grown faster than the high-tech manufacturing activities and accounted for an equal proportion of the total employment in 2008. With the on-going downsizing of Nokia in Oulu, it is expected that this proportion will further increase.

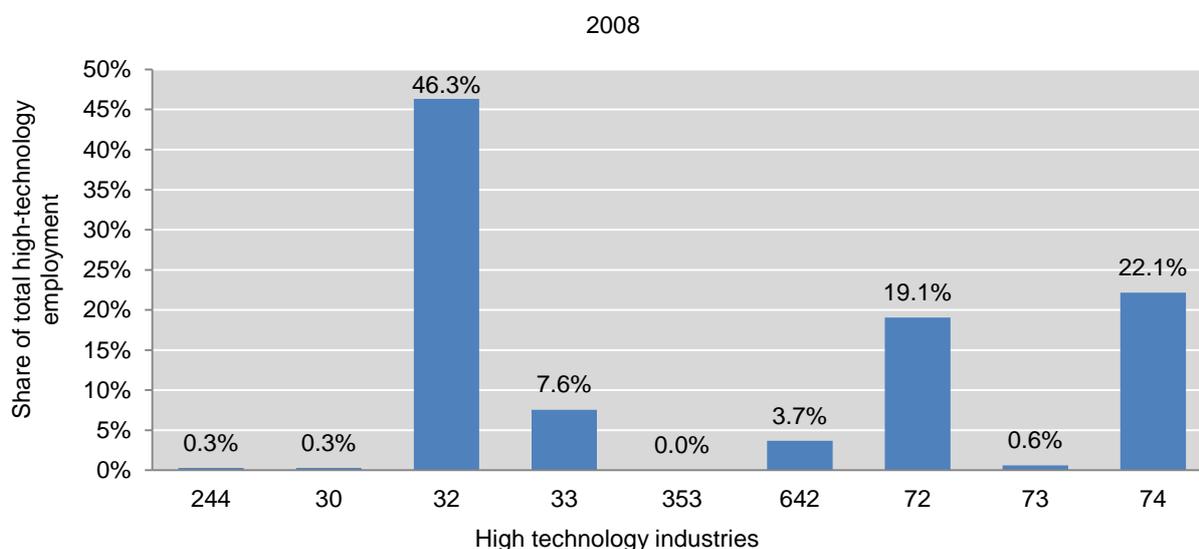
Figure 1.3. Number and share of employment in high-tech manufacturing in the Bothnian Arc



Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Source: Nordregio, as used in Kontigo (2012), "Towards a borderless innovation system in the Nordic region: Final report from the evaluation conducted by Interreg IVA Nord", report to the European Commission, Stockholm.

Figure 1.4. Share of employment in high-tech manufacturing and services by subsector in Oulu



High technology industries	(SIC 2002)	Service sector	(SIC 2002)
Manufacture of pharmaceuticals, medicinal chemicals and botanical products	(244)	Telecommunications	(642)
Manufacture of office machinery and computers	(30)	Computers and related activities	(72)
Manufacture of radio, television, communications equipment and apparatus	(32)	Research & development	(73)
Manufacture of medical, precision and optical instruments, watches and clocks	(33)	Architectural and engineering activities and related technical consultancy, technical testing and analysis	(742, 743)
Manufacture of aircraft and spacecraft	(353)		

Source: Simonen, J. (2013), "Structure of the high technology sector on the Finnish side of the Bothnian Arc", Oulu Business School, University of Oulu, unpublished paper, presented during the OECD mission in Bothnian Arc, 18-20 February 2013.

There are several notable innovation actors in the Bothnian Arc that help drive the innovation performance, particularly in the two hubs (Table 1.5). The universities and higher education institutions (HEIs) in the Bothnian Arc have 46 400 students and 5 200 employees. Swedish public research is concentrated in universities, while in Finland, the governmental research institutes are also important players. In general, the number of these actors differs between the two sides of the Bothnian Arc, which is true not only for the universities but also for business support organisations as well. Business Oulu has 75 employees and a budget of EUR 5 million, while business organisations in Luleå are of sub-critical size and fragmented (Teräs and Ylinenpää, 2012).

Table 1.5. **Key innovation actors in the Bothnian Arc**

Actors	Finnish side	Swedish side
Universities and higher education institutions	University of Oulu: full university Oulu University of Applied Science Kemi-Tornio University of Applied Sciences Lapland University Kokkola University Consortium Chydenius 5 innovation centres ¹	Luleå University of Technology with Piteå and Skellefteå campuses
R&D-intensive and innovative companies	Nokia, Nokia-Siemens Polar Elektrobit Itella	Large ICT companies with headquarters outside of the region: TeliaSonera, CapGemini, Google Steel company SSAB, Metal MEFOS
Technology transfer entities, intermediaries and networks	Business Oulu: support to companies Oulu Innovation Alliance: strategic alliance between the city of Oulu, the University of Oulu, the Oulu University of Applied Sciences, the VTT Technical Research Centre of Finland Technopolis Science Park Digipolis – Kemi Technology Park	Energy Technology Centre in Piteå and the Solander Science Park Innovation Office North, located in Umeå in collaboration with Luleå Krenova, incubator for creative industries Aurorum Science Park, LTU Innovation, Internet Bay Business development company LNAB

Note: 1. Centre for Environment and Energy, Centre of Excellence in Health and Technology, Center of Internet Excellence, Martti Ahtisaari Institute (energy) and the Center of Printed Intelligence.

Sources: Launonen, M., K. Launonen, H. Sundvall and M. Lindqvist (2013), "Background report for OECD study on cross-border regional innovation policies: Bothnian Arc", Bothnian Arc, January; Technopolis (2012a), "Regional innovation monitor: Baseline regional profile Upper Norrland", report to the European Commission; Technopolis (2012b), "Regional innovation monitor: Baseline regional profile Northern Finland", report to the European Commission.

Despite the similar context conditions, the difference between the Finnish core of the Bothnian Arc – the Oulu region – and the Swedish core around Luleå are striking. Oulu has developed into "the" high-tech area in the north, with a strong specialisation in high-tech industries and services and an impressive GDP growth rate. This remarkable trajectory has been sometimes referred to as the "Oulu miracle", signalling the capacity of the city to transform itself over time after the collapse of its major supporting industries: tar in the 19th century, pulp and paper in the beginning of the 20th century, and more recently the efforts to diversify into knowledge-based activities after the drastic downsizing of Nokia (Box 1.2). The situation is quite different on the Swedish side, despite apparently similar context conditions. Luleå is only one of many small cities in Northern Sweden, and its economy is still dominated by basic and first transformation industries.

Several explanations for these historical differences in trajectories between the two cities have been proposed (Teräs and Ylinenpää 2012):

- The role of the locomotive company Nokia in Oulu, acting as a demanding customer and role model for other companies in the region.
- The presence of dynamic clusters in emerging and knowledge-based sectors of the economy in Oulu, while Luleå and its region, to a high degree, was characterised by company constellations in mature and often declining business sectors.
- A dynamic mode of co-operation between industry, the university/research sector, and local and regional government.
- A significant role in the hierarchy of cities for Oulu as a natural centre for the northern part of the country.

- Differences related to the universities (Oulu with a complete university structure while Luleå focuses mainly on technology) and the science parks (where Technopolis in Oulu, at that time, was regarded as one of the most successful parks in the world).
- The Finnish leadership and management style, which could be advocated to work better than the “consensus-seeking” Swedish style during turbulent and dynamic development periods.
- A more marked international orientation among the Finnish SMEs.

Box 1.2. Oulu (Finland): A success story in the north

The story of Oulu is one of a city/region that succeeded in transforming itself on several occasions when faced with changing markets and technologies. Oulu was founded in 1605 by Swedish King Charles IX, however archaeologists have proven settlements as early as 6 000 years ago. Oulu had its first prosperous era in the 18th and 19th centuries when it was the second in the world for tar production and export, which was used for protecting wooden vessels. That market collapsed when new material (steel) replaced wood for the construction of boats.

