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The Evolving Role of Academic Institutions in Innovation Systems and Development

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The Role of Academic Institutions in the National System of Innovation and the Debate in Sweden

by

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Abstract

This paper examines the role academic institutions play in the Swedish National System of Innovation (NSI) as well as the public discussion on how this role should be formulated and performed. After discussing the origin of the present NSI and its roots in the Swedish welfare system, the paper presents main characteristics of the NSI and indicators on quantity and quality of the academic system. The controversial issues of today's public debate in Sweden on the role of academic institutions is scrutinized with respect to a) organization, funding, quality of university education and research, academic freedom and internationalization, b) rights and promotion of e.g. women, ethnic minorities, social class and regions, and c) the economic and industrial relevance of Swedish research and development efforts as well as its linkages to economic growth.

The paper is written as part of the project Developing Universities – The Evolving Role of Academic Institutions in Economic Growth (UniDev) which was launched in 2005 as a joint undertaking by research partners in 14 countries. The overall objectives of the network are to contribute to a better understanding of the changing role of academic institutions in national contexts, and to contribute to initiating a process of policy learning and exchange between countries in different stages of economic development.

1. Introduction to the Swedish context

The Swedish Welfare Model, or for that matter the Nordic Welfare Model, has often been referred to as an example of systemic success. The 1930's have been regarded as the starting date of the model, which was subsequently developed and maintained throughout the post World War II period, and it has been characterized by equitable and long term sustained economic growth.

The Great Depression hit Sweden severely in the early 1930s, causing widespread despair, with high unemployment rates and the collapse of financial institutions. It was under these circumstances that the Social Democratic Party came to power in 1932, and the party has been in power since then, except for short periods (altogether 9 out of 73 years), when the center-right opposition has reigned. But even with the opposition in power there has practically been no questioning of the principle of a welfare model.

The vision of the Social Democratic party was the creation of *Folkhemmet* (People's Home), transforming Sweden into a safe haven for all Swedes. The fight against unemployment had originally top priority on the agenda, and economic policy was for a long time based on the idea, influenced by Keynes, of finding ways and means to increase aggregate demand and stimulate the expansion of public utilities. The welfare model had several different features (based on Andersson and Gunnarsson 2005):

1. A first aspect is the principle that the welfare insurance system should be publicly funded via extensive income tax transfers. It is basically a system for ex-post redistribution, i.e. redistribution of the fruits of growth. However, in the Swedish context income transfers had a special meaning, namely to push up domestic demand, which via accelerator effects would stimulate investments and growth. So, initially, there was strong growth enhancing mechanism built into the redistributive system;
2. A second aspect is public sector involvement in terms of provision of free education, health care, social security to all and other public services. An intrinsic concept was to provide equal opportunities to all citizens;
3. A third aspect was that the model focused on labour market regulations, first by a centralized wage negotiation system between employers and trade unions, and secondly by the so-called solidaric wage policy that was implemented from the beginning of the 1950s.

However, the so-called golden period of growth (that lasted from 1950 to more or less the mid-1970s) is over, and it is quite clear that Swedish model is not unique any more. A number of countries have reached, and surpassed, Sweden's per capita income, and Sweden's welfare system today contains few features, which cannot be found in many other countries. The original Swedish Welfare Model is generally regarded to have come to an end.

On the other hand, in spite of several years of economic drawback, especially in the 1990s, Sweden is still one of the richest countries in the world, and has kept high standards if applying UNDP's Human Development Index (HDI), which uses indicators such as GDP per capita (PPP), life expectancy, adult literacy, and infant mortality. However, in comparison with other countries it becomes apparent that other countries are catching up, and Sweden has slid down on the global HDI ranking. In 2005 Sweden holds the sixth position in UNDP's Human Development Report (2005), compared to the fourth in 1995 (UNDP 1995).

