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Policy Induced Regional Interactions in Enhancing Global Industrial Competitiveness

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1. Introduction

This chapter discusses the role of policy induced regional interactions in promoting regional competitiveness in globalized industrial role. The chapter is based on two Swedish regional policy initiatives that are strongly influenced by a regional innovation systems approach and a Triple Helix framework. The highly interrelated concepts of Regional Innovation Systems (RIS) and Triple Helix (TH) have not only contributed with the theoretical foundation for policy to offset global pressure; they also contribute to the theoretical framework for the policy analysis in this chapter.

The concept of interaction, as introduced here, may be looked upon as a general term that encompasses all those non-market relations, abstracted from orthodox economic theory but which are necessary for the understanding of the function of the economic system. It may be argued that Coase (1937) with his transaction costs identified the border between interactions in the form of a hierarchy inside the firm and the market outside it. With the exception of Marshall (1890), to which we will return to below, non-market interactions outside the firm, and/or crossing firm borders, were for a long time neglected however in economic and industrial analyses.

Today, when the network economy is a widely used concept in characterizing the globalization processes of our time (cf. Castells, 1996, 2000), it should be noted that interactions in the form of industrial networks were in focus among industrial researchers in Uppsala university in Sweden already in the 1980:s. The "Uppsala School", with its focus on actors, activities and resources, is one important pillar in the development of the family of network approaches (cf. eg. Håkansson, 1982 & 1989; Håkansson & Snehota, 1995 & Axelsson & Easton, 1992). Although with some exceptions, the Uppsala School focused on industrial networks proper; institutions were not part of the system. With the point of departure in an industrial marketing perspective the Uppsala network approach was rather broad; innovations were part of it but, with some exceptions, not in focus. The Uppsala school was far from alone in developing academic theory beyond market relations proper during the 80s and 90s, however. The variety of network approaches is great, including sociological approaches as well as geographical and economic; explicit and intentional approaches as well as externalities and cultural (for an overview cf. Coombs et al, 1996). The approaches used in this chapter are discussed in detail in section two below.

Methodologically, the chapter is based on 30 semi-structured interviews conducted between 2004 and 2006 with industry, government and academia involved in two initiatives aimed at promoting and fostering regional interactions. The two initiatives are part of a policy programme called Vinnväxt, which has the aim of creating and promoting regional innovation systems. This programme is launched by the Swedish Governmental Agency for Innovation Systems (VINNOVA). The first initiative, Robot Valley, aims at making the region of Mälardalen in Central Sweden an internationally competitive and “world leading” region within the field of robotics. The second initiative, Triple Steelix, is an initiative with the purpose of creating a distinct regional innovation system based on steel making – a backbone of the Swedish economy. In addition to the qualitative semi-structured interviews with industrial, academic and policy actors, the chapter is also based on secondary data in the form of official records including the applications, plans of action and other documents submitted by the two initiatives to VINNOVA. The data was collected at an initial stage of the initiative and thus not aimed at providing a comprehensive evaluation of the initiatives *per se*, but rather selectively focus on the initial prerequisites for the creation of regional interactions. In other words, it was not our ambition to evaluate the actors themselves but rather to analyse the conditions created for them to act – it is more of ‘policy analysis’ than ‘project evaluation’.

Apart from the short introduction, the rest of this chapter is organised as follows: in section two, we put the initiatives in the theoretical context underpinning them. In section three, we present the two initiatives in regards to the established interactions and identify some of the collaborative projects that the initiatives have generated. In section four – based on the two initiatives – we analyse the implications – and possible limitations – of this policy measure to, on its own, achieve the ambitious goals of creating world leading regional innovation systems.

2. The raison d'être for regional innovation systems

Both the initiatives discussed in this chapter – Robot Valley and Triple Steelix – are launched at a time when the importance of innovations as enablers and drivers of global competition is widely recognised as well as the recognition that innovations do not take place in solitude but are often the result of interaction between different actors. Introduced by Freeman (1987), in his studies of the Japanese model, and Lundvall (1990; 1992), the innovation systems (IS) approach has received a dominant position among policy makers as a tool for understanding economic development. Although originally national in its scope – National Innovation System (NIS) – the concept has in the last two decades developed into a conceptual family that includes regional innovation systems (RIS) (cf. e.g. Asheim & Gertler, 2005), continental and sub-continental innovation systems (Freeman, 2002), sectoral innovation systems (SIS) (cf. Malerba 2005; Edquist, 1997) and related concepts such as technological systems (TS) (Carlsson, 1995).