Oulu restructured its economy around the pulp and paper industry. Two very large mills were built in the 19th century and ensured a constant flow of revenues to the region. Mounting competition from emerging countries during the 20th century producing pulp and paper at lower costs decreased the competitiveness of this industry in Northern Europe, and forced Oulu to radically revise its economic orientation once again.

In the early 1970s, engineers interested in radio waves in one of the pulp and paper factories established a dedicated development unit in Oulu. VTT invested in this small unit and Nokia made the decision to move from rubber boots to consumer electronics. In two decades, the company had become the largest world mobile computer manufacturer. At its best, Nokia employed 5 000 people in Oulu, mostly R&D engineers. The company established a rule to create spin-offs as soon as its labour force reached 5 000. This helped to generate a cluster of high-tech companies in the region, and in 1970s and 1980s, Oulu hosted a very large mobile tech cluster, with 15 000 highly qualified people working on new developments in mobile technology. The University of Oulu developed education and training programmes in electrical engineering and related disciplines, in close connection with Nokia.

Recently, Nokia lost important market shares due to the competition with touch screen technology, since the company largely missed the consumer shift to smart devices. Nokia has laid off thousands of engineers in the last years and this leads Oulu to once again find alternative sources of growth and jobs. The current strategy relies on the availability of a qualified workforce and the development of a large number of SMEs in innovative ICT applications, notably in e-health since the medical faculty in Oulu has strong expertise: 200 new start-ups have been created, but the challenge remains to ensure the continuous creation of new firms, their survival and growth.

Other opportunities explored in the Oulu area include energy and smart cities. Renewable energy production and distribution in Nordic conditions is considered a possible new growth opportunity in Oulu. This area offers development potential for Oulu within the perspective of an increasingly integrated Nordic energy market. The development of the proposal of Oulu as an “Arctic smart city” (focusing on traffic systems, energy grids, water management, smart food systems) is an attempt to spur the next revolution in the Oulu economy.

Source: Interviews during OECD mission to the Bothnian Arc, February 2013, notably Mr. Rauli Svento, University of Oulu.

But the Oulu success story is challenged yet again today, and Luleå may have new opportunities catalysed by Facebook. Luleå was recently the winner of a competition to host the data centre for Facebook, a promising investment for the transformation of the other side of the Bothnian Arc. Today, the two parts of the Bothnian Arc are confronted with several challenges (Teräs and Ylinenpää 2012):

- The diversification in other knowledge-based domains after the downsizing of Nokia in Oulu, is still on-going and fraught with uncertainty: in particular, companies that used to be sub-contractors of Nokia are experiencing difficult times.
- The lack of locomotive knowledge-based companies in Luleå is a drawback for the development of the region: in this respect the coming establishment of Facebook might indicate a turning point, both of symbolic and real economic value.
- The threat of delocalisation of large as well as small new technology based firms to the capital regions exists on both sides.
- The lack of finance and venture capital for risky and new businesses is a threat in both city-regions.
- The key role of universities for high-tech development is recognised on both sides of the Bothnian Arc: the recent difficulties faced by the Luleå University of Technology to attract students and the funding pressures at Oulu University might signal a danger for these unique assets.
- The fragmentation and lack of effectiveness of the intermediaries in the Luleå region is also a barrier.

1.4. Functionality of the cross-border area

There is little data available on cross-border flows across the Bothnian Arc area. People and vehicle flows at the vicinity of the border are measured. Approximately 14 million people travel through the border crossing points of Tornio-Haparanda every year, but other flows are not subject to systematic measurement.

There is activity at the border area, albeit the focus is not on innovation per se. The municipalities of Haparanda and Tornio (the ones situated physically on the border) have a long history of practical cross-border collaboration as well as linguistic and cultural commonalities. The two municipalities are also active in the organisation of business seminars, meetings, networking events and fairs as well as in the facilitation of cross-border business development, which focuses on solving the practical issues of firms that want to cross the border. With respect to cross-border business promotion in the tourism industry, Tornio and Haparanda have established a joint tourism office to advertise the cross-border area.

There is some evidence of hub-to-hub connections between the two main cities. Connections and partnerships exist between companies, HEIs, development organisations and local authorities on the two sides of the Bothnian Arc, as well as cross-border industry-university partnerships. However, this remains anecdotal evidence with no measure of the density and relative strengths of these links or their potential economic impacts.

Accessibility remains an important limitation for the functionality of the region. There is a distance of close to 300 kilometres between the main growth poles, Oulu and Luleå (and 800 kilometres

between the two extreme points of the area), and no high-speed road or rail connections. It is therefore difficult to travel between the two hubs in a single day. As an example, travelling by bus requires changing bus depots at the border (1 kilometre walk), albeit a new joint terminal will soon be available. While regulatory barriers do exist within the area, they are not significant obstacles.

Language and cultural differences do exist between Sweden and Finland, but given the tradition of Nordic co-operation these are not significant barriers. Swedish is an official second language in Finland. The widespread use of English in economic and scientific exchanges also helps to reduce the significance of language barriers. And while the knowledge of the other language is relatively common at the border, it seems that this declines with distance from the border, such as in the main centres of Oulu and Luleå.

The whole region is characterised by a duality between the two high-tech hubs (particularly Oulu) on the one hand, and the more rural parts of the territory with traditional industries, on the other. There is a remarkably low sense of rivalry between the two main hubs. It appears that, to a certain extent and linked to the joint challenge of peripherality, there is a consensus of the joint benefits from a positive development in one part of the Bothnian Arc, generating spillovers for the whole area. This is a sound basis on which to further build the area. However, those rural parts are not without knowledge assets, certainly when compared to the areas that are not included in the Bothnian Arc, and which are extremely sparsely populated and lack major economic activities beyond primary sector activities (agriculture and mining) and tourism.

In summary, the Bothnian Arc area can support cross-border complementarities and economies of scale for innovation, albeit accessibility among the whole area reduces this potential. The area is larger than border municipalities and smaller than macro-regions where many of the advantages of proximity are lost. The distance between the two extremes renders some exchanges difficult. There is potential for leveraging complementarities and creating critical mass towards nurturing “Knowledge hubs in the periphery”. The spatial definition, selecting the areas most relevant for innovation, has the drawback of not corresponding to administrative units that have additional resources to support innovation.

CHAPTER 2

DRIVING FORCE AND KEY ACTORS FOR THE BOTHNIAN ARC CROSS-BORDER AREA

2.1. Rationale for the establishment of the cross-border area

Table 2.1. Snapshot of rationale and relevance for cross-border collaboration

(Bothnian Arc in bold)

Driver	Explanation	Relevance for cross-border co-operation
Economies of scale	Combine resources for efficiency of investment, larger labour markets or access to wider business and knowledge networks to increase critical mass	Strong Moderate Weak/Not present
Political influence	Develop greater political power for more financial resources and better dialogue with higher levels of government	Strong Moderate Weak/Not present
Complementarities	Build on diversity of assets in terms of research, technology and economic base, as well as supply chain linkages	Strong Moderate Weak/Not present
Branding	Increase internal recognition of the cross-border area as well as its external attractiveness to firms and skilled labour	Strong Moderate Weak/Not present
Border challenges	Address the day-to-day challenges associated with flows of people, goods and services (including public services) across the border	Strong Moderate Weak/Not present

Note: The assessment of relevance relates to the actual relevance in current cross-border collaboration, not necessarily to the potential relevance.

The rationale for the creation of the Bothnian Arc is mainly to develop economies of scale, thus compensating for the peripheral situation of the area by creating a dynamic and competitive region. This is a real challenge in times when a metropolitan area is seen as a necessary ingredient to regional economic growth and competitiveness. The area is located at the “first periphery” between the heart of the Nordic countries around the capital cities of Helsinki, Stockholm, Copenhagen and Oslo, and the “second periphery” consisting of the more remote and sparsely populated parts of the area further north. The ambition of the Bothnian Arc is to act as a bridge between the Nordic core and periphery by capitalising on knowledge and business assets in the region. The opening of new trade corridors between the Bothnian Sea and the Barents Sea is an opportunity for the cross-border area as a geostrategic gateway between the two seas. Developing better access to markets in energy, mining and oil exploitation in the Russian Federation and Norway is an opportunity for high-tech service companies located in the cross-border area.