The decline of the original model

The start of the decline of the Swedish Model can be found in the early 1970s. Then the Swedish state started intervening in a new manner at the labour market, introducing a series of laws affecting fundamental aspects of the labour-capital relationship. Later the Swedish Trade Union Confederation (LO) challenged the Saltsjöbaden Agreement¹,

¹ An agreement reached in 1938 between the Swedish Trade Union Confederation (LO) and Swedish Employers' Confederation (SAF), significantly lowering the need for state intervention on the labour market.

claiming control over investments of Swedish firms. This proposal was to break a 30 year long understanding between the LO and SAF, thus weakening the alliance between labour and capital, which was so central to the Swedish Model. Finally, in the 1976, a centre-right wing coalition took over the control of the government. For the first time in 34 years social democratic rule was set aside by a different political ideology, a fact that has been pointed out as the end of the Swedish Model.

2. The Position of Academic Institutions in the Swedish National System of Innovation

An Introduction to the Swedish System of Innovation

Sweden has given high priority to research and development for the last decades. Sweden actually is at the top of OECD countries in the terms of R&D expenditures per capita. In 2001, Swedish R&D totalled an impressive 4.3% of GDP, although the interpretation of the figure is quite controversial, not least in Sweden (see further on debates in Section 4 of this paper). It should be stressed that business sector accounts for the bulk of this percentage (or 74% of the total in 2003). However, it is likely that this share will decline as a result of the trend of outsourcing of private R&D activities to new and emerging economies. But even so, it is quite clear that Sweden has been, and continues to be, at the top in R&D spending on a global scale. Research at universities and other higher education institutions accounted for 22% of the total in 2003 – up from a low of 19.84 in 2002 - while the remaining 4% of research expenditure was accounted for by government agencies, including research foundations and the private non-profit sector (see Table 1.).

Table 1. R&D expenditure per sector 1995-2003 (current million SEK)

Year	Total	Private sector (%)	Universities/ colleges (%)	Government agencies (%)	Non-profit organisations (%)
1995	59 297	74.25	21.93	3.66	0.16
1997	67 007	74.84	21.54	3.54	0.08
1999	75 813	75.12	21.40	3.36	0.11
2001	97 276	77.24	19.84	2.83	0.09
2003	97 101	74.10	22.03	3.48	0.39

Source: Adapted from SCB 2005b Table 4.

The State has traditionally played an important role in Swedish education and research. Uppsala University was created already in 1477, the oldest university in the Nordic countries, and Lund University, in Skåne (South Sweden), was founded in 1666 (just after Skåne became Swedish after Danish rule). The Royal Academy of Sciences was created in 1739 with the objective of “using science in the service of society”. In 1811 the Royal Academy of Agriculture and Forestry followed suite and in the 19th century research began taking an important position at the Swedish universities. In the 20th century the expansion of universities expanded, especially towards the end of century, and today Sweden has 13 state-owned universities and 23 other state-owned academic institutions (university colleges and professional schools).

State resources have traditionally gone directly to the universities as part of the government appropriation bill. In addition, however, a system of research councils (along the US and British models) have been put in place gradually since the 1940s. From the 1960s on, resources for research have grown impressively, as a result of a rapid expansion of the higher education system and big investments in sectoral research. In the 1970s the awareness rose about *the need for national research policy* where the state was to take an active rector role. In the 1960s and 1970s the OECD countries had become increasingly aware of the imperative of states to have a policy on science and technology (OECD 1969). In 1979 the Swedish Government presented its first research policy bill. The Parliament not only approved the bill but it also decided that this kind of bill should be submitted to it during each term in office, serve as “instruments for long-range planning and coordination of public sector R&D investments”.

As mentioned, the state directly (through the budget) accounts for the funding of most of the research activities in the higher education sector. In 2001, this funding amounted to 47% of the R&D revenues of this sector. The rest was accounted for by external financing (most of which were national research councils, central government agencies and research foundations). External financing is particularly high in engineering sciences (two thirds of the total), while the share in humanities and law is only one third. In social sciences, medicine and natural sciences the share is about 50%.

Medical sciences absorbed 27% of total R&D resources in 2001, while 23% went to engineering sciences, 19% to natural sciences, 11% to social sciences, 6% humanities, and 5% to agricultural and forestry sciences.