From an industrial development perspective, the innovation systems' (IS) approach may be argued to be part of neo-Schumpeterian economics, which was given potency by Nelson & Winter's seminal contribution “An Evolutionary Theory of Economic Change” published in 1982 in which they revealed the mechanisms that lead to industrial change and growth. IS may be looked upon as one of the paths followed by evolutionary economics and innovation theory (cf. e.g. Nelson 1995, Fagerberg et al., 2005) although this is not always explicitly the case among those that analyse it (cf. Nelson, 1993). The IS approach recognises economic, industrial and technological development as long-term processes in which the creation and

diffusion of capabilities involve interactions and relations that are institutional, i.e. related to the development and functioning of cultural, social and political stabilities/rigidities which are more or less enabling for industrial development and in addition more or less formalised (see, e.g. Nuur et al, 2009; Gustavsson, 2009).

2.1 Regional innovation systems

In recent years, a vast literature on the spatial dimension of the innovation systems approach has also emerged (cf. Asheim & Gertler, 2005). Particularly influential has been the RIS approach which somewhat simplified can be described to focus on the dynamics that arise from regional interactions and other relations between firms, their supporting industries, and the institutional infrastructure, such as research institutes and higher education providers, financial institutions etc. (cf. Asheim and Isaksen, 2002).

The RIS approach views development and diffusion of technologies as long term processes involving formal and informal webs with a strong spatial dimension (Edquist, 1997) since innovations often are cumulative processes more or less favoured/disfavoured by the incumbent regional institutional infrastructure. Moreover, another point of departure is that regions that have a similar history are likely to experience similar patterns of economic development in the future (regional path dependency) strongly based on the cumulative previous decisions made by economic actors (cf. Storper, 1995; Malmberg 1998).

Apart from the conceptual dimension developed among academics, the RIS approach has also become highly topical as an instrument of regional development strategies and has gained strong acceptance in Sweden as a mechanism of regional development. At least two reasons for this can be indentified: first, the process of globalization and the emergence of hotspots (e.g. the successes of Silicon Valley (cf. Saxenian, 1994) and Italy's Emilia Romagna (cf. Putnam, 1996)) in meeting global challenges in terms of industrial development and competitiveness indicates that the earth is yet not entirely flat (cf. Friedman, 2005). Knowledge formation (and communication) processes that permeate innovation are far from perfectly mobile and, as discussed by Markusen (1996) a decade ago already, take place in "sticky places in a slippery world". Second, from a policy perspective, breaking down the units of analysis from the national level to the regional level is assumed to help to identify the vital attributes of the system. It allows authorities to identify and analyse regional variations within a larger system supposed to be reasonably coherent and provide differentiated inputs to augment regional competitiveness. This is all the more important since the development of technologies is more or less connected. Depending on how we define the region, it may be argued that the regional system reveals the importance (or non importance) of networks and direct interpersonal relations, the local culture and the entrepreneurial spirit.

From a policy perspective thus, adopting a regional innovation systems approach has the point of departure of stimulating locally gained dynamics through interacting regional actors so that industrial knowledge creation and dissemination is fostered (cf. Florida, 1995; Cooke, 2001; Asheim & Isaksen, 2002). Geographical proximity is considered to spur the creation of a nurturing milieu in which innovations are induced and capabilities created because the totality of the web involving proximate actors may result in cumulative learning processes of a path dependent character. Geographical proximity is also assumed to facilitate the evolution and sustention of internal institutional factors such as unique sets of norms, values and conventions that are important for external competitiveness. Thus, underlying the regional innovation systems approach is the notion that knowledge creation,

diffusion and transfer can be facilitated by local dynamics that is created as a result of the interactions between geographically proximate actors in systems that are institutionally linked (cf. Amin & Thrift, 1995; Asheim 2000; Ernst et al 2002; Maskell & Malmberg, 1999). Conceptually, however, the economies of proximity in contributing to specialisation and knowledge spillovers is nothing new in the literature: the interactions were discussed at the end of the 19th century already when Marshall (1890) described the territorial dynamics as a locus of learning and competition as were they “in the air”. The idea among RIS researchers of “learning regions” may in fact be looked upon as a more advanced formulation of the complex localized learning processes once identified by Marshall (cf. Asheim 2005).

2.2 Triple Helix

The Swedish innovation systems policy as implemented by VINNOVA is, in addition to the “conventional” innovation theory, also strongly influenced by a second theoretical platform: the *Triple Helix* framework, which states that the positive interactions between academia, industry and government is a crucial factor for economic growth. This has its origins in the “New Production of Knowledge” discourse (cf. Gibbons et al, 1994) but has been developed primarily in many texts by Etzkowitz and Leydesdorff (cf. e.g. 1998; 2000). The Triple Helix framework provides a simple but nonetheless politically powerful metaphor for a dynamic innovation system since it is based on a spiralling dynamic model. Somewhat simplified it may be argued that it is more appealing than the more vague notion of innovation systems as it focuses on three players, or rather actor families, whose interaction is said to determine the overall systems’ dynamics and as such it provides a strong policy case. Issues such as learning, industrial traditions, entrepreneurial climate, culture, etc. are found at an implicit or secondary level (cf. Laestadius et al, 2007).

The Triple Helix framework assigns universities a primary role in the evolution of innovation systems since they are not only viewed as knowledge centres mainly for basic research and education but are in addition assumed to play an active and direct role in the industrial innovation processes alongside, and in interaction with, government and industry¹. Core to this is the idea that the old discipline-based scientific knowledge (“mode 1”) is redundant as far as the knowledge creation function is concerned. In contrast, a new paradigm – originally referred to by Gibbons et al (1994) as “mode 2” – with the following characteristics has emerged: first and foremost: knowledge formation is a social process that is created through interactions and produced in close cooperation between actors in industry, university and government. Secondly, the creation and diffusion of knowledge is a multi-disciplinary phenomenon that results from interactions between several scientific disciplines. Furthermore, the mode 2 approach recognises knowledge as been characterised by heterogeneity and organizational diversity.

The Triple Helix framework may be looked upon not only as a synthesis but also as a formalized interpretation of mode 2 because it considers, and is focused on, the interactions between the system’s main players. Given that the dynamics can be found in the interaction between the three main actors (or families of key players – “government” may e.g. include municipalities and county authorities) the Triple Helix visions that the interactivity of the

¹ In a Swedish context, the Triple Helix concept reinforces the so called third task of universities introduced through a bill in the late nineties; apart from education and research, Swedish universities are mandated to participate in developmental issues.

three players make up the core of the innovation system. Accordingly, universities should be entrepreneurial enough to promote entrepreneurial spirit and may establish technology parks and incubators in their activities. Although the Triple Helix framework has become very common in policy circles and in parts of academia it may be critically looked upon as still assuming that the processes leading to innovations are linear i.e. innovations begin with "basic research" followed by more applied research, product development and then more near-market activities. This is somewhat contradictory to the view that innovation processes often take place at different layers - different systems levels that interplay - and thus that the bulk of scientific research does not automatically (even if government intervenes in the process) lead to new products, the later of which are often based on market demand i.e. far beyond the research laboratories (cf., Kline & Rosenberg, 1986).

2.3 The challenge of capturing the web of relations

Although the regional innovation systems approach and the Triple Helix framework are often used together, the two concepts are not synonymous. One major difference between them relates to the role of geographical proximity. The Triple Helix framework does not, in its original formulation, take an explicit territorial approach: its focus is on the interactions and collaborations between universities, industry and government at a period in which the process of globalisation is blurring the boundaries between these institutions (Etzkowitz and Leydesdorff, 1998; Etzkowitz, 2005). On the other hand, a basic assumption in the RIS approach is that geographical proximity permeates social interaction, trust and local institutions necessary for the realisation of an innovation system.

At the regional level the RIS approach and Triple Helix frameworks are interwoven structures characterised by interdependencies on a variety of levels. In this context, the regional innovation system may be viewed as more or less open towards the rest of the world but with a touch of spatial concentration. This view has been discussed more than half a century ago by Perroux (1950) when he introduced the concept of *economic spaces* which in contrast to geographic spaces is not necessarily only territorial. In addition, many technological and scientific fields also appear to have scientific cultures (communities) that irrespective of physical proximity maintain close collegial relations although geographically dispersed (c.f. Amin & Cohendet, 2004)

Whatever differences between the Triple Helix framework and regional innovation systems, and challenges relating to where the border between systems goes, the establishment of VINNOVA and its Vinnväxt programme is a clear example of the influential role of these approaches in innovation policy. The popularity can partially be explained by the fact that they are intuitively easy to embrace and to communicate and by the attractiveness of creating a platform for actors engaged in industrial policy issues to get closer to each other. However, neither the innovation systems approach nor the Triple Helix model is conceptually uncomplicated. Although these approaches may be applied on different levels - national, regional and even on sectorial level - one major difficulty with both these concepts is how to specify the boundaries of the system (cf. Edquist, 2000, Miettinen, 2002; Gustavsson & Laestadius, 2005, 2007; Oughton et al 2002, Nuur et al, 2009). Already in the early anthologies on national innovation systems it was observed that the innovation process had become multinational and transnational (cf. Lundvall, 1992). The system's border challenge is not related to geographical aspects only but also to what may be labelled the *systems domain*. It may for instance be argued that adopting a traditional linear model of

innovation focusing on knowledge formation processes in universities and R&D units in big corporations, we may come very close to the Triple Helix approach – but that would probably exclude most of the kind of entrepreneurial mechanisms found to be important e.g. in the innovative regional systems of northern Italy or in the likewise innovative Gnosjö region in southern Sweden. Also global industrial success stories like Ikea and H&M – based on logistics and design but with low scientific and academic content (basically no research!) and strongly independent from government support – fall outside the Triple Helix inspired IS approach (see e.g. Nuur and Laestadius, 2009).

The identification of a useful systems concept within a global context is, to say the least, a challenge: nor are the RIS and Triple Helix interactions necessarily confined to the regional level (for a critical review see Shinn, 2002). In conclusion, as has been suggested by Edquist (2000), the systems approach should be seen as a “targeting tool” in order to identify those factors that affect and condition innovation activities.

3. Two illustrative cases on how the concepts are put to practice

As mentioned in the introduction, the aim of the Vinnväxt programme is to create regionally based, world-leading, innovation systems (for a more thorough presentation of the programme and its aims and scope, see Laestadius, Nuur & Ylinenpää, 2007). In this section we present the two case studies concerning two of the selected eight initiatives (the initiatives are discussed in more detail in Gustavsson & Laestadius, 2006, 2007 and Laestadius & Nuur, 2006, 2007).

3.1 The two policy initiatives

Robot Valley, located in the region of Mälardalen with a population of 790,000 (Statistics Sweden, 2008), has the vision of creating and sustaining a regional innovation system that is world-leading in the manufacturing, research and development of robot-based automation. Triple Steelix has the goal of enhancing the global competitiveness of the steel industry in the region of Bergslagen with a total population of 800,000 (Statistics Sweden, 2008). Both these regions are important nodes in the Swedish industrial tradition. In the Bergslagen region, Swedish natural resource based industries in iron, steel and forestry have coevolved in what may be labelled a development bloc (cf. Dahmén, 1950). The Mälardalen region has a strong industrial base and a long tradition of robot-related activities. Thus, both regions display forward and backward linkages in the form of direct vertical supplier and development relationships as well as horizontal relations to other sectors (cf. Hirschman, 1958/1971).

The primary beneficiaries of both the initiatives are small and medium sized enterprises (SMEs). In the case of Robot Valley the expectation is that the interactions between the Triple Helix actors will help develop new automation solutions. The reason for this is twofold – on the one hand it is assumed to help expand the marketplace for robots – from the automotive industry dominance when it comes to robot users to a wider set of industries and activities. On the other hand it may also be looked upon as a means to help the SMEs in the region to combat the increasing competition from so called low-cost countries, by helping firms to automate and thus increase their productivity. Also the Triple Steelix initiative centres on helping SMEs in developing technological capabilities. In addition, both the initiatives incorporate more holistic approaches that would help the robotics and steel

industries respectively. One of these is to devise strategies that promote the number of women working in the traditionally male dominated industries. There are also measures to put in place mechanisms that encourage young women to study natural sciences and technology at secondary schools which in the long run will increase the number of women working in the industry.

The Triple Helix actors whose interactions will pave the way for regional innovation systems are regional university colleges, regional development bodies and regional firms. Thus, the Triple Helix framework is well incorporated into the organisation, as the initiative spans across industries, universities and regional policy units. In the case of Robot Valley, it is the three counties of Västmanland, Örebro and Södermanland, the three global industrial companies, ABB, Atlas Copco and Volvo Construction Equipment, and three regional campuses (Mälardalen University in Västerås and Eskilstuna, and Örebro University). The Triple Steelix initiative also encompasses three regional governments (Länsstyrelser) of Dalarna, Gävleborg and Västernorrland while the academic arm of the TS initiative involves the two regional university colleges of Dalarna and Gävle.

The activities of Robot Valley centre on *industrial robotics*, *field robotics* and *healthcare robotics*. The industrial robotics field is the most mature one with a long tradition in the region, with ABB as the largest industrial actor. Within this field the initiative focuses on regional SMEs demand for increased automation. Field robotics is a relatively new industrial area which is also seen to have growth potential including the development of for instance autonomous loading and mining equipment. Within this segment, Robot Valley has two global companies, Atlas Copco and Volvo Construction Equipment, which are located in the region. Healthcare robotics is a more recent area for robot applications and is expected to be an area with a great potential, especially considering that industrialised nations are facing a future with an increasing number of elderly people who will need care. Within the coming two decades, it is estimated that the industrialised world will witness a dramatic increase of people over 65 years of age and a 'greying' Europe increases the need for technological support both at home and for professional medical care (Europ, 2004). However, it is far from evident how those artefacts should be constructed in order to work well – and with dignity – within the healthcare sector. In this segment, there remains a huge amount of development and innovative work – plausibly in cooperation with users, producers and researchers.

Likewise, the Triple Steelix initiative draws on the capabilities of the larger steel manufacturers in the region. Three of these are Outokumpu (stainless steel), SSAB Tunnpått (thin plate sheet) and Sandvik (cutting). The *stainless steel* capability activities concerns providing resources to the 35 SMEs in the stainless industry which are located in the south and south east of Dalarna – with the majority located in the municipality of Avesta where Outokumpu has a stainless steel processing plant and a research and development unit, Avesta Research Centre. The *tooling and tools (cutting)* capability area is built around the operations of 35 SMEs which are all involved in subcontracting agreements with Sandvik. Because of historical reasons there are a number of SMEs that are involved in operations such as cutting, welding, tooling, heat treating and hardening of steel products and this capability node intends to ensure their efficiency by helping them with lean production techniques. The third capability area, *thin plate sheet*, also borrows its name from a decade long existing business network "nätverk tunnpått" which brought together SMEs that manufacture, process or market thin sheet plate steel products in the region. Although

involved in the same kind of business activities, i.e. thin plate sheet, there are no necessary business ties between the lead firm (SSAB Tunnpåt) and the SMEs.

3.2 Policy induced regional interactions in the two initiatives

Both the initiatives have induced the onset of several projects that centre on creating interactions among the Triple Helix actors in the regions. Further, a number of projects, which can be grouped into R&D interactions and projects aimed at facilitating SMEs to access and apply new technology, have been initiated. For example, the creation of an information platform on the internet, production/distribution of information leaflets, workshops and seminars aimed at discussing strategies and marketing campaigns with the purpose of informing the public, industry and academia about the initiatives have been initiated. Measures to improve SMEs manufacturing methods have been put in place including the introduction of business development schemes by arranging seminars, offering the SMEs support to participating and visiting in trade fairs as well as offering partnership platforms to promote relationship building. There are also other strategies which support the SMEs with competence generation by putting in place mechanisms that allow them to attend courses (many of them offered by the global players) so that their product base and markets could be developed. In addition, activities also involve promoting the development of incumbent products and new products by conducting seminars, marketing research, feasibility studies and financial support to product development.

In both Robot Valley and Triple Steelix, access to a qualified workforce is prioritised. In order to build a regional critical mass of educated personell, work is also taking place to secure a regional knowledge base within the respective technology areas. A major ambition with the initiatives is to turn around the negative trend of a weakening interest among young people and children, and particularly among young girls, for technology and for higher technical education. An example of measures to improve is the Robot Valley after-school centre called RobTek where girls and boys are given the opportunity to develop their technology interest.

R&D interactions

A number of projects that are aimed at R&D interaction have been initiated. For instance, in Robot Valley, a number of potential innovative projects were identified within the three technology areas at an early stage. The more short-term projects, the so called 'low-hanging fruits' (LHFs) are projects with more clearly defined customers, suppliers and markets already from the beginning. These projects are considered to be an important part of jump-starting the Robot Valley initiative. The more long-term projects are focused on new project ideas and products, as well as needs driven R&D schemes. The initiated LHFs are primarily within industrial robotics, whereas within field robotics some somewhat more mid-term projects have been initiated and health care robotics is much more long-term.

One LHF-project initiated within Robot Valley is 'Friction Stir Welding' (FSW) which is a technology that was developed in Great Britain, and based on the principle of solid state joining method - welds are created by the combined action of frictional heating and mechanical deformation due to a rotating tool, meaning that metal is not melted in the process, to join two aluminium components. The project is run in cooperation between the three companies Esab AB, ABB and Specma Automation AB in collaboration with Örebro University. ABB provides the robots, Esab holds the welding competence and Specma

delivers the software for the welding applications. The welding robot will be marketed and sold by Esab. The technology per se is not new but for the actual welding application (FSW) the application with an industrial robot for welding irregular light metal joints is completely new. The automotive industry is seen as the major customer, but the need for flexible welding of light metals exists also within for instance the space-, aeronautical- and shipyard industry.

Within field robotics, two medium to long-term, and to some extent connected, projects have been initiated. One project, Navigation Systems for Automated Loaders (NSAL), focuses on developing autonomous trucks to navigate in e.g. difficult terrain and mine shafts. This project is run in collaboration with Örebro University, Mälardalen University College, Atlas Copco and Volvo CE. In the second project, Optical radar for mobile robots, the focus is on developing the sensor system for navigation of the autonomous vehicles. This project is run by Örebro University, Atlas Copco and Optab optronikinnovation AB, a company that develops optical and electronic equipment. Both projects involve applying existing technology in new applications. The projects were initiated as a result of the new contacts created by Robot Valley. Both to academia and to the companies involved, these collaborations are new.

Also in Triple Steelix, a number of R&D projects were identified. One R&D project involves material technology and aims at devising methods to improve high resistance shaping of steel, tooling methods to produce ultra-resistant steel products, research into pre-treatment of steel with laser in order to steer material properties when shaping and finding new applications for duplex stainless steel products and nanotechnology and modelling and simulation of new product domains.

Two other parallel research projects that specifically target product development were initiated in 2005. Here, the Swedish Steel Producers' Association (Jernkontoret) has together with other organisations financed ten PhD students focussing on the material aspects of steel in research projects are "High velocity compaction of high-speed steel powder", and "Surface characterisation of hydro formed stainless steel tubes". These two R&D schemes are expected to be integrated into another subproject that has the goal of developing high resistant shaping, coiling and sheet steel bending. These R&D development schemes are expected to result in prototype constructions that could be used by the small and medium sized companies. Thus far subprojects have been launched focussing on R&D on enhancing high resistance shaping of steel, R&D on tooling methods to produce ultra resistant steel products, R&D on investigating pre-treatment of steel with laser in order to steer material properties when shaping, R&D new applications for duplex stainless steel products, R&D on modelling and simulation of new product domains, and finally R&D on devising shaping techniques using nanotechnology on steel and steel products

Interactions aimed at regional SME:s

The regional SMEs are a major target group for both initiatives in terms of new technology and application developments. In Robot Valley, there is a flagship project within the industrial robotics domain called Robotics for SMEs. This project aims at introducing the benefits of automation and robots to industry and in that way increase the level of robotisation among the SMEs in the region. Robotics for SMEs consists of two different kinds of projects – on the one hand the short term *industry projects* aiming at improving the applicability of existing robotics for SMEs, and on the other hand the long-term *conceptual technology projects*. The latter focuses on developing new robotics technology and increasing

the user-friendliness of industrial robotics. With these two projects, Robot Valley wishes to, in the short run, help SMEs to increase their level of robotisation, and in the longer run find entirely new solutions for robotisation of industrial activities.

According to the stakeholders, Robotics for SMEs has been successful, and the project has been prolonged and expanded. More than 100 companies have been analysed within the project and about half of them have introduced robots or other automation solutions as a result. The project has also resulted in job opportunities for students who carried out the studies at the firms. Robotics for SMEs contributes both through spreading knowledge about robots and robotics to new customers, as well as increasing the knowledge within Robot Valley about which technologies and technological solutions that companies are in need of. The project successfully integrates the efforts of the Triple Helix actors i.e. industry, society and academia.

Robot Valley has also been a catalyst in the establishment of a new company, FlexPack Robotics. This company develops robot systems for customised final packaging of medicine, a system that has to meet high demands on production safety and traceability. This is a new application for the pharmaceutical industry, and which hopefully also in the future can be introduced in e.g. the food industry. The company is a strategic partnership between ABB as a robot supplier and FlexPack as systems integrator. Another owner is Prevas AB, a consulting company in electronics and software development. FlexPack was established by former ABB employees, with financing from ABB, Prevas and Robot Valley.

Also Triple Steelix acts as an intermediary and facilitates the interaction process between the large firms, public bodies, the two university colleges and the SMEs. The interaction of the Triple Steelix (TS) innovation system hitherto lies in between SME needs in terms of resources and the R&D units of the three global companies. In this way, the three relatively large firms are expected to act as catalysts for the development process by contributing through their global capabilities and opening their research and development units to SMEs. The public bodies at the municipal level are co-financiers and the two university colleges of Gävle and Dalarna are according to the TS design expected to contribute with research and development that relate to products, methods and production needs of the SMEs. In this way, TS shoulders the task of an inventory organisation with a knowledge bank that contains specific information that relates to product and production methods of the three large companies, the kind of R&D carried out at the two university colleges and the magnitude of SMEs needs. Through contacts with the capability nodes, public policy bodies and the two university colleges TS then provides the resources to develop to the SMEs.

In Triple Steelix, a number of subprojects have been initiated to start R&D activities, which were intended to be of assistance to SMEs to acquire technological and organisational competences that would in the long term improve their competitiveness. These range from a project that created a platform to allow SMEs to improve manufacturing techniques e.g. in the areas of welding, shaping, joining, cutting and the surface treatment of metal alloys to improve its sustainability to specific R&D initiatives such as the creation of a machining centre in Borlänge. This machining centre will apart from catering to the needs of the SMEs also can be used as a testing laboratory for the global players in the steel industry. Another R&D project aims at helping SMEs in efficient engineering methods that would introduce them to lean production methods, atomisation and logistics. One of the university colleges -

Gävle – has started an R&D project on improving the efficiency of the subcontracting SMEs to Sandvik.

Thus, in summary, both Triple Steelix and Robot Valley have contributed to create an infrastructure for interaction within the regions.

4. Discussion and conclusions

The aim of this chapter was to analyse the role of policy induced regional *interactions* which intend to promote regional competitiveness in globalized industrial structures. Theoretically, the chapter has been based on innovation theory and on the Triple Helix framework – as is the policy evaluated. We have also discussed the policy rationale behind the inception of the regional innovation systems approach.

The initiatives discussed in this paper have strong historical roots in regards to Swedish industrial and technological capabilities. Also, both the selected industrial and technical domains display a future growth potential – robotics with new and expanding areas of application of automated solutions, and steel where the increasing sophistication in materials development allows for new and advanced product application areas. It is not surprising, therefore, that policy authorities have identified the strength of promoting robotics and steel.

The two case studies we present in this study illustrate how a policy induced regional innovation programme has resulted in successful engagement of Triple Helix actors in the two studied regions. Industry, regional government bodies and academia in the region have become involved in a number of joint projects. As we have shown, several new collaborative projects that involve actors who previously have had little or no interaction have commenced. They have also resulted in a number of new products, new start-up firms and new job opportunities. Hence, as the empirical cases illustrate, the two initiatives have been successful in creating new regional platforms and arenas for co-operation, and which evidently have resulted in innovative knowledge formation.

However, if we look at the policy rationales behind the initiatives and the expected outcomes of them – i.e. *world leading* regions within their respective industries – some caution should be exercised. Bearing the big words and fancy rhetoric of these policy initiatives in mind, when the results are boiled down to actual projects – which *an sich* may be very good – the question would remain: will this increased regional and local interaction result in world excellence and improved competitiveness in core areas of robotics and steel technology? There is reason to be cautious since both the innovation system's approach and the Triple Helix approach – have been formulated and interpreted to be highly regional.

The main industry players that are to play a crucial role in research and development of relevance for the initiatives are very global; SSAB, Volvo, Atlas Copco, ABB and Sandvik are all firms that conduct their R&D activities globally; in fact most of their R&D is performed outside the regions of the initiatives. Also many of the most important knowledge providers as well as the sophisticated markets/purchasers for the robotics and steel products are global. Although regional milieus are important for these actors in enhancing innovation processes, it is not so that the regional connections are always the most obvious or necessary. Neither the large steel companies in Bergslagen, nor the three large companies in the Robot Valley, display any particular predilection for regional actors when it comes to innovative collaboration – not historically nor in current collaborations. Focal relationships

regarding R&D are often outside the immediate region and geographic proximity – although fulfilling vital institutional functions – often plays a secondary role in terms of relationships between buyers and sellers (Audretsch & Stephan, 1996; Markgren, 2000). For instance, it has been argued by regional economists that the *number* of actors in a region is subordinate to the *sophistication* of suppliers and customers in the region. In other words, the quality of actors rather than quantity is decisive to the development of the system (cf. Malmberg, 2002; Porter 1990).

Although not denying the importance of local dynamics in industrial competitiveness, as has been revealed by students of social sciences, it is our contention that when it comes to regional innovation systems, the current Swedish regions in many cases are too narrow to deal with the issues at hand considering that Sweden, as regards population, is a small country of nine million people, which in a global comparison corresponds for instance to the magnitude of several cities in China or the state of Michigan in the US. In addition this population is dispersed on a large area; among the largest in Europe. Hence, on a global scale, a small regional part of the Swedish economy such as Mälardalen with a little less than 800, 000 inhabitants is small as well as thin as regards network density. Issues related to developing interactivity among industrial and technological actors are thus in many cases better dealt with on a larger scale than Swedish regions proper. For instance, health robotics is a new and largely unexplored technology area within robotics. This could mean great potential for new markets and product niches for robots, but it also implies a high degree of uncertainty and need for vast research and development efforts. Due to its great social and economic prospects, it is an important technology area to stimulate through policy measures. Yet, such a project would probably yield more if operated on a national – or even larger – level. Another area that seems more suited for a national approach rather than regionally operated initiatives is that of increasing awareness on the part of young people – particularly girls – for technology and higher technical education and consequently increasing the number of women working in traditionally male dominated industries. We see e.g. no reason to stimulate only girls in Västerås to learn robotics or only girls in Borlänge to learn about steel. This is – indeed – a national issue for a small economy!

In summary, it may be argued that the present Triple Helix inspired regional innovation systems policy needs to be freed from the administrative regional constraints as well as the cognitive blinders which restrict the visions of interactions to the immediate territorial proximity. The strength of such a reformulated policy approach is the potential to focus on the core actors and their interaction in innovation processes. This focus is, in the (original) Triple Helix discourse, not necessarily fettered in a regional strait jacket. Instead of – which seems to have been the case in the present Vinnväxt programme – getting stuck in the dilemma of knitting political/administrative regions (municipalities and counties) with functional ones (based on natural labour markets) within a Triple Helix dress we argue for a policy that explicitly leaves the regional dimension open. An open and more relative regional policy approach we argue, is much better to capture the multidimensional character of industrial and innovative activities.

This multidimensional character may be explained as a traditional multilayer picture based on transparencies all of which focus on different aspects or layers of the same phenomenon. The geographical picture of the R&D network of the core industrial actors may differ from the picture on main component suppliers and from the geographical recruitment of engineers as well as from the location of raw materials providers. It is not necessarily so that

it is possible to locate a core and coherent functional region in which labour market mobility is central. In fact this approach has similarities with the economic space discussed already by Pérroux (1950). In policy terms, any geographically dispersed constellation of actors focusing on any innovation problem of relevance to an industrial policy call could be important for policy makers to consider. In this model the region is the ex post outcome of the policy rather than the ex ante and de facto condition for the agenda. And this regional outcome may well consist of a set of actors located in a set of hubs which do not necessarily have any close geographical connection to each other. Policy makers may well influence this process through giving incentives for network activities based on actors that are not located close to each other.

Using our cases from above to illustrate our proposition it can be argued that an initiative focusing on global excellence in service robotics could include actors from all over Sweden in a hub based programme. Similarly instead of a thematically dispersed Triple Steelix located to Bergslagen we can imagine a set of thematically coherent Steel programmes located to different hubs dispersed all over Sweden. The regional outcome of such a set of programmes is not that regions become neglected. In fact this approach will economize better on the knowledge hubs that exist all over Sweden and many regions may be represented by a set of actors in different programmes.

In short – such an approach has the advantage of improved interactions since

- it opens for the inclusion of all relevant actors irrespective of their location
- it opens for a realistic formulation of the goals of the initiatives as their regional strait jackets are loosened
- it explicitly admits that important connections may be hub based and geographically dispersed rather than strictly regional/local
- it makes it natural to include also foreign based actors in win-win relationships

Theoretically this may be interpreted as giving the Triple Helix approach a higher priority, i.e. focusing on the dynamic interaction of actors irrespective of their location. The mirror image of this is also that the “policy abuse” of the regional innovation systems’ concept is reduced. It has obviously – and this is an area for further research – been attractive for policy makers to adopt the RIS concept. We argue, however, that the RIS concept should be handled with care in policy formulation in one of the most globalized small economies in the world. Finally our approach also has implications on the understanding of the regional innovation systems concept. Whether over sold by academics, profiting from perceived policy relevance, or misinterpreted by policy makers, in need for tools to handle industrial restructuring, it may have narrowed the scope of understanding the significance of globalized learning and knowledge formation.

Our conclusion, thus, is that there is a need in policy to focus more on the content and cognitive aspects of the networks rather than on geographical and institutional proximity. In a world where technologies are created more or less all over the world the “technological system” concept, as originally introduced by Carlsson & Stankiewicz (1995), becomes more relevant than ever (for an overview cf. eg Laestadius, 1998). Technological systems are cultural and social constructs among actors engaged in the same technology, sharing the same technological paradigm and parts of the same technological regime; something which may be more relevant than their regional or national connection. Departing from that provides challenges to industrial policy in a globalized world – and opportunities as well. The details of that is a topic for further research, however.

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