The complementarity of assets in the cross-border area is another rationale, albeit less so than critical mass. There are several areas of shared competencies in core sectors found on both sides of the border. Some projects demonstrate that such complementarities can indeed be pursued. But the primary means to overcome peripherality is to increase scale.

Political influence is also a challenge since the municipalities in both regions are far from the national capitals. With much of the innovation policy in both countries managed by national governments, actors in the Bothnian Arc can have difficulties in making their needs understood at the

national level. In some cases, lobbying through Brussels is used to convince national capitals to address relevant cross-border issues. A strengthened degree of co-operation in this cross-border area can serve to raise awareness in the capitals.

Branding efforts would help to compensate for the lack of an internal identity and to increase the external visibility of the Bothnian Arc. Both sides of the Arc feel a common membership to the wider Nordic space as well as its heritage and values. However, a Bothnian Arc identity does not (yet) exist beyond the small circle of actors involved in the promotion of the initiative. It is not a joint identity felt by its citizens. The area is a political construction, not a stakeholder-driven initiative. The high degree of non-rivalry between the two sides, and the co-operative attitude of the two main city mayors, who see developments in any part of the area as beneficial to all parties, are assets in building a sense of identity in the Bothnian Arc.

Border challenges are still present, but are not the main driver of collaboration in the Bothnian Arc. Overcoming practical problems originated by the border may help develop stronger ties between the two sides. Physical distance remains one of the main obstacles to co-operation. The problem of distance (more than 800 kilometres along the Bothnian Arc coastline) is exacerbated by the lack of infrastructure (motorways, railways and direct flight connections), which makes connections difficult and time consuming, especially during winter. The resolution of these problems often needs a cross-border approach where different municipalities co-ordinate, such as, for example, the establishment of smoother bus transport across the border. Other than distance and lack of infrastructure, some of the more common challenges that firms face across the border are differences in languages, taxation regimes and currency fluctuations. However, some firms see the border as an opportunity to establish one or more locations in each country in order to maximise the benefits from the different legislations in Finland and Sweden.

2.2. Role of the key actors in the establishment and evolution of the cross-border area

The 1996 objectives set for the Regional Innovation Strategy for Northern EU are at the core of the Bothnian Arc Association, established in 2002. In the mid-1990s, the European Commission was supporting regional innovation strategies (RIS) and regional innovation and technology transfer strategies (RITTS), which were at that time pioneering initiatives. Among the very first experiences was “RIS Northern EU”, the only cross-border regional innovation strategy (Box 2.1). The project covered an area overlapping, but larger than, the current Bothnian Arc footprint. The RIS area extended up to the Northern Finnish and Swedish frontiers.⁶ The high-tech developments around Oulu and Luleå were the main reasons for establishing a regional development policy focusing on innovation, in an economic area characterised by the decline of heavy industries and difficult general conditions (arctic environment, long distances and sparse population). The RIS was seen as a catalyst for regional development, capitalising on the technological developments and the science parks around the Luleå University of Technology and Oulu University, and diffusing these across the wider region.

Box 2.1. A precursor to cross-border collaboration: RIS Northern EU 1996

The Regional Innovation Strategy (RIS) for Northern EU was among the first of the RIS programmes sponsored by the European Commission. It started in 1996, just after EU accession of the two countries in 1995. It was the only RIS at that time that involved a cross-border dimension.

The goal of the RIS Northern EU was to “help the regions in Northern Finland and Northern Sweden to identify their common problems and opportunities and to compare different, preferably cross-border, mechanisms to select and implement optimal solutions for regional development”. At that time, there were few cross-border linkages between the two regions and mutual information on the potential, actors and activities across the border was lacking. The aim of the RIS was to catalyse cross-border co-operation and to support the use of EU Structural Funds for such projects in the region. The project started with a large survey on small and medium enterprises’ (SMEs) needs across the area, and pilot projects were launched involving businesses from both sides of the border. The survey revealed the strong interest from companies to develop collaboration on marketing, research and product development on a cross-border basis. As a result, joint platforms bringing together enterprises and support organisations were established and technology roadmaps and market studies were developed. The key actors of this initiative were the science parks Technopolis in Oulu and Aurorum in Luleå. The Steering Committee involved public-private-higher education actors from both regions. The focus was placed on six technology domains:

- electronics
- software technology
- metal industry
- wood processing/paper
- space technology
- environmental technology.

Source: http://ec.europa.eu/regional_policy/archive/innovation/innovating/pdf/ue-nord_en.pdf.

While the local authorities are the key actors in the Bothnian Arc Association, the universities are important drivers of cross-border co-operation, individually and collectively.⁷ The Luleå University of Technology has identified the University of Oulu as a preferred partner in its international strategy. Companies, as such, are not drivers of the establishment of the cross-border area, but are involved in co-operative projects initiated by local authorities (for SMEs) or with research institutions (for large companies).

2.3. Barriers for cross-border co-operation linked to actors

There are three main barriers with respect to the strategies of the key actors behind the cross-border area. These are above and beyond the physical, regulatory, cultural and linguistic barriers inherent to the bi-national and peripheral nature of the region (see Chapter 1).

First, there is a general lack of information on the potential, capacities and activities on either side of the border, particularly among firms. This is true for both companies and knowledge organisations. This is a main barrier for identifying and capitalising on the opportunities for cross-border co-operation in the Bothnian Arc area. As firms are not drivers of the Bothnian Arc, this raises the question as to whether the firms themselves recognise the opportunities for working across the border. If they do not, the question remains as to whether this is due to a lack of knowledge about the potential partners or simply a lack of business opportunities. Programmes like Business Link are seeking to overcome this problem by matching firms in different parts of the area and with Norwegian firms, but this work remains

challenging. This is especially problematic for SMEs, which can promote industrial renewal and diversification towards new activities responding to societal challenges.

Second, weaknesses in the institutionalisation of a “third mission” at universities hinder the development of joint, innovation-oriented partnerships across the border. Universities are subject to a results-based funding mechanism, in which the main criteria relate to their first (education) and second (research) missions. The third mission (service to society) does not play a significant role in funding, and this is becoming a more important barrier to joint innovation actions in times of budget pressures. Although this is the case in both countries, the problem is more acute in Finland. This has led to the closure of several campus locations and to a certain degree of withdrawal from third mission activities, as evidenced by the closure of some university campus projects for technology transfer. There are reportedly few cross-border flows of students and researchers between the leading universities, in part because if they do seek to leave, they prefer opportunities farther away than just across the border. Therefore, some of the greatest potential for promoting co-operation is in third mission activities, in addition to joint research.

Third, many smaller municipalities and regions are in the driving seat of the Bothnian Arc Association. These smaller authorities may not have the in-house capacity and resources, nor the competences and legitimacy, to run strategies aiming at the development of large-scale innovation-oriented initiatives.

CHAPTER 3

GOVERNANCE OF THE BOTHNIAN ARC CROSS-BORDER AREA

Table 3.1. **Snapshot of governance characteristics**

(Bothnian Arc in bold)

Characteristic	Specification	Comments
National political capitals	Yes, each side Yes, at least one None	The two main cities on both sides: Luleå (SWE) and Oulu (FIN) are distant from their respective capitals, Stockholm and Helsinki.
Longevity of public co-operation (social proximity)	>20 years 10-20 years <10 years	The Bothnian Arc Association was established in 2002. A 1996 strategy laid some of the foundations for this later work.
Innovation policy competencies (institutional proximity)	Balanced, strong Balanced, weak Unbalanced	On both the Swedish and Finnish sides of the border, innovation policies are somewhat centralised; however, sub-national entities (regions in Sweden, municipalities in Finland) have some innovation and business development mandates.
Political commitment (institutional proximity)	Balanced, strong Balanced, weak Unbalanced	Commitment for cross-border innovation co-operation in the Bothnian Arc is relatively strong at the municipal level (notably Oulu and Luleå) but weak at regional and national level.
Institutionalisation and legitimacy (institutional and social proximity)	Present, strong Present, weak Not present	The Bothnian Arc Association is a small entity (two staff) and has limited visibility beyond the mainly municipal public board members.
Actors in governance	Public sector University/research actors Firms Mix of actors (triple helix)	Universities, intermediaries and firms are not active partners in efforts to support a vision, strategy or implementation, albeit universities appear more active than firms.
Funding sources	Mainly public Mixed public/private Mainly private	The Bothnian Arc Association is funded by member public authorities and the Nordic Council of Ministers. Projects are funded mainly by European Territorial Co-operation funds (with some minor private co-financing).