The Swedish Knowledge Economy Confronting the Challenges of Globalization

During the last few year the Social Democratic Government produced a series of reports aimed at coming to grips with the challenges of globalization, and the opportunities (and threats) that increased global competition implies for the Swedish knowledge and learning economies. In a recent Government report (Ministry of Industry, Employment and Education), it is stated that:

“The role of the state is to create the conditions that will enable Sweden to provide the best research and education in the world and to maintain a stable economy, a first-class business climate and efficient innovation systems”

The report stresses that in order to ensure “high-level growth and increased productivity, and thus our future welfare, we must develop conditions that are conducive to innovation and we must enhance the innovation climate”. The challenge is to maintain the competitiveness of Swedish industry (in a broad sense) in an increasing competitive climate. In this endeavour the knowledge intensity in industry (products, processes and services) is vital. Hence, not only is an attractive investment climate important for industries to grow, traditional and new industries alike, but it is also as important to create the conditions for an attractive knowledge and learning economy at large. However, large companies are as a rule international and they base their operations in whichever countries best suitable for their business.

BOX 1. Definitions of some key concepts

Innovation systems: Sectoral, regional or national systems where societal knowledge development and research constitute critical resources for the development of international competitiveness within business and industry.

Clusters: Geographic concentrations of related companies and other actors characterized by interdependence and mutual influence, without a direct demand to interact with research and other knowledge activities.

Business networks: Has as their aim to increase revenues and/or reduce costs through co-operative activities. They are limited to constitute innovation systems or clusters. But business networks can constitute an important (inner) core in innovation systems or clusters.

Source: NUTEK (www.nutek.se/sb/d/725/a/2779)

In June 2004 the Government launched a new innovation strategy, Innovative Sweden: A Strategy for Growth Through renewal, a platform that would pursue the “vision of Sweden as the most competitive KBE (knowledge based economy) in the world”. This strategy plan was the result of discussions involving various ministries (most importantly the Ministry for Industry and Trade and Ministry of Education and Science) and representatives of academia, the business sector, public authorities and labour organizations. In connection with the launching of this new strategy the government also appointed a special Innovation Policy Council. These initiatives are in line with the Lisbon Strategy (of the European Union), which has a pronounced goal of making Europe the most dynamic and competitive economy in the world by 2010. The Lisbon Strategy calls for innovation strategy initiatives that strive to the promotion of business investment in R&D, commercialization of research results, creation of new dynamic (SME) firms, injection of venture and seed capital, and the providing a fertile

environment for cluster regional cluster development. Sweden also takes an active part in EU Framework Programme for Research, Technological Development and demonstration.

As part of the innovation strategy the Government is developing programmes for maintaining and strengthening Sweden's leading position in some key sectors: the metallurgy industry; the forest and wood industry; the vehicle industry, the pharmaceuticals and biotech industry; the IT and telecom industry, and finally, but not least, the aerospace industry.

Sweden is very much dependent and sensitive to the world economy. But so are most other countries in the present trend of globalization. In the case of Sweden there is a special type of dependency, although not unique, resulting from the dominant position that large multinational corporations (such as Ericsson, Volvo, Saab, ABB, Astra Zenica) have in the Swedish NSI. The industries listed in the sector programme above account for 80 percent of Swedish business investment in R&D, they generate about 70 billion dollars in exports and provide almost 600 000 jobs in Sweden.

The Third Mission

Since the late 1990s the Swedish system for higher education has been given a so-called Third Mission, which means that in addition to the two traditional tasks, education and research, the universities and other academic institutions are also obliged *to interact with surrounding society and economic life*. This new task has caused quite a lot of controversy and will be dealt with at length in discussed in Section 4.

Cluster Policies

Due to the benefits associated with a range of so-called agglomeration economies, the concepts of Innovation systems and clusters have attracted the interest of the research community and policy makers wanting to facilitate innovation and competitiveness in industrial growth sectors such as biotechnology and telecommunications, as well as to support local economic development in disadvantaged localities and regions.

The notion of innovation system puts an explicit emphasis on innovation as the summoning force driving competitiveness and performance. It has inspired a literature that has dwelled into mapping and examining the way different actors and institutions impact on conditions for innovation. In part, the innovation systems approach aims to broaden the scope of the policymaker to encompass actors, institutions and infrastructure that may be most important to address in order to improve the potential for innovation and economic growth. It has contributed to an understanding of innovation as a process by paying attention to linkages between different types of institutional arrangements, organizational forms and configurations of relationships among individuals as well as organizations.

The concept of innovation systems has features in common with the cluster approach, applying especially to the *Regional Innovation System* (RIS) approach. Clustering is generally defined as a process of firms and other actors co-locating within a concentrated geographical area, cooperating around a certain functional niche, and

establishing close linkages and working alliances to improve their collective competitiveness. In one sense, the cluster concept is narrower in its definition than that of innovation systems, since it is functionally delimited. While a cluster consists of co-located, interconnected actors *in a particular field*, an innovation system serves as a framework for the creation of capabilities for firms *in a variety of sectors and activities*. Furthermore, the cluster concept is generally viewed as having a more demanding definition (a high density of functionally related firms, etc.) while the notion of an innovation system is so loose that it may be interpreted as appearing almost everywhere.

Clusters and innovation systems may clearly co-exist. While an innovation system may contain several clusters, however, it need not itself be a necessary ingredient in a cluster. Clusters often play an important role in innovation systems, serving as the basis for their perhaps most effective and intensive interactive processes. The most important difference, however, is probably that the concepts place the attention differently. That of clusters focuses on the way that interactions and transactions at the micro level occurring day-by-day shape competitive relations, taking account of markets, suppliers, partners, etc. Innovation systems, on the other hand, focus on the mechanisms for generating innovations, including both the overriding macro framework and incentives structures between institutions that are highly specific for innovation.

Proponents of clusters thus tend to be more prone to emphasize spontaneous interactions and concrete efforts by firms whereas proponents of innovation systems are likely to place relatively greater weight on the role of public institutions and framework conditions. Such differences may or may not show up or have practical implications in the specific case and furthermore both approaches can be utile in enhancing each other and setting up of proper policies.

The stakeholders, institutions and infrastructure that are the nucleus of a regional innovation system existed prior to these new efforts, such as targeted FDI promotion, Incubators, Science Parks, Applied research and engineering, IP-rights reforms, University/industry collaboration. What is new from these last years is approaches that tries to systemize the relationships between the components and how to improve the system.

The Role of Vinnova in Sweden

Innovation System and Cluster thinking has been present in Sweden for a number of years both on a national level as well as on regional levels. The topic of clusters has mainly been promoted by the ministry of industry, from a growth perspective, but also from the ministry of education due to the links between universities and industry, and also by the foreign ministry as a way to promote FDI, mainly through the Invest in Sweden Agency (ISA).

Sweden has in a pioneering way developed a specific governmental organization focused on supporting the development of innovation systems, *Vinnova* (an acronym for the Swedish Agency for Innovation Systems). Vinnova's mission is to promote sustainable growth by financing RTD and developing effective innovation systems, it

does so by integrating research and development in technology, transport and working life.

Vinnova has launched a cluster program as a means to push for new ways of approaching regional policy more broadly. Through the so-called *Vinnväxt* program, Vinnova is attempting to inspire enhanced competition and experimentation through a contest over which regions are able to advance the most competitive clustering alliance in a particular field. Different regions are encouraged to build broad based alliances of actors, from universities, private and public sectors. These alliances should interact in particular fields in order to enhance the regional innovation system and make them globally competitive and also secure resources in order to match the Vinnova funding. If a project is chosen Vinnova provides 200 million SEK for ten years for projects.

All regional business development agencies have been asked to incorporate cluster and regional innovation systems thinking in their regional development programs (RUP) and in their regional growth programs (RTP). The national business promotion agency (Nutek) is assigned to coordinate this work, by analyzing the needs of different actors, possible collaborative efforts and the promotion of best practices.

Vinnova, Nutek and ISA have jointly launched the *Visanu-program*, which is an effort to strengthen clusters and innovation systems as policy tools. It consists of three main components; i) process support, which is given to regional innovation systems and clusters that has been chosen by regional government as suitable for increasing international competitiveness. In total around 30 regional initiatives have been given support; ii) knowledge development with the aim of supporting the development of dynamic clusters and innovation systems; and, iii) international promotion, in order to attract foreign investments and international competencies. Visanu has also created a network for regional process leaders and is involved in the creation of the Dahmén institute, a non-profit organization, aiming to link researchers and practitioners in the development of innovation systems and clusters.

Vinnova's program, *Forska@Väx*, was introduced in 2005 with the purpose of contributing to R&D efforts in SMEs. Both policymakers and company representatives have dubbed the program a success. The traditional Swedish strength - some very large and successful, but mobile MNCs, contributing with about two thirds of Swedish R&D - have increasingly been challenged by various manifestations of globalization. This has in turn meant that innovative SMEs now much more than before is at the policy focal point. A comprehensive policy effort, *Innovative SMEs – The Future of Sweden*, has been recently been launched by Vinnova in order to suggest policies on a whole range of areas for these companies.

In Search of a New Model

Sweden provides an intermediate case in between US and Japan, with a mix of bottom up and top down initiatives. A relatively weak “top down” introduction of a “third mission” for universities to be more involved in society has been variously interpreted. It can mean anything from educational outreach to better inform the public about academic activities to the establishment of a range of technology transfer mechanisms.

Intellectual property emanating from academic research, irrespective of the funding source, is owned by academics and its disposition is up to them. It can be transferred to an existing firm; handed over to a university organization or used as the basis for firm formation, as academics see fit. Given a tradition of industrial interaction primarily with large firms, most intellectual property flows to companies through informal relationships, as in Japan.

The Effect of the Intellectual Property Regime

According to some observers, diffusion of research results in Sweden is hindered by the current intellectual property regime. A “professor’s or university teacher’s exemption” from employment contracts giving ownership to the employer was confirmed in a 1949 law. Ownership, however, is a formal rather than a real incentive to transfer technology, without a source of resources to do the follow-up research to produce a prototype, prepares a patent application to protect the intellectual property. Moreover since existing firms are often unwilling to license discontinuous inventions, a source of seed venture capital is required to form a firm to further develop the technology and move it toward the market. Individual academics seldom have the knowledge and resources to realize benefits from their formal ownership rights (see further Section 4 of this paper).

Thus, government policies and programs have encouraged universities to form “Holding Companies” to purchase intellectual property rights from professors. Regional technology development agencies have also provided funds to support technology transfer and firm formation. However, these initiatives are typically splintered and competitive without a clear focus provided by a highly professionalized technology transfer office within the university. Internal academic initiatives, complemented by government programs, have thus far been more important to the academic entrepreneurial transition than changes in the intellectual property regime.

3. Mapping the Academic System in Sweden

Expansion of higher education

Compared to several other European countries, Sweden has a relatively small research institute sector. Instead, the Swedish academic system is dominated by universities and university colleges. In the Fall of 2004, there were 41 universities and university colleges of which 36 state-owned and 5 state-supported foundations.

The size of these academic institutions differs considerable, ranging from under a hundred employees for the smallest colleges to over 6 000 full-time employees and over 37 000 registered students at the largest university, in Lund, during the academic year 2004/2005. Together, the ten largest universities employed 71 percent of the total number of personnel in 2004, measured in person-years (SCB 2005b). In terms of R&D person-years, this dominance is further accentuated with 52 percent of total person-years carried out at the five universities in Lund, Uppsala, Gothenburg and Stockholm

in addition to Karolinska Institutet (SCB 2005a). Research in the academic system is, thus, fairly concentrated to the large universities.

The size and number of academic institutions has increased considerably in the post WWII period to accommodate a large-scale expansion of higher education. In the early 1960s, higher education was a matter for a small and select group. From a few thousand students, higher education has grown to today's mass-university system with close to 400,000 students engaged in studies at the university system. As can be seen from Table 2, the number of students enrolled at the universities more than doubled over the 25-year period 1980 to 2005.

Table 2. Registered students at universities/university colleges 1979/80 – 2004/05

Year	1979/1980	1984/1985	1989/1990	1994/1995	1999/2000	2004/2005
Students	184,095	187,773	193,175	269,632	319,036	394,523

Source: SCB, 2006

Research performers

Public research is performed mainly (64%) by universities and by university colleges. Money resources for public research are distributed by direct block funding to these institutions and by the research councils to individual researchers or research groups. Research at these institutions is also financed by funds from the European Union, the Swedish industry and research foundations. On average the fixed funding constitutes slightly less than 50% of the total funding of research in Swedish universities and university colleges. However, there is a considerable variation between different research subjects in this respect. Research within the technical sciences is to a high degree (2/3) externally financed and research within the humanities are the least externally financed area (1/3) (Government bill p 18).

Research funding

There are three public research councils in Sweden. The *Swedish Research Council* is the largest, with 2 523 million SEK at its disposal in 2005 for basic research in all areas of research. (Government bill p 17) It is a governmental agency under the Ministry of Education, Research and Culture, and it has three main areas of responsibility: research funding, research policy and science communication. Furthermore, it includes three scientific councils: for humanities and social sciences, for medicine, and for natural and

engineering sciences. Two other public councils are targeting specific research areas: *Swedish Council for Working Life and Social Research* (FAS), with access to 291 million SEK, and The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS), with 531 million SEK for distribution in 2005. Representatives from the research community are in the majority in these bodies, and international experts are frequently consulted to evaluate their policies and activities.

Vinnova is another important actor in research financing. Apart from developing effective innovation systems, it has the mission to finance Swedish R&D. For that latter purpose, it had 1 122 million SEK at its disposal in 2005. Several other governmental agencies are funding research within their specific areas of competence.

In the public funds for research and development is also comprised research financed with funds from research foundations established in 1993-94. They were financed by capital from employee funds. These entities receive no capital from the State, though the government appoints their boards of trustees. At the time of founding of these foundations, The Bank of Sweden Tercentenary Foundation got a share from the dissolved employee funds and is now the largest financiers of research in social science and in the humanities. Together these foundations distributed in 2004 about 1 500 million SEK.

Some foundations of private origin are also of significant importance. The Knut and Alice Wallenberg Foundation donated about 950 million SEK in 2004. Within the field of medicine there are several important actors financing research, e.g. funds for cancer, heart and lung diseases, and diabetes. Together these private or NGO based actors financed research, mainly within universities and university colleges, for 2 200 SEK in 2001 (Government bill, p. 17). Figure 1. provides an overview over the flows of funding in 2001 between the financing sectors and the research performing sectors.

Figure 1. R&D in Sweden by financing and performing sector 2001 (SEK bn)

strong legal framework has, however, not been supplemented by similarly strong implementation mechanisms.

Faculty Initiatives and Student Roles

The type of entrepreneurship that has emerged is, therefore, mainly an indirect kind, where either firms or students act as carriers of commercial ideas. There are different strategies among university professors representing a range of involvement in commercial activity. Despite the fact that they are reflections of the typical Swedish academic system and its regulatory regime, the typology should reflect the conditions for academic entrepreneurship in other European countries as well.

The first category, *the integrated academic-entrepreneur*, is still relatively rare among Swedish academics. The category is growing, though, especially in biotechnology and environmental technologies, and several of the interviewed university professors take active part in the operation of firms that they have founded. They have different strategies, though: some are serial firm-founders, with a clear sense of commercial and practical applications of their work, and are involved as founders or co-founders of several technology-based firms, based on their current research interests. While they seldom are involved in the daily activities of their firms, they serve on the board of the companies and/or act as senior consultants, etc. In most cases, former students run the companies on a daily basis and/or colleagues of the university professors, who have left for various reasons, such as closed career paths, or low wages.

The most common form of commercial involvement is that of the *cautious strategist*. The university professor makes a calculation of the benefits of commercial involvement. This involvement mainly takes place in new firms spun off from the academic setting. The cautious strategist is usually expected to (or invited to) give ongoing advice on a fairly wide range of issues. Sometimes funding agencies demand that research include a plan for commercial exploitation. This necessitates an organizational response, and a common reaction to these demands is a cautious one: as one interviewee said, “I am an amateur – I’ll leave the tricky commercial issues to those who know better”. However, with a declining venture capital market, this connection between academia and industry may become weaker, and the entrepreneurial future of the “cautious strategists” is uncertain.

The current focus of university-industry relations is on incremental innovation. The role as *consultant*, as discussed above, has emerged primarily in sectors where universities aid mainly established companies with relatively concrete problem-solving tasks. Given the often routine-based nature of these contacts, many research groups have spun off the consultancy role to firms, often run by former students and/or colleagues.

The university professor as a *network-builder* is a role where commercial involvement takes place without company formation. It refers to a role as provider of generic knowledge for a whole sector or sub-sector of the economy in areas where knowledge interplay is difficult to achieve via traditional entrepreneurship. This is particularly valid for areas with large obstacles to firm formation, but also when academic researchers for normative and other reasons are less prone to entrepreneurship: “I want to help industry and interact with it but not get involved in commercial activities directly”, said one university professor with a clear orientation toward basic research but working in an area with large industrial applications.

The mechanism for interacting with industry in this case was the heterogeneously composed research consortia. Funding agencies that support the consortia - rather than technology-based firms - acted as intermediaries between academia and large firms. This reflects the traditional tight relations between the state, industry and the university system in most European countries, and the role of the state as the conductor or orchestrator of academy-industry collaboration through various research funding schemes. A bottom-up entrepreneurial model is complementing these highly organized forms of interaction, where universities and academics themselves take on the role of entrepreneurial agents.

Although Sweden has traditionally had a high level of public funding of R&D, the so-called “Swedish paradox” of relative lack of translation of research findings into economic growth has called such spending into question (see further the debate in Section 4 of this paper). Nevertheless, the basic issue is whether to continue focusing on meeting the needs of a relatively small group of older, large corporations, several of which, like Volvo and Saab, have become branches of multi-national corporations or to shift focus to basic research and firm-formation as a strategy for discontinuous innovation in emerging technological areas.

However, there is also a large gap in transformation of start-up into growth firms. Most start-ups have few employees, little invested capital, and low revenue. In other words, many are virtual companies with little near term prospects for growth.

The Bologna Process

Historically, Sweden has scored low on “exports of students”, i.e. studies abroad. For Swedish students new opportunities for university studies in Europe arose with the Swedish adherence to the European Union in the mid 1990s, e.g. within the Erasmus program which makes it possible for students to study for part of their degree in other European countries. The current debate has to a large extent evolved around the so-called Bologna process, which perhaps should be seen against the background of the Lisbon strategy which includes measures in areas such as economic reform, R&D and social coherence. The overreaching target of the Bologna process is to create a single European area for higher education, The European Higher education Area (EHEA). The process comprises in practice more than EU member states (40 states had adhered after a meeting in Berlin 2003). One operative target is to harmonize the academic credit system and the cycles of higher education (Kim, p.1).

Sweden has participated in a somewhat more defensive manner in this process than its neighbours Norway, Finland and Denmark. Sweden has emphasized the importance of some domestic, distinctive features such as a 4-year doctoral education. (Kim, p.4, n.1). Representatives from some academic professional educations have expressed specific concerns regarding the proposed formula for European standardization: Bachelor level (3 years) – Master level (2 years) – Doctoral level (3 years). The Swedish Medical Association has expressed such worries regarding Medicine. They have *inter alia* maintained that the integration between clinical and pre clinical education would be in jeopardy if the entry point for the doctoral level would be possible only after 5 years of study (students in medicine can presently enter their doctoral studies after 2 years and integration between research and clinical education is encouraged) (<http://www.lakarförbundet.se/templates/ArticleSLF.aspx?id=9222>).

4. The Current Swedish Debate

It is generally acknowledged that debates on the editorial pages in the most influential daily newspapers are an increasingly preferred method used in order to influence policymakers and other important stakeholders in Sweden. In fact, politicians and other policymakers themselves see these articles as an effective and expedient way to get their message through. Ample space is available for each article, but the writers are carefully selected by the editor, seemingly much in accordance with the “news value” of the topic and the position of the writer in Swedish society. Higher education and research policy issues have increasingly been highlighted in this context.

A few years ago Ulf Sandström, research leader at the Swedish Institute for Studies in Education and Research (SISTER), presented some empirical findings from their research on the Swedish debate on research policy and its “long waves” from 1980-2001. During the 1980s, the debate on these issues in the daily newspapers was quite sparse and more descriptive than normative. When a right-center government took office in the early 1990s, at the beginning of a deep economic crisis, significant critique began to appear. Professors from the humanities protested against diminishing funding, the question of industrial relevance of university research became a hot topic, as well as the position of women in the Swedish research system. When the social democrats came back to power and appointed a new Minister for Higher Education, Carl Tham, the position of female researchers came at the center of the debate (Sandström, 2002, pp.53-54). The new minister also came under increasing pressure from well organized groups of researchers concerning diminishing research funding. (Benner 2002, p.72) The confidence between researchers and politicians was indeed low, and this was indicated by an increasing amount of debates in the media (Sandström 2002 p 55).

The next Minister of Higher Education, Thomas Östros, also a social democrat, presented in 2000 an official report, with the laconic title “Research” (“Forskning”). It was considered rather friendly towards the aspirations of the research community but instead a renewed critique regarding relevance of Swedish research, for industry and society at large, began to appear. During Minister Östros’ term of office the amount of media debates on research policy and associated issues increased, stabilizing at a high level (Sandström 2002, p. 55-56).

The current Swedish debate can best be categorized under three general headings, though the particular issues often are overlapping, interacting or clashing:

- 1) A general debate regarding higher education and research, such as organization, funding, the quality of university education and research, academic freedom and internationalization.
- 2) A debate concerning rights and promotion of e.g. women, ethnic minorities, social class and regions considered as underprivileged in the present Swedish education and research system

3) A debate concerning the economic and industrial relevance of Swedish research. In this category economic growth is an explicit or implicit policy goal.

Some issues will be discussed under each of these headings, but emphasis will be put on the third.

Third mission: Doubts about its Relevance

Since the late 1990s the Swedish system for higher education has been given a so-called Third Mission, meaning that in addition to the two traditional tasks, education and research, the universities and other academic institutions are also obliged *to interact with surrounding society and economic life*. The legislation was closely connected with worries regarding economic growth and increased unemployment rates. The new task highlights a classical discussion on ‘academic freedom’ within independent universities and ‘the university in service of society’. In a report made shortly after the introduction the third mission amendment, two researchers from the Centre for Regional Science in Umeå asked representatives from seven Swedish universities and university colleges on their views of different aspects of the third mission. Heads of departments, directors of studies and administrative personnel from selected departments (Computer Science, Physics and Biology) were interviewed. The institutions for higher education consulted in the report were: Umeå University, The Technical University of Linköping, Örebro University College, The Royal School of Technology, Karolinska Institutet, Lund University and Karlskrona/Ronneby University (Asplund and Nordman 1999). Based on the survey, the authors concluded *inter alia* that:

- Attitudes towards the Third Mission differed considerably between universities and also between departments within universities. For example, of the six universities with a department computer science, half of them were positive towards the Third Mission and half were negative.
- The Third Mission is of greater importance to small university colleges. Smaller universities to a higher degree need to build alliances with the local community in order to raise external funds to complement funds from the government.
- Time-pressure and massive burden of work on researchers are felt to be major obstacles for the researchers. The research community creates new ideas with a potential for economic growth, but often lack time to develop them.
- The Third mission is regarded by many to exert an extra administrative burden and an annoying source of paperwork, i.e. “more talk and less action.” (Asplund Nordman, pp. 30-31).

The Question of Affirmative Action in Recruitment

According to Laila Abdallah, a cultural anthropologist and gender issue specialist, women applying for research funding are not directly discriminated against in the Swedish system (Abdallah 2002, p.177). It is however, a fact that so far women are underrepresented at the higher levels of the research hierarchy, and one reason may be the existence of barriers of an informal character, such as lack of access to informal networks. (Abdallah pp 186-188) The gender issue is a much debated topic in Sweden

throughout the society as a whole. As for research, the debate seems to evolve around the barriers just mentioned on the one hand, and the gender perspective as a factor so important in government policy that it may threaten the freedom of academic research on the other.

Ethnic discrimination is sometimes discussed in connection with higher education. Students with an origin in countries outside Europe, mainly with families that have come to Sweden as refugees, have a low enrolment rate on the universities. Recently the Faculty of Law at Uppsala University admitted access to students with foreign background, in spite of the fact that their grades from secondary education would not have been sufficient under normal circumstances. After an action from a group of non-admitted students with better grades than some of the admitted students with foreign background, the magistrate court in Uppsala decided that the affirmative measures effectuated by the faculty, was not in accordance with Swedish law and was to be abolished (Dagens Nyheter, 13 December 2005).

The Swedish Trade Union Confederation (LO) is sometimes involved in the debate on higher education and research. Apart from issues concerning industrial relevance and the like, sometimes “socially biased recruitment” is discussed. In a recent article on the webpage of LO, the Swedish secondary education was debated. Enrolment in Swedish secondