

The Bothnian Arc

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Abstract:

The countries of Northern Europe, Sweden, Finland and Norway lie of the outskirts of the Northern European economy. Their land mass is greater than that of France and Germany combined, but their relative population is tiny by comparison. This paper looks at the attempts made by the northern most parts of these countries, especially, Finland and Sweden to effect a degree of cooperation that would enable their respective economies to compete internationally. This, it is hoped, will be achieved through a discussion of the potentialities of the Bothnian Arc Association to promote interregional cooperation to both boost local economic development and to improve living standards.

Keywords: industrial clusters, infrastructure, higher education, tourism, European Union

A hallmark of the EU is the degree of regional diversity that stretches from its Mediterranean South to its Arctic North. Such diversity poses a number of geographic, economic, social and political problems, forcing member states individually and collectively through the EU Commission, to develop policies that both attempt to mitigate regional economic and social inequalities as well as give rise to new opportunities. The intention is for areas, regions and countries in the Community's more peripheral outposts to improve their infrastructures and develop industries and institutions that enhance their overall competitiveness and so play as full a part as possible in the life of an increasingly integrated EU (Armstrong, and Taylor, 2000).

Debate continues whether or not regional policy is desirable and to what extent it should be centralised or devolved to member states individually or in concert. For the purposes of this paper, however, both policies are at work, though in this case the argument for decentralisation as a factor encouraging local participation is strong, given the relative geographic isolation of the countries participating in the Bothnian Arc project

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The Bothnian Arc project began in 1998 and primarily involved the cities and towns around the coastlines of Finland and Sweden promoting policies that would enhance the economic prospects of the communities situated along the respective littorals. Since then the project has expanded economically though not institutionally to incorporate the Barents regions of North Norway and North West Russia. The purpose of the article is not to attempt an evaluation of progress made so far but to investigate the concept of cooperation between these respective areas and to show what might be in the future in a qualitative rather than in a quantitative sense.. Firstly, after a brief review of EU Regional Policy. The paper will explore the reasons why the Arc was formed. It will then look at how it has expanded and examine current policy.

Literature Review.

Regions are not readily defined as they do not necessarily fit into discreet categories. Regions may or may not be spatially coherent areas. They may comprise of a town or a municipality or a vast territory which is transnational with no clear cut boundaries like the Bothnian Arc. Similarly, some regions can be described as homogenous with

a clear national and linguistic identity which has been stable over a long time. Others may be described simply as functional with their main unifying feature lying in economic linkages.. Further subdivision leads into discussion of polycentric regions which contain several urban sites in which inter-city or area collaboration takes place at regional, national and supranational levels. Such nodes are often linked through their labour markets, service sectors and cultural activities. Though cities etc. may compete for resources in such regions, this needs not necessarily be negative, but stimulating in outcome. Finally, there are 'development corridors' which follow river valleys and which can be enhanced by both road and rail transport. (Matteson, 2004) All of these aspects to a greater or lesser degree are to be found in the Bothnian Arc and its neighbouring Barents Sea Region

In recognition of the different types of regional problems that exist within its borders the EU has devised a policy around six main principles. These include the Structural Funds which are targeted at the Community's most vulnerable and disadvantaged areas: lagging regions, declining industrial regions, rural areas and low population density areas. . The latter category fits in with Objective 6 and is relevant to the Nordic countries of Finland and Sweden. Much of the EU's approach was based on partnership as there was no reason why the Community should relieve individual countries of their regional responsibilities. Moreover, given that regions are notoriously difficult to define, it was logical that countries were expected to deal with problems through their own regional instruments. In other words, this was the principle of subsidiarity as expounded in the 1992 Maastricht Treaty. Additionally, there is the expectation that the authorities in different countries should harmonise their policies to their mutual benefit when dealing with common problems, especially

when these problems are shared due to proximity. It is against his background that the Bothnian Arc's activities must be seen. (Armstrong and Taylor, 2000)

The growth and development of regions has generated a considerable volume of literature and given rise to several schools of thought. Prominent among these is the role of agglomerations or clusters which has been developed by writers such as Marshall (1920), Markusen (1996), Porter (1990; 1998, 2000). Granovetter (1985) and Piore and Sabel (1984). Clusters, like regions, are not easily defined. Markusen has identified three distinct models: hub and spoke industrial districts, state anchored districts and satellite platforms. The concept of clusters, as propounded by Porter, is that they offer the possibilities of increased competitiveness and competitive advantage through productivity, innovation, increased flexibility and the creation of new business (Porter (1990, 1998, 2000) Stress in this subject is also laid upon the role of institutions such as universities, polytechnics, research institutes and the availability of an adequately skilled labour force. When such institutions work in harmony with the local authorities and entrepreneurs, as a Triple Helix, this constellation is said to lead to a high rate of innovation in both product and process development, leading to the creation of new business as clusters evolve over time in an innovative milieu (Saxenian 1994). Often such scenarios are referred to as 'learning communities' in which theoretical learning is supplemented through 'learning by doing' or 'learning by using'. This is considered particularly important in what is termed the 'knowledge economy' (Cooke and Morgan, 1998). The Nordic economies, as will be shown, are noted for their concentration on High Tech industries and fit this model relatively well, but it needs to be stressed that, despite their high wage and social costs, they are able to compete in what are often considered low tech industries such as forestry and related industries (Maskell, P, Eskelinen H,

Hannibalsson, I, Malmberg, A and Varne, E, 1998) Finally, there are discreet social factors that can contribute to economic success. These can be found in commonality of language, educational experiences, religious/cultural views which can often act as reinforcing mental modes of thought and behaviour (Tidd, J, Besant, J and Pavitt, K (2001)

The Bothnian Arc

The economic needs of Northern Finland and Sweden were identified many years ago, but it was only in the 1990s that joint action was taken to improve the situation. Launched in 1998, the Bothnian Arc, as shown in Figure 1, comprised five Finnish regions/sub regions: Kemi Tornio, Ii, Oulu, Lakeus, Raahe and the municipality of Kalajoki, which forms part of the sub-region of Ylivieska. From the Swedish side the key town and municipalities were Haparanda, Kalix, Boden, Lulea and Pitea. In effect the Arc stretches from Pitea on the Swedish side to Kalajoki on the Finnish.

Figure 1: The Bothnian Arc



Source: Programme: The Bothnian Arc of Knowledge (2002)

The Arc though is not geographically bounded and looks to areas such as Russian Karelia and Murmansk in North West Russia as unofficially being within its sphere of influence. Essentially, the narrowest point of the Arc is the intersection of the Baltic Sea, via the Gulf of Bothnia, and the Barents region through to the Barents Sea, which includes North Norway and North West Russia, Thus the Arc is a highly strategic point between the Baltic and Barents areas.

A board was set up to manage the Arc Association and, in addition to its municipal representatives, were members from industry and commerce plus members from the Universities of Oulu (Finland) Lulea (Sweden) and later the University of Lapland from Rovaniemi. These were supplemented by members from Oulu, Kemi-Tornio and Rovaniemi Polytechnics in Finland and the School of Music in Pitea and the School of Wood Technology at Skelleftea from Sweden. Finally, offices were established in Haparanda and in Oulu. Consequentially, it needs emphasising that the Bothnian Arc Association is not a government body and so has no executive power, but is primarily a collection of cities and town that work on behalf of the region as a whole.

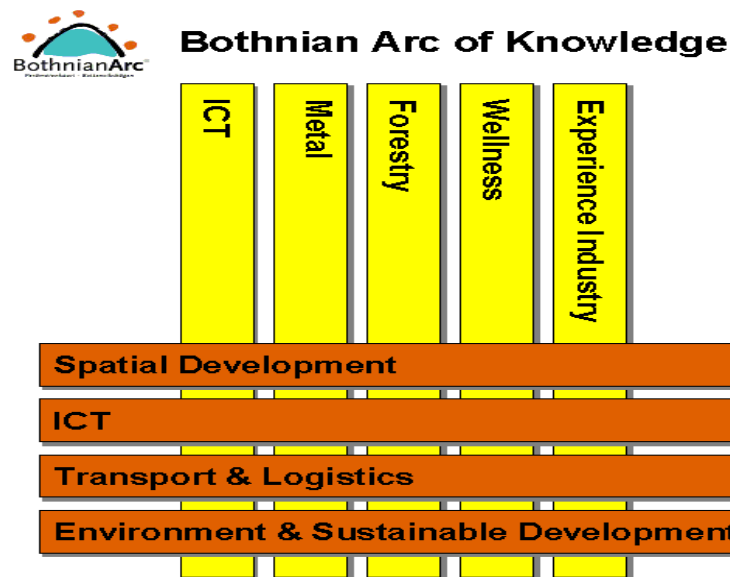
With a population of between 600,000 and 700, 000 the Arc region is the most densely populated area of the northernmost parts of the Nordic countries, but population density per square kilometre is low. In Northern Finland, for example, population density is only 2.2 persons per square kilometre (Look Oulu). The climate is harsh with over a hundred and eighty days of snow per annum, while the physical environment is delicate, requiring careful husbandry, but within its lower regions the four seasons of the year do exist thanks to the proximity of the Gulf Stream (The Bothnian Arc Project (2004)

Initially the Bothnian Arc was considered an umbrella project with a common vision and whose goals would be achieved through three sub-strategies:

- Vision, strategy and networks;
- Communication systems
- Tourism and the environment

It must be emphasised that no matter how desirable economic growth was in its broadest sense, everything had to be achieved within the confines of the region's delicate natural environment, which required protection as much as its unique biodiversity, culture, heritage and languages. Nevertheless, there was a perceived potential that the Arc could eventually come to represent an example of a 'Europe of the Regions' and of the success of the EU's Northern Dimension.

In trying to develop the economy of the extended region and operationalise the sub-strategies, several approaches have been taken. Initially there was a recognised need to improve the area's infrastructure and, secondly, to identify key industries and sectors where common potential were greatest. This was modelled very much upon Porter's theories of the role of clusters. Such an approach requires intervention from national and EU authorities to assist in what the municipalities are trying to achieve, but the key to much of this, lies in engendering a very close relationship between educational establishments, the towns and industry/commerce. In other words, this was also a harking back to Etzkowitz's Triple Helix. (Etzkowitz and Leydersdorff, 1 (2000). Implicit in this was the identification of particular areas or clusters of expertise and support systems as shown in Figure 2.

Figure 2

Source; Programme: the Bothnian Arc of Knowledge (2002)

From Figure 2 it is clear from the vertical axis that the agreed areas of expertise lay in Information Communication technology (ICT), Metallurgy, Forestry, Wellness and the Experiential industry. Underpinning these on the horizontal axis are Spatial Development, ICT, Transport and Logistics and Environmental Sustainable Development. These, though, should not be seen as separate entities but considered as being highly interrelated. The key technology was ICT, which, allied to 'high tech' in general was the underlying element in promoting growth and development throughout the region. This was based very much on the Oulu model of growth in Ostrobothnia. (Ukkola, 2005) Lack of space precludes universal coverage of all aspects of potential developments in the Arc, so only what are considered the more salient will be discussed.

Given the geographical location of the northernmost part of the Nordic countries, transport improvement was considered essential. Enshrined in this was the necessity of improved road, rail, sea and air transport to ease the flow of goods and so stimulate trade. Road transport in the Northern part Finland, Sweden, Norway and the Barents area is weak and not sufficiently integrated into the European 'E' road system even if the E4 runs from Lisbon to Helsinki and Haparanda. This it is claimed reflects weaknesses in the EU's transport strategy. For instance, the planned St Petersburg-Helsinki-Stockholm-Oslo road is too far south to have a profitable impact on the North. Therefore, there is a need for a comparable Bothnian Corridor to connect with the Barents Euro Arctic Transport Area (BEATA) which is of vital importance in the light of the huge investment programmes in North Norway and North West Russia in gas, oil, wood and metals. This might be helped by upgrading the E4 and E8 highways. The concept of a Bothnian Corridor includes all forms of transport as well as ICT facilities. Other envisaged improvements affect rail transport with priorities such as the construction of a new central line in Norrbotnia in Sweden; the electrification of the line between Kemi and Tornio; and a high speed connection from Kemi to Oulu. Strong links from Boden in Norway, through Haparanda to Finland would also ease the transport of freight to Russia. This has been facilitated by the opening of a customs post at Salla on the Russian border, increasing trade with Murmansk, with its population of over 400,000 people, as well as with the Russian City of Archangel. (Bothnian Arc ACTion Project, 2002) Finally, road and rail transport improvements are considered vital for the metal and forestry related industries, as raw materials often have to be hauled over long distances to more advanced processing centres which are situated mainly on the coastal strips close to docks and harbours. (Ukkola 2005)

Turning to air transport, similar improvements are essential. Haparanda's nearest Swedish Airport is 130 kilometres away at Kallax airport in Lulea and no direct link exists, whereas Kemi Airport in Finland is a mere 15 minutes away. Moreover, Kemi has several direct flights to Helsinki per day. What would ease matters considerably would be the establishment of direct flights from Kemi to Stockholm, which would save Swedes having to fly to Stockholm via Kemi and Helsinki. Indeed, it has been argued that the whole of the North would benefit from Oulu and Lulea airports being upgraded to international status and a new airport of international status being established in North Norway (Ukkola, 2005; Bothnian Arc ACTION Project, 2002)

Fundamental to the health of the north are the sea routes linking the Gulf of Bothnia to the Baltic and Barents seas and regions as well as to other parts of Europe. The principal ports in the region are Kemi and Oulu, with the former being the more prominent. In 2003, the City of Kemi Authorities wrote to the EU stressing the sea connections, vital to the future economic health of the whole of Scandinavia and the communities in the Barents and other far northern seas. In effect they were asking for the Bothnian Corridor be included in the TEN network. Kemi was at the heart of Scandinavia, serving not only Finland, but North West Russia and North Calotte. It was also connected to the many other European ports. Kemi accounted for 7 per cent of Finnish GNP and was home to Finnish multinationals such as Stora Ensor, which enjoys a world-wide reputation for high technology forestry management and paper making. Moreover, Finnish ports in the Northern half of the Gulf of Bothnia handle 17 million tons of throughput per annum, or 18 per cent of all Finish goods traffic. When the Swedish ports of Lulea, Pitea and Skelleftea are added, the quantity of

goods handled per annum rose to 27 million tons. Closer cooperation and increasing trade, it was argued, would necessitate improved port and harbour facilities on both sides of the Gulf which would further enhance the region's capacity to play a wider and more fully integrated role in the EU (City of Kemi Letter, 2003).

Transport improvements were also depicted within the growth of the tourist industry. To date the Nordic countries have played a relatively small role on the European tourist industry as a whole. The region, though, is ripe for development, but only in the context of environmental protection. Having four distinct seas the Bothnian Gulf is open to different types of tourist activities. A targeted area is sea cruises. Though such activity is ripe in the Baltic Sea with 5 and 10 per cent of cruise ships coming from UK or German ports, only a tiny number enter into Bothnian waters. The strategy therefore, is targeted mainly at British and German visitors to give them a Nordic experience. This, it is thought, could lead to cooperation between the various tourist agencies, shipping lines, towns, universities and tourist activity centres scattered along the coast of the Arc. The policy has three strands: Bothnian Ice; Bothnian Beach and Bothnian Road. The first obviously includes winter holidays with an emphasis, for example, on skiing, travelling over the frozen sea or visiting the Ice hotel at Kemi. In contrast there are summer experience holidays such as camping on the beach at Nallikari or visiting the Health Spa at Eden on Oulu's outskirts. Similarly, there were opportunities to visit the Lulea Archipelago which contains 742 islands and which is the only brackish water archipelago in the world. (Bothnian Arc ACTION, 2002). Finally, it is fully realised that successful tourism brings its own problems in the form of pollution and progress. This explains why there is cooperation between the Finns, Swedes, Norwegian, Icelanders and Greenlanders in

looking at how High Tech can be harnessed to deal with fast effective and efficient methods of waste disposal to preserve the environment. Progress on cooperation to date has been slow, the number of tourists is increasing, but countries, but the respective countries have yet to devise a cooperative strategy (Ukkola, 2005)

Beyond tourism industry within the Arc is highly concentrated. The main centres around the coastline itself with Oulu and Lulea being the main hubs. Of crucial importance is the role of the steel industry, sometimes referred to simply as the Steel Arc. Both Finland and Sweden have advanced technology iron and steel industries. The Finnish sector consists of the facilities worked at Raahе, Tornio and Nivala with the Swedish focussing primarily at Lulea through SSAB and Mefos. Individually each of these is small and has little choice but to combine in product and process development and knowledge transfer if they are to compete against larger international concerns. A particular spur to cooperation, centres upon the opening up of the oil and gas fields, known as Snohvit (Snow White) in the Barents seas some 130 kilometres off Hammerfest in Norway. The development of these fields with their large potential resources is shared by the Norwegians through the state owned firm Statoil and the Russians with the latter especially seeking western technology and techniques. Working in the Arctic seas demands high quality steel if the structures erected are to endure. Consequently, there has been a significant degree of cooperation in research and product development in order to meet these challenges. Indeed, Tornio has become a recognised centre of excellence in product and process development as well as in education in steel technology. (Programme: The Bothnian Arc of Knowledge, 2002). Similarly, Finnish computer technological expertise looms

large in the highly sophisticated computer systems used in locating and extracting oil (Ukkola, 2005).

In discussions on the Bothnian Arc, a great deal of attention has been paid to the role of ICT. Finland and Sweden have both developed individual international reputations in the field through the activities of company such as Nokia and Eriksson. Much of this goes back to debates from the 1960s and 1970s, when it was realised in the Nordic economies, that future survival in the modern world would not depend exclusively on natural resources and that much would depend on harnessing 'knowledge' type industries based on electronics of one type or another. In the Bothnian Arc area, Oulu is undoubtedly the leading centre for High Tech Industries. Its knowledge economy is dominated by Nokia which has one production site and three research and development facilities in the city. Additionally it has a range of partnerships (locally and internationally) and subcontracting agreements with approximately 50 per cent of the hundred or so High Tech firms in the area to say nothing of its joint research with Oulu University. On a lesser scale, Lulea is Oulu's Swedish equivalent. The Oulu Phenomenon as it is known, began in the 1970s and was the outcome of a joint project involving the city, local entrepreneurs and the university. In other words it was almost a perfect example of the implementation of the Triple Helix theory. Part of this involved the setting up of 'Technopolis', a technology park beside the University for incubating new firms. So successful was this was today, 'Technopolis' houses over 200 concerns. Following on the heels of 'Technopolis' was the formation of a second, though smaller park, in 1992 to concentrate on medical technologies. In sum, Oulu has around 12,000 people employed in its knowledge industry cluster (ICT, electronics, wellness, environment

and biotechnology). The Oulu example was adopted in other parts of Northern Finland and around a dozen or so smaller 'Polis' were set up in other municipalities in the north. Their aim was to bring modern industry and up-to-date techniques to communities in sparsely populated areas, helping to create new employment and stem the flow of outwards migration to the south. Not all of the 'Polis' concentrated upon ICT and its related industries, but rather on traditional industries such as forestry where High Tech solutions can be applied. (Donnelly and Hyry, 2004)

Though Sweden, too, can boast of a substantial high tech industry, it came to adopt the concept of 'Polis' after the Finns. Nevertheless, the Bothnian Arc Association considers it opportune to promote the 'Polis' concept along the same lines as has Finland and to attempt to establish high levels of co-operation between them. The concept enshrined in the 'Polis', is that each polis should specialise and become a centre of excellence. Kemi Polis, for instance, concentrates on media technology, whereas Tornio focuses on digital technologies. It is intended that all should eventually be connected through a complementary network to benefit from the multidisciplinary synergies generated between them. Within this specific areas would play lead parts:

- Oulu and its surrounding area
- The Swedish square comprising Lulea, Pitea, Boden and Alvsbyn
- Border areas of Haparanda and Kemi-Tornio.

These areas are seen as local platforms in conjunction with the Universities of Lulea and Oulu which were considered as the driving forces of development, and in turn they are supported by the Universities of Lapland and Umea as well as the polytechnics.

Finally, the Bothnian Arc of Knowledge initiative was predicated on a number of actors, the municipalities, universities, polytechnics, specialist colleges, industry and commerce and the various 'Polis.' Through their combined efforts, the region would become a centre of learning, achievement and excellence that would be able to compete economically and socially with the any other region in the EU through their cutting edge of knowledge and competences. (Programme: The Bothnian Arc of Knowledge 2002)

Much of what are proposed centres on the role of education to create a 'learning region.' As expected, growth and development in education is highly dependent on cooperation between institutions through exchanges of students and staff on a transregional basis to facilitate the dissemination of knowledge and best practice. Oulu and Lulea Universities and Oulu Polytechnic, for example, cooperate in the field of civil engineering. At undergraduate and postgraduate levels, English would be the medium of instruction which would encourage the recruitment of international students and staff. This it is thought, would raise educational levels generally and encourage developments in research of an international standard. Teaching and research, though grounded within their generic areas, would not neglect their regional surroundings and there is a hope that, especially at postgraduate level, synergies and cooperation could be achieved with local industry through networks being established between academia and industry, especially at doctoral levels. Indeed, the University of Oulu is considered almost as an ideal model for such ventures through its relations with firms such as Nokia, Elektrobitt and Polar (Programme: The Bothnian Arc, 2002, Donnelly and Hyry,2004) Ultimately, attention has also been paid to the sheer size of

the area and the importance of distance learning for students living in isolated regions. It is the ultimate intention of the University in erecting a 'Virtual Arc of Knowledge' known as 'Campus Neo' which would involve all types of higher education institutions, with students when necessary being able to attend classes in their local colleges as well.

From what has been said, it is clear that the Bothnian Arc concept is ambitious. However, to date not a great deal has been achieved. The highest levels of enthusiasm for the project are in the border areas Kemi Tornio-Haparanda and Tornio Valley areas, which collectively often refer to themselves as 'Eurocity.' Co-operation between the towns should not necessarily be seen as an outcome of The Bothnian Arc as cooperation began back in 1960. Sharing a common vision, the towns share the same labour market, educational facilities and technical services. On a less enthusiastic note, Mattesson's survey (2004) indicated that awareness of the possibilities of what could be achieved was strongest on the border areas of Sweden and Finland, especially in Kemi-Tornio and Haparanda. The further away from Haparanda in a westerly direction, there was less interest. Even in Oulu there is a great deal of scepticism of its value. (Mattesson, 2004, Marjomaa, 2005) This is perhaps because Oulu is already a dynamic and prosperous area and the perception may be that there is little to be gained from wider participation in the projected activities in the Arc project?

Finally, beyond the level of perception, it is argued that while being part of the EU Northern Dimension programme, this does not meet what is perceived as the essential requirements of the North. Though funding does come from Brussels, the main road

projects remain too far south to have a really positive impact on the northern regions. Secondly, while transport improvements are essential, much more support for new business formation would be welcome. Thirdly, despite problems with EU policy, there is a feeling that the EU is more sympathetic to the north's requirements than the national governments of Finland and Sweden. These seem unwilling to commit sufficient funds to meet the needs of the northern communities. In the case of Finland, it has been speculated that this was due to too many ministries being involved in the Northern part of the countries affairs that a coherent policy to meet the needs of the north has yet to emerge. (Ukkola, 2005)

Conclusion

There is little doubt that the northern most part of the Nordic countries need to do everything possible to maintain their levels of economic growth and living standards. Equally, there is a decided limit to the exploitation of natural resources, especially in sparsely populated areas where the climate can be extremely harsh and the winters long. Alternative sources of growth which at the same time preserve the delicate environment must be found. Moreover, there is a need for cooperation to achieve a critical mass if such regions are to compete effectively within the EU.

Conceptually, the Bothnian Arc looks good. However, it remains a relatively young institution and results will only be fruitful after a long period of gestation. Though there is an over-riding spirit of cooperation, the participating countries are still separated by identity, language and legal systems, even if cultural aspects are not

radically dissimilar. Perhaps there is a need still for greater harmonisation of legal systems etc., but this would probably have to be part of a wider EU policy.

Industrially, there is little doubt that the right clusters of expertise have been identified. Regardless of what the clusters are, they are underpinned by ICT and over time genuine synergies may emerge as might other clusters as economies and technological development progress. Oulu, for instance, began in somewhat basic electronics and now has a small thriving biotechnology cluster.

Achieving cooperation between what were formerly national institutions such as universities, institutions and towns is far from easy and can take nearly years to effect. In the case of Kemi-Tornio and Haparanda, to get to the current level of cooperation has taken over forty years. Similarly, inter-university cooperation is normally slow to emerge and often this is due to pressure on resources with much cooperation arising out of personal contacts between staff rather than from inter-institutional agreements which can often prove of short duration.

In effect perhaps too much has been expected of the Bothnian Arc Association in the short-term and that rather than seeing it as a failure, judgement perhaps should be postponed for at least another ten to fifteen years. At the very least the Bothnian Arc can act as a lobby, voicing the views of the northern European Union.

References

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Armstrong, H and Taylor, J. (2000), ***Regional economics and Policy***, Blackwell, Oxford

Bothnian Arc ACTION project, (2002)

<http://www.bothnian.acr.net>. Accessed 24 Jan 2005

City of Kemi Letter (2003), ***Letter to the European Commission on the Gulf of Bothnia Logistics Centre***, (26 August, 2003) Accessed 24 January, 2005.

Cooke, P and Morgan, K (1998), *The associational economy: firms, regions and innovation*, OUP, Oxford.

Donnelly, T and Hyry, M (2004), ***Urban and Regional High Technologies: the case of Oulu, Local Economy***, Vol 19, No 2, pp 1-16.

Eztkowitz, H and Leydersdorff, (2000), ***The Dynamics of Innovation: from national systems and Mode2 to a Triple Helix of university-industry-government relations***. Research Policy, Vol 29, No 2 February

Granovetter, (1985), ***Economic Action and Social Structure: the problem of embedded ness***, American Journal of Sociology, Vol 91, pp.481-510.

Look Oulu, (2004) Oulu City Council, Oulu.

Marshall, A (1920) ***Industry and Trade***, Macmillan, London,

Maskell, P, Eskelinen H, Hannibalsson, I, Malmberg, A and Varne, E (1998) ***Competitiveness, localised learning and regional development: specialisation and prosperity in small open economies***. Routledge, London.

Matteson, M (2004) ***Networking or Just Working: firm managers' views on cross border cooperation in the Bothnian Arc***. UMEA University Report,

Piore M.J. and Sabel, C.F. (1984) ***The Second Industrial Divide: Possibilities for Prosperity***, Basic Books, New York

Porter, M (1990), *The Competitive Advantage of Nations*, The Free Press, New York.

Porter, M (1998), *Clusters and the New Economics of Competitiveness*, *Harvard Business Review*, Nov/Dec. Vol 76, Issue 6, pp.79-80.

Porter, M, (2000) *Localisation, Competition and Economic Development: Local Clusters in a Global Economy*, *Economic Development Quarterly*, February, Vol 14, Issue 1, pp.15-31.

Programme: *The Bothnian Arc of Knowledge* (2002). Accessed 26January 2005.

Saxenian, A (1994) *Regional advantage: culture and competition in Silicon Valley and Route 128*, Harvard University Press, MA.

The Bothnian Arc Project (2004),
http://www.tkem.fi/English/KVOL/projects/completed_projects/bothnianarc.html.
 Accessed 24 January 2005

Tidd, J, Besant, J, Pavitt, K (2001) *Managing Innovation: integrating technological, market and organisational change*, Wiley, Chichester.

Ukkolaa, T, (2005, Private Communication from Director of the Bothnian Arc Project, February, 2005.