3.1. Vision for the cross-border area

According to the Bothnian Arc Association, the vision is that of “Europe’s most functionally unified border region and the European Union’s northernmost centre of industry, research and know-how”. It also aims to be “a step in the development of the whole of northern Europe”. This general vision has been adopted by the Board of the Bothnian Arc Association. However, there is a limited set of partners, which does not reflect the wide scope of public and private actors involved in shaping the cross-border area. Furthermore, this vision has not yet been translated into a strategy and budgeted action plan with precise and time-bound targets.

3.2. Institutionalisation and multi-level governance of cross-border co-operation

The governance of the Bothnian Arc area rests on the shoulders of the Bothnian Arc Association, a small non-profit established in 2002 by municipalities and the Northern Ostrobothnia region. The Bothnian Arc Association aims to promote cross-border relationships in the area. It is funded by its members and the Nordic Council of Ministers. The association has a very small team (two people) and its role is to facilitate interactions between actors on both sides of the border. It does not run projects itself but acts as a catalyst. This includes three types of activities:

- matchmaking and brokerage
- support to the development of joint projects
- marketing and dissemination of information

As the association's Board is mainly composed of municipal authorities, the national (and regional) authorities holding decision-making power and budgets for innovation are not involved in the governance of the area. The implication of Finnish and Swedish regions in the cross-border region appears limited, with the exception of the Northern Ostrobothnia region of Finland. This is linked to the restricted role of regions in innovation policy in the two national contexts, certainly when compared to that of regions in federal countries. Nevertheless, regions in both countries do play some role in innovation policy, which differs between the two countries. Such a lack of common governance arrangements between authorities in charge is a typical barrier for the evolution of Nordic co-operation partnerships into fully-fledged functional regions (Eriksen et al., 2003). National and regional policy documents include generic interest in an international dimension to innovation, but this interest is not translated into joint or aligned policy instruments for cross-border efforts.

In Sweden, regions have been given increased responsibility for regional development and innovation. The main public actors deploying innovation policies in the regions are the national actors Vinnova, Tillväxtverket and Almi. The regions make use of EU Structural Funds to deploy their own policies, which typically support clusters, incubators and various local innovation intermediaries targeting new firm creation or existing SMEs. In Norrbotten, it is the County Administrative Board, representing the national authority, which develops and implements the policy. In Västerbotten, this role is assumed by the Regional Council. Norrbotten has also recently adopted a Regional Innovation Strategy, and the two regions have provided a joint input to the National Innovation Strategy of Sweden. Both NUTS 3 regions have also developed a regional growth strategy including the cross-border dimension (Box 3.1). The latter raises the issue of a more in-depth involvement of the Swedish regions in the Bothnian Arc's governance structures.

Box 3.1. Regional growth and innovation strategies in Västerbotten and Norrbotten (Sweden)

The **Regional Growth Strategy of Västerbotten County** aims to co-ordinate efforts in areas where industry is supporting sustainable development in local employment areas from a business perspective. Actions in the Regional Growth Strategy also correspond to the priority areas in the National Strategy for Regional Competitiveness, Entrepreneurship and Employment. However, the content of each priority is adapted to the specific needs of Västerbotten County. The Regional Growth Strategy defines specific goals, priorities and actions in the area of innovation, renewal and skills supply. There are four action areas: 1) innovation and renewal; 2) skills supply and increased labour supply; 3) accessibility; and 4) strategic cross-border co-operation.

Västerbotten is currently involved in the preparation of a “smart specialisation” strategy.

The **Regional Growth Programme for Norrbotten** describes areas of growth, conditions for growth and priorities that are important for sustainable economic growth. The aims are to strengthen regional competitiveness and increase standards of welfare. This is achieved by focused efforts in industrial development within the county's growth areas. The county's need for growth conditions is in line with the strategic policies of the National Strategy for Regional Competitiveness, Entrepreneurship and Employment for 2007-13. The regional priorities and efforts are concentrated in five strategic action areas: 1) cross-border co-operation; 2) research and development and innovation; 3) skills and labour supply; 4) employment and entrepreneurship; and 5) accessibility – transport and information technologies.

The 2012 **Regional Innovation Strategy for Norrbotten** emphasises the importance of innovation and creativity to enhance regional growth and jobs creation. It is produced by a triple helix partnership, focuses on both established and new firms, and includes the horizontal theme of environmental sustainability. The strategy spells out a specialisation on a few focus areas where the region has competitive edge, as well as the intersections between the focus areas: 1) technology and service development in primary/basic industry; 2) testing (winter testing, i.e. automotive, trains); 3) energy and environmental technology/cleantech; 4) digital services (i.e. e-health); and 5) cultural and creative industries.

Source: Technopolis (2012a), “Regional innovation monitor: Baseline regional profile Upper Norrland”, report to the European Commission; Sjökvist, J. (2013), “Regional Innovation Strategy for Norrbotten, Sweden”, presentation at the seminar “Bothnian Arc: Cross-Border Regional Innovation Policies”, 28 February, Oulu.

Finland has a more centralised governance system generally as well as for innovation policy matters. The Ministry of Employment and Economy is in charge of regional innovation promotion. The main tools are the centres of expertise (OSKE programme), of which four are located in the region, and the upcoming Innovative Cities programme (INKA), which sponsors knowledge-based activities across the country (Kavonius, 2013). There are also 15 centres for economic development, transport and environment (ELY centres) throughout the country. The NUTS 2 regions do not have any responsibilities for innovation, while the NUTS 3 regions develop regional programmes supporting clusters or technology transfer activities of comparatively limited scope. NUTS 3 regions also make use of EU Structural Funds to support innovation.

City-regions are the main sub-national policy actors in innovation in Finland. One of the most prominent innovation support initiatives for the Finnish side of the Bothnian Arc is the Oulu Innovation Alliance. It is a triple helix partnership promoting open innovation in three core areas: Internet research, printed electronics and international business (Box 3.2).

Box 3.2. Oulu Innovation Alliance

The Oulu Innovation Alliance is a strategic alliance formed in 2009 with the goal to maintain Oulu's position as an acknowledged centre for innovation. It builds on a long tradition of co-operation between education and research institutes, companies and the public sector. The alliance partners include the city of Oulu, the University of Oulu, the Oulu University of Applied Sciences, the VTT Technical Research Centre of Finland and Technopolis. The founding partners have committed themselves to focusing on the agreed innovation areas, investing in the agreed infrastructures, and creating and developing mechanisms for joint use. The agreed focus areas are:

- **Internet research:** The Center for Internet Excellence (CIE) is a research and innovation unit at the University of Oulu, which combines leading-edge Internet research, innovation processes and new infrastructures. The CIE provides a unique environment combining research and network partners from different fields in a practical setup, where idea creation, observation, measurement and validation are enabled for user-centred innovation and design.
- **Printed electronics:** PrintoCent is the centre for business development in the area of printed intelligence. PrintoCent combines the printed electronics (printed intelligence) and optical measurements efforts at VTT and the universities in the Oulu region with respect to know-how, R&D, education and business development. PrintoCent creates a business, production and educational environment for companies to develop and manufacture prototype products, demonstrators and system solutions, and acquire a skilled workforce to enable these.
- **International business:** The Martti Ahtisaari Institute of Global Business and Economics, established in 2008, is a research and education institute within the Oulu Business School at the University of Oulu. The institute conducts research, development and education that build new knowledge in international business, responsible leadership and the global economy and business. The institute's activities enhance business opportunities and expertise, especially in Northern Finland.

Source: www.businessoulu.com.

3.3. Funding for cross-border co-operation

The Nordic Council of Ministers is co-funding 12 cross-border committees in Nordic countries, including the Bothnian Arc Association. This source provides structural, but relatively limited, funding for developing cross-border co-operation in the Nordic space. The association is co-funded by the local authorities that comprise the Board. This intervention is linked to the strong focus of Nordic policy on cross-border co-operation as a way to improve the position of the Nordic area in global competition. The 2009-12 Nordic Regional Policy Co-operation programme states: "The Nordic Council of Ministers believes that the border regions should be highlighted as key players with a new weight in Nordic integration work." However, it has been announced that this type of funding will be reduced in the future, which places a strain on maintaining the activities of the Bothnian Arc Association and other committees.

Larger funding sources are available on a project basis, from European Territorial Co-operation (Interreg) programmes, part of EU Cohesion Policy.⁸ The Bothnian Arc area was not an eligible area for the Interreg programme before 2007, so there has only been a short history of using these funds. The 2007-13 EU Interreg programme IVA Nord covers the Bothnian Arc and surrounding regions, with a total population of 1.5 million (the Bothnian Arc represents half of the total population). It is the main source of funding for cross-border projects in the Bothnian Arc, and this area has proven to be the most active one within the larger "Nord" eligible territory. Nordic funds are often used as a co-funding source for Interreg projects. Overall, the implementation of projects related to innovation support under this Interreg programme is increasing the area's functionality. The projects have mobilised many actors (universities, colleges and research institutes, major companies and local actors in charge of business promotion) around cross-border business development and innovation projects (Box 3.3). Chapter 4 gives examples of projects funded by Interreg Nord in the Bothnian Arc area.

Box 3.3. Lessons from the Interreg IVA Nord Programme

The **EU Interreg IVA Nord programme** covers Northern regions in Finland and Sweden (and associates Norway, a non-EU member country), including the whole Bothnian Arc area. The programme supports growth-enhancing co-operation among border regions from at least two different EU member countries. It has a budget of EUR 34 million for the period 2007-13 and is divided into five areas:

1. industrial development
2. research, development and education
3. regional functionality and identity
4. the Sápmi sub-programme – borderless development
5. technical support

An evaluation was conducted of the programme, with a specific focus on priorities 1 and 2. The evaluation found that the programme has contributed to the creation of a borderless network for innovation in the Nord region:

- Most projects aim to establish and develop effective co-operation around research and development between universities, colleges, research institutes and businesses, often with a focus on technology or product development, process development and the provision of cutting-edge knowledge to businesses.
- The main driving force for the projects is the creation of greater critical mass. A common element of successful projects is that they aim to utilise a greater critical mass of resources (both in the form of money and skills) and a greater number of results recipients/interested parties.
- The key success factors are: 1) the engagement and responsibility of major companies; 2) a strong mandate to emphasise innovation issues and to require clear industrial participation (as opposed to funding public research); 3) concentration around the Bothnian Arc as the most developed part of the Nord region.
- Three different types of projects have been funded:
 1. Co-operation projects between major companies and universities, based on a long history of co-operation. The focus of these projects is on research and not necessarily on short-term development. The involvement of small businesses in these projects is relatively limited.
 2. Projects initiated and led primarily by research actors such as universities, research institutes and the like. These cases lack initial involvement or pronounced interest from companies. They have a clear connection to regional development issues within, for example, the environmental area.
 3. Projects designed from small business needs and demands, but often carried out in co-operation with research institutes. These have, to a high degree, been focused on short-term results which are achieved within the project period, i.e. product development, supply of skills, testing and implementation of technology.
- Logically, companies are the most active partners within the industrial development projects, and universities and colleges are the most active partners in R&D projects, but both types of partners are active under both priorities. Companies are generally larger in the R&D projects. Industry projects often support smaller companies in new branches and provide support to new businesses. In contrast, the R&D projects involve a greater number of the region's well-established companies, primarily within basic industry.
- Municipalities, regional public organisations and authorities are more often actively involved in the industrial projects: business support and branch-promotional activities, network building between businesses and support organisations on both sides of the border.

Box 3.3. Lessons from the Interreg IVA Nord Programme (cont.)

- Universities and colleges play a major role in the projects: R&D projects are often directed at the development and implementation of new technology, new working methods and the efficiency of production, improved system surveillance and the like. They also often have industry as their final target group. Universities and colleges contribute with personnel resources for the developmental work, cutting-edge knowledge within specific areas, and carry out testing and pilot studies of various kinds.
- The main value-added of the projects for companies is the development of skills and knowledge (especially for R&D projects) and access to new networks and the development of new market channels (especially for industrial projects).
- The value-added of the cross-border dimension is assessed differently by companies or project managers. Just over half of the companies state that the borderless way of working has had a large or very large significance in terms of the projects' concrete results, whilst 90% of the project managers have stated so. The borderless way of working is valued more by companies in industrial projects, compared to those involved with the R&D projects. Small businesses also value the borderless aspect somewhat more than larger businesses.
- Interreg funding is the principal funding source for the projects and seems necessary for their sustainability: 85% of the project managers state that they have approached Interreg with an application for a follow-up project.

Source: Kontigo (2012), "Towards a borderless innovation system in the Nordic region: Final report from the evaluation conducted by Interreg IVA Nord", report to the European Commission.

There are limitations to this Interreg funding programme. The participation of SMEs could be expanded, as most of the projects rely on the involvement of large corporations. The sustainability of the projects remains a question, since most of them remain dependent on public funding sources after the funding period. It is not clear that the Bothnian Arc has been able to capitalise on the range of projects supported in linked areas or sectors. For example, there is neither detailed information nor evaluation available on the projects, and apparently no strategic exploitation of the results obtained by the projects beyond their participants. Finally, the selection procedures, which are run by a committee mainly involving municipalities from the area, do not guarantee the absence of conflicts of interest, nor a strategic capacity to fully assess the future perspectives of innovative projects.

Some amount of public funding is necessary to develop the cross-border region institutionally, and this needs to be complemented by more private funding for innovation projects. Public funding by the Nordic Council of Ministers began in the 1970s and was critical for the institutionalisation of Nordic cross-border committees. It has a leverage effect on other funding sources and provides a powerful signalling effect. However, the foreseen decline of this source in the near future calls for alternative structural funding sources to complement the limited allocations from municipalities. The major source of money for cross-border projects is Interreg funding, which has proven instrumental to raise awareness of the potential for cross-border co-operation, mostly for universities and large corporations. However, this source is fraught with a number of weaknesses, the main drawback being that it tends to fund a collection of projects without much strategic capitalisation linked to regional development goals. Last but not least, attracting more private funding to cross-border innovation projects is needed, in view of the fact that most of the initiatives implemented under the Bothnian Arc seem to be unsustainable beyond the period of public funding. The availability of private funds is the best way to ensure a good match with market needs for innovation projects.

CHAPTER 4

BOTHNIAN ARC CROSS-BORDER INNOVATION POLICY MIX

4.1. Cross-border initiatives and policy instruments

The cross-border innovation initiatives in the Bothnian Arc take the form of time-bound projects funded by international sources, mainly European Territorial Co-operation programmes. Many of them have a geographical scope that is either smaller or (more frequently) larger than the Bothnian Arc (since Norway is also eligible for Interreg Nord). Variable geometry is a key characteristic of many projects involving Bothnian Arc actors. The main innovation-oriented projects that involve partners in the Bothnian Arc (see Table 4.1 for an overview and Table 4.A1 for project details). The total amount of these projects running in the Bothnian Arc amounts to EUR 18 million (Launonen et al., 2013). The main co-funders are local authorities, and HEIs are also frequently co-funding partners in public research projects. The largest and most numerous projects concern joint academic research business support initiatives, the latter taking place both in traditional and new sectors. Joint academic education and public-private partnerships around innovation are less frequent. There is no information on the results achieved by these projects.

Co-operation between the University of Oulu and the Luleå University of Technology is quite developed, and the two universities appear to be frequent partners in cross-border projects. The co-operation relies on complementarities: the two universities are second-tier universities in their own national context; hence they face more pressure to specialise than the main universities. The joint Nordic Mining School is a good example of a cross-border partnership, as it combines scientific competences at HEIs and industry in both locations (Box 4.1). It is not always easy to assess the intensity of industry involvement in projects led by academia. The HighBio project, with potentially huge applications in industry through the development of alternative techniques for a high refinement of bio energy, only involved industry to a marginal extent (Box 4.2).

Many other projects are funded by the Interreg IVA Nord programme, particularly in the area of supporting SMEs. Such projects are not listed in Tables 4.1 or Table 4.A1, either because of their small size or because they do not cover the Bothnian Arc area. Sharing lessons and experiences between these projects and those funded in the Bothnian Arc would provide valuable sources for improving future projects.

Table 4.1. **Cross-border innovation policy instruments in the Bothnian Arc**

Instruments	Presence in the Bothnian Arc
Strategy and policy development	
Benchmarking and policy learning	
Analytical exercise (i.e. mapping of clusters or value chains, technology foresight exercises)	
Joint branding of the cross-border area	Mayoral collaboration between Oulu and Luleå
R&D support	
Joint public research programmes	Finnish-Swedish collaboration in the wood sector High Bio project Vision System Research Platform Oil Research Prolas (laser-welding technology) Nordic Interaction and Mobility Research Platform Mätä Jämt 2 (integrated equality and diversity in the workplace)
Joint research infrastructure, shared access to research facilities	
Cross-border private R&D funding programmes (generic and thematic)	Increasing Energy Efficiency in Buildings (public-private) SensorBand in Real Life Environment (public-private)
Technology transfer and innovation support	
Cross-border innovation advisory services (vouchers, intermediaries)	Nordic Business Links
Advisory to spin-off and knowledge-intensive start-ups	Forum for the Industrial Future e-maintenance for industry and SMEs
Other technology transfer centres and extension programmes	
S&T parks and innovation networks	
Cross-border science, technology parks and incubators	
Cluster or network initiatives	Bothnian Arc Steel and Metal Industry project (research) Filmarc (film industry support; training in creative industries)
Human capital investment	
Scholarships/student exchanges	
Joint university or other higher education programmes	Nordic Mining School InnoPreneurship Other joint activities (University of Oulu and University of Luleå)
Talent attraction, retention or mobility schemes and support initiatives (i.e. cross-border placement or information for cross-border commuters)	
Other	

Note: Some of these projects extend beyond the Bothnian Arc area into the wider European Territorial Co-operation cross-border area (Interreg IVA Nord).

Box 4.1. The Nordic Mining School: Complementarity and critical mass in education and research

The University of Oulu and the Luleå University of Technology have jointly established the Nordic Mining School (NMS). The NMS offers a new degree programme in the field of mining industry. The aims of the NMS are:

- to bring the students at masters level in both universities together to reach critical mass
- to build the best graduate school in mining-related education in Europe
- to strengthen the research co-operation in mining, exploration and environmental engineering, mineral processing, metallurgy and process engineering

The initiative, which received funding from the European Union Interreg IVA Nord programme in the 2008-11 period, offers students master's degrees in both universities. Students enrol in a relevant master's programme at either of the universities and spend at least six months of their studies at the other university and qualify for a double degree from the Nordic Mining School. The course offering comprises, for instance, geology, mineral technology, mining technology and metallurgy. A joint professorship in "mineral entrepreneurship" was established in the Nordic Mining School to give students knowledge of the economics of starting and running businesses in the mining and exploration industry.

Source: Launonen, M., K. Launonen, H. Sundvall and M. Lindqvist (2013), "Background report for OECD study on cross-border regional innovation policies: Bothnian Arc", Bothnian Arc, January; www.nordicminingschool.eu.

Box 4.2. Academic collaboration in the Bothnian Arc: The HighBio project

The aim of the Interreg-funded HighBio project is to examine and test new methods for refinement and gasification of forest commodities, in order to promote small local/regional businesses involved with bio energy. The idea and initiative for the project came primarily from Finnish partners within academia: Kokkola University Consortium Chydenius, Centria Research and Development and the University of Oulu. The Luleå University of Technology and the Energy Technology Centre in Piteå were engaged as Swedish implementation partners. Implementation was characterised by collaboration primarily between the research environments. A smaller number of large and small businesses have carried on a dialogue with the project and participated in information meetings and seminars; one of these has been more actively involved during the implementation. The results have primarily taken the form of strengthened networks, mutual knowledge development between the research environments and a strengthened exchange/dialogue regarding the needs of companies within this branch.

Source: Kontigo (2012), "Towards a borderless innovation system in the Nordic region: Final report from the evaluation conducted by Interreg IVA Nord", report to the European Commission.

4.2. Untapped potential for promoting cross-border innovation

A first area of untapped potential is the development of structural (as opposed to temporary) cross-border initiatives relying on the alignment of regional/national initiatives on both sides of the border. More structural approaches, as compared with the list in Table 4.1, would dramatically increase the scope and reach of cross-border collaborative ventures, which are to date limited to Interreg and Nordic Council-funded projects. This would also allow for more leverage of national and regional funding sources, provided that these can be aligned to a common cross-border goal.

More long-term initiatives could involve, for example:

- Extending the model of the Oulu Innovation Alliance partnership over the border, aiming at developing a "Bothnian Arc Innovation Alliance".

- Implementing joint funding programmes for R&D projects in areas of shared interest, drawing lessons from experiences such as the Wood Material Science and Engineering Research Programme (Box 4.3).
- Establishing joint competence centres, based on joint investment from Finnish and Swedish sources, exploring the idea of extending the reach of centres of expertise over the border.
- Exploring the possibilities to give a more structural shape to co-operation between HEIs in the region, drawing lessons from the failed attempt to get a “Bothnian Academy” funded under the Interreg programme.⁹
- Considering business support to cross-border clusters. The identification of these clusters could build on Interreg Nord projects focusing on business support. It is interesting to note that Business Links has prioritised the following sectors as the most promising ones for Norwegian-Swedish-Finnish co-operation: 1) subcontracting operations in the fields of metal, mining and construction; 2) experience sector and creative sector; 3) IT services and telecom industry; 4) renewable energy and environmental engineering; and 5) oil and gas industry.

Box 4.3. Joint Finnish-Swedish research programme in wood material science and engineering

The Wood Material Science and Engineering (WMS) Research Programme (2003-07) is a joint Swedish-Finnish programme with the aim to improve the competitiveness and sustainability of European forestry and forest-based industry. The programme is a first attempt to align several national public funding sources from the two countries:

- Finland: the financers were the Ministry of Agriculture and Forestry, the Academy of Finland and Tekes
- Sweden: the financers were VINNOVA and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning.

The budget of the WMS Programme was EUR 19.7 million and it involved 317 researchers from 29 research units and more than 70 partner organisations from the 2 countries. The WMS programme funding was organised as a “virtual common pot” in which one programme virtually combines different existing funding mechanisms. The benefit of this approach is its flexibility at the programme level, while at the same time, the decisions and management of individual projects remain in the hands of each funding organisation. To a large extent, the WMS projects were curiosity-driven rather than mission-oriented.

The programme was successfully concluded and had a valuable impact, particularly with regard to:

- The definition of the programme’s scope was systematic and project selection ambitious. The programme managed to advance top-level research in fields that were considered relevant within academia, the five funding organisations and industry. In these areas, scientific output was extensive (articles, degrees), particularly in relation to its rather limited duration and volume of funding.
- There has been a positive contribution in bringing Swedish and Finnish researchers closer together. Several excellent research projects would not have started without the WMS programme. The transnational research collaboration has continued in many projects after the programme, but rather at the individual level than at institutional or research group level. Existing networks have continued and have been strengthened and some new cross-border collaborations have emerged. Researchers and industry value getting to know new partners for potential future collaboration.
- The competence and readiness of the five research funding agencies to organise transnational research programmes has significantly improved through the joint learning process of the WMS programme. This has had immediate positive implications.

Source: Halme, K., S. Kanninen, K. Viljamaa, E. Arnold, T. Åström and T. Jansson (2008), “Creating cross-border competence: Impact evaluation of the Wood Material Science and Engineering Research Programme”, *Tekes Programme Report*, n°2.

4.3. Relevance and effectiveness of the policy mix for cross-border co-operation

Table 4.2. Snapshot of innovation policy approach

(Bothnian Arc in bold)

Element of policy mix	Definition	Degree
Information	Mutual exchange of data, actor mappings and policy information	Strong Moderate Weak Not present
Experimentation	<i>Ad hoc</i> and temporary common initiatives without joint funding	Strong Moderate Weak Not present
Alignment	Mutual opening of programmes or structures across borders – no joint funding	Strong Moderate Weak Not present
Joint actions narrow	A few cross-border measures, structures and actions with joint funding by actors from several regions	Strong Moderate Weak Not present
Joint actions broad	Many joint instruments co-funded by the constituting regions	Strong Moderate Weak Not present
Strategic policy mix	Joint common strategy adopted at the level of the cross-border area, translated into common policy mix co-funded by all constituting regions	Strong Moderate Weak Not present

Cross-border innovation co-operation is supported by the Bothnian Arc Association, but through a collection of Interreg-funded projects rather than the implementation of a shared strategy. There are no dedicated policy instruments corresponding to the vision of the Bothnian Arc, but rather interesting experimentations based on grassroots initiatives from key actors – mainly HEIs and local authorities. A main issue concerns the possibility to learn from these initiatives to drive the cross-border partnership in fruitful directions and address barriers revealed by these projects. To a large extent, this work remains to be done.

Variable geometry can be observed as to the spatial location of the partners involved in the experimental projects due to Interreg funding rules that target a wider geographic area. Nevertheless, Interreg helps to reveal the most active actors in cross-border innovation within the Bothnian Arc. The area, with its strong concentration of knowledge-based actors, emerges naturally as a core space for such partnerships. Nevertheless, co-operation should not always be limited to the area. Indeed, the value of developing joint programmes, and including Norwegian partners or partners located further away from the coast (eligible under Interreg but not part of the Bothnian Arc), should not be dismissed if relevant. However, there are likely many cases where projects are involving Norwegian actors solely to increase the probability of the project being accepted for Interreg funding rather than for the project goals.

The key question for the Bothnian Arc going forward is how to move beyond information exchange and experimentation. Some mutual exchange of information and collection of externally funded projects does exist. There are opportunities to further align projects with joint funding from the countries and regions involved. The development of a strategy would facilitate this alignment and possible joint actions across the border (Table 4.2).

Annex 4.A1.

Table 4.A1. **Projects focusing on innovation in the Bothnian Arc: descriptions**

Project – scope	Objective	Main actors	Budget
Joint business support			
Filmarc	Develop and strengthen film production companies and train workers in audio-visual and creative industries	Regional resource centres and film funds	Total EUR 2 400M Interreg EUR 667M Co-funding by local authorities, and Norway
Nordic Business Links (two projects: I 2008-10 and II 2011-13)	Raise awareness of SMEs on cross-border opportunities through: – business support – business delegations – information packages – seminars and business arenas	I: Norrbotten Chamber of Commerce; municipality of Oulu; VINN II: addition of chambers of commerce and business Oulu	Project I: total EUR 1 171M Interreg EUR 430M Co-funding by local authorities and Norway Project II: total EUR 1 519M Interreg EUR 437M Co-funding by local authorities and Norway
Bothnian Arc Steel & Metal Industry	Identify resources available within the industry, society and the academic world and disseminate information about activities and operations as to establish effective partnerships	Raahe Region Technology Centre; Luleå University of Technology (LTU); Business Oulu	Total EUR 777M Interreg EUR 443M Co-funding by local authorities
Forum for the Industrial Future	Awareness-raising and training for SMEs to improve the economic turnover and reduce the impact on the environment	Luleå University of Technology; University of Oulu	Total EUR 772M Interreg EUR 403M Co-funding by local authorities and LTU
Innovative services in the sphere of e-maintenance for industry and SMEs	Platform e-maintenance for basic industries and SMEs Create a model for innovative services in e-maintenance to improve productivity and accessibility for technical systems as well as reduce costs	Luleå University of Technology; Kemi-Tornio University of Applied Sciences	Total EUR 568M Interreg EUR 330M Co-funding by local authorities and LTU, HEIs and science park
Joint public research			
HighBio	Develop an alternative for a high refinement of bio energy for local use of raw material through processing	University of Jyväskylä, Chydenius Institute – Kokkola University Consortium; Oulu University, Luleå University of Technology, Energy Technology Centre	Total EUR 1 600M Interreg EUR 900M Co-funding by local authorities, HEIs and science park
Nordic Interaction and Mobility Research Platform	Establish a common research platform within interaction and mobility in the region	Luleå University of Technology; Oulu University; University of Lapland; municipality of Skellefteå	Total EUR 1 450M Interreg EUR 702M Co-funding by local authorities, HEIs
Vision System Research Platform	Develop a cross-border network in the sphere of optic research between universities, basic industry and information and communication industry	Kemi-Tornio University of Applied Sciences; Luleå University of Technology	Total EUR 832M Interreg EUR 499M Co-funding by local authorities, HEIs and research institute
Oil research	Interdisciplinary research to develop a solution for particle analysis in oil	Luleå University of Technology; Kemi-Tornio University of Applied Sciences	Total EUR 816M Interreg EUR 486M Co-funding by local authorities, HEIs and science parks

Table 4.A1.1. **Projects focusing on innovation in the Bothnian Arc: descriptions** (cont.)

Project – scope	Objective	Main actors	Budget
Prolas	Develop laser-welding technology with fibre and disk lasers and encourage the use of laser welding and high strength materials in the region's manufacturing industry	Luleå University of Technology; Oulu University	Total EUR 782M Interreg EUR 469M Co-funding by local authorities, HEIs
Mäta Jämt 2	Develop and implement tools and methods for measuring the effects of an integrated equality and diversity work in the IT project environment	Luleå University of Technology; Oulu University	Total EUR 721M Interreg EUR 430M Co-funding by local authorities, HEIs
Joint academic education			
Nordic Mining School	Co-operation between the universities in education and research within metallurgy and mining	Luleå University of Technology; University of Oulu	Total EUR 995M Interreg EUR 596M Co-funding by local authorities and LTU
InnoPreneurship	Build competence among teachers in universities to teach entrepreneurship	Kemi-Tornio University of Applied Sciences; Luleå University of Technology; Bodö University College	Total EUR 547M Interreg EUR 228M Co-funding by local authorities and LTU and HEIs
Joint public-private innovation projects			
Increasing Energy Efficiency in Buildings	Technological development of low-energy solutions in housing Transfer of knowledge about energy solutions to the construction industry and society	Oulu University of Applied Sciences; Luleå University of Technology; Umeå University; city of Oulu; Building Supervision Office; NORUT Narvik; several companies	Total EUR 1 676M Interreg EUR 620M Co-funding by local authorities and HEIs
SensorBand II – SensorBand in Real Life Environment	To develop, establish and evaluate a service within elderly care in a major test in Finland and Sweden	Meri-Lappi Institute; Luleå University of Technology; Oulu University, Kemi-Tornio University of Applied Sciences; companies	Total EUR 1 000M Interreg EUR 597M Co-funding by local authorities and science parks

Sources: www.bothnianarc.net; www.interregnord.com.

CHAPTER 5

RECOMMENDATIONS FOR CROSS-BORDER INNOVATION IN THE BOTHNIAN ARC

The Bothnian Arc, a peripheral region at the crossroads between the Arctic region and the European core, has opportunities for creating a “knowledge hub of the North”. The Bothnian Arc has significant knowledge-based activities in the two main cities of Luleå and, especially, around Oulu. Creating greater critical mass and building on complementary strengths in a larger area has potential. Despite the foundation of the Bothnian Arc Association and support by the Nordic Council of Ministers, these opportunities are not yet fully recognised. There remains a lack of knowledge and awareness of knowledge-based assets and innovation co-operation opportunities on both sides of the border. National (and regional) policies active in the cross-border area generally do not include a cross-border dimension. Internal and external accessibility barriers, and to a lesser extent other barriers such as regulation and culture, persist. Today, the Bothnian Arc has good potential to demonstrate prosperity in the periphery. However, the functional region has yet to take shape as a widely-endorsed reality beyond public authorities. The existing cross-border regional innovation policy experiments, mostly thanks to the European Territorial Co-operation support, pave the way towards a more strategic and bottom-up approach for increasing the cross-border innovation benefits in the Bothnian Arc.

5.1 Cross-border area

Build on the two urban hubs, collect data and improve internal accessibility to support cross-border innovation potential

- **Build on the main innovation hubs of Oulu and Luleå, while also connecting firms in more rural municipalities that have distinctly different industrial profiles.** The largest concentrations of high-technology sector potential are in the two hubs on each side of the border. However, there are several more “traditional” industries located outside of the hubs that also have innovation potential in this knowledge-intensive area.
- **Collect cross-border statistics to help guide a potential strategy for the cross-border area, as well as document the main areas of expertise (public and private actors) in different sectors.** The lack of statistics makes it difficult to build internal branding of the Bothnian Arc area. A cross-border entity such as the Bothnian Arc Association could, with financial support, oversee the production of some basic cross-border facts. This could include information on the potential, direction, intensity, results and barriers for cross-border co-operation in innovation in the Bothnian Arc. The contribution of many partners and changes in practice in reporting for institutions would be needed. The work can start on a micro scale by requesting strategic accounting on the cross-border dimension from beneficiaries of public funding. This work needs to be accompanied by the development of new capacities in regional and national administrations that would be in charge of the cross-border strategy implementation.
- **Identify opportunities for improving internal accessibility within the cross-border area.** Given the low population size and density as well as climatic conditions, the options are relatively limited. But seamless ground public transport across the border, for example, can facilitate stronger internal innovation-related connections. Opportunities for hub-to-hub sea and air transport could also be explored.

5.2 Governance

Develop a shared vision and strategy for the Bothnian Arc area, with greater involvement of firms and knowledge institutions

- **Develop a joint strategy for the Bothnian Arc to drive cross-border innovation.** An overall strategy for the cross-border region is missing today. Such a strategy would identify the unique combination of strengths and synergies in this cross-border area. It would thus build on the “smart specialisation” strategies under development by the constituent regions as a condition for accessing EU Structural Funds. There are several common sectors of mutual interest to develop, such as mining and forestry. There is also a strong ICT base on the Finnish side (driven by Nokia and a number of spin-offs) and the promising developments on the Swedish side (Facebook data centres) to establish strategic actions.
- **Seek the involvement of private actors and knowledge institutions (triple helix) in the development of cross-border activities.** The Bothnian Arc needs a wider commitment of innovation actors to drive its development. The co-operative approach and engagement of the two leading city mayors is commendable. However, the public sector-dominated Bothnian Arc Board (mainly participant mayors), has not yet facilitated greater engagement of firms. In addition, public authorities are represented mainly by municipal authorities, who do not hold significant powers in the areas of business development and innovation in the Finnish and Swedish institutional contexts. Strategic engagement in shaping the vision and strategy for the Bothnian Arc should include:
 - businesses, large and small, in traditional and new sectors, who are the main drivers of innovation
 - HEIs and research and training institutions, which have shown interest in cross-border co-operation in innovation through the implementation of concrete projects, but have to raise this interest to a strategic level in their respective organisations
 - regional and national authorities, who to date have not taken any actions in their policies to facilitate cross-border co-operation beyond internationalisation more generally.
- **Increase resources to the Bothnian Arc Association to augment its capacity for supporting strategic cross-border development.** The current structure only has two staff, perhaps with a greater orientation towards the Finnish side of the border. Given the considerable work to be done, an increased level of funding or in-kind donation of staff time of constituent public members may be necessary to accelerate action and increase the breadth of the association’s research and development capacity.

5.3 Innovation policies and instruments

Communicate more about cross-border area opportunities to support strategic programmes and instruments

- **Communicate and diffuse information on the cross-border area’s innovation potential and successes.** Greater awareness will foster internal and external visibility. Cross-border area actors need to see the concrete results of the innovation-based co-operation facilitated by the cross-border governance tools. Existing programmes are seeking to build up connections with firms that are often more familiar with counterparts outside of the cross-border area than within

it. This requires increased and targeted communication efforts towards the direct beneficiaries of the co-operative projects, but also towards indirect beneficiaries and other stakeholders, including cross-border residents. It also serves to gain endorsement of this approach by a wider constituency of people, firms and knowledge institutions.

- **Define strategic programmes and instruments to increase cross-border, knowledge-based interactions, learning from other cross-border area experiences.** Interreg today plays a role of facilitator of projects, leveraging other co-funding sources mainly from municipalities, but it cannot be the glue that holds a region together. More resources from a broader set of partners, particularly private funds, need to contribute to the Bothnian Arc Action Plan. Other cross-border regions have implemented a variety of types of initiatives to support cross-border innovation, in addition to existing experiments within the Bothnian Arc area. The list below is not exhaustive, but could provide a starting point for discussions for developing a more structured set of policy instruments, notably those that have gained experience through Interreg-funded projects. Among the most promising are (Table 5.1):
 - extending the model of the Oulu Innovation Alliance to include other actors, in the form of a “Bothnian Arc Innovation Alliance”.
 - implementing joint funding programmes for R&D projects in areas of shared interest, drawing lessons from experiences such as the Wood Material Science and Engineering Research Programme (Box 4.3).

Table 5.1. **Potential initiatives for expanding cross-border innovation in the Bothnian Arc**

Type of cross-border initiatives or programmes	Potential starting points in the Bothnian Arc
Joint study programmes at tertiary education level, exchange of students	Capitalise on the experience of the Nordic Mining School to consider other relevant areas for collaboration
Cross-border research funding programmes	Draw lessons from the Wood Material Science Finnish-Swedish programme and from Interreg-funded co-operative research among HEIs in the Bothnian Arc
Joint technology transfer infrastructure/joint competence centres	Study the possible cross-border extension of Finnish centres of expertise and alignment with Swedish competence centres
Cross-border technology parks or incubators	Evaluate the possibility for existing technology parks such as Digipolis to work cross-border
Support to innovative start-ups	Define joint coaching or funding programmes for start-ups on a cross-border basis
Cross-border cluster or poles promotion	Extend the role of business support organisations such as Business Oulu on a cross-border basis, building on the Oulu Innovation Alliance
Shared business innovation support services	Learn from the Nordic Business Links project and evaluate the application to the Bothnian Arc area
Joint talent attraction initiatives	Explore the possibilities at chambers of commerce and HEIs to develop joint programmes or mobility schemes covering the cross-border area
Joint branding of cross-border area as knowledge region	Evaluate and further improve actions of the Bothnian Arc Association in marketing the region and investigate possibilities for wider involvement of actors in this mission

NOTES

1. These two NUTS 3 regions form together the Övre Norrland NUTS 2 Swedish region.
2. These three NUTS 3 regions form together the Pohjois-Suomi NUTS 2 Finnish region.
3. For the purpose of the statistical analysis in the remainder of this case study, the area will be approximated by the two NUTS 2 regions Övre Norrland and Pohjois-Suomi.
4. See the OECD categorisation of regions with respect to innovation-related indicators developed in Ajmone Marsan and Maguire (2011). In this case study, OECD regions with sufficient similar characteristics have been grouped together by means of a statistical methodology called “cluster analysis”, on the basis of 12 socio-economic indicators related to innovation and economic performance.
5. See Ajmone Marsan and Maguire (2011) and OECD (2011a).
6. RIS Northern EU covered the Finnish NUTS 3 regions of Northern Ostrobothnia (including Oulu), Kainuu (to the east of Oulu, not included in Bothnian Arc) and Lapland, as well as the NUTS 3 Swedish region of Norbotten (including Luleå).
7. The Bothnian Arc of Knowledge and the Bothnian Academy initiatives represent their joint efforts to collaborate over the cross-border area.
8. For example, the University of Oulu currently participates in ten European Territorial Co-operation (Interreg) projects, focusing on mobility, establishment of research platforms, and the fields of chemistry and new materials (EUR 2 million in total).
9. The Bothnian Academy project was developed by HEIs and R&D actors in the Bothnian Arc. It was not retained for funding under Interreg Nord. The aim of the project, which also included Norway, was to build a co-operative forum for research and innovation actors, including transnational research and deeper business-academy-public sector linkages.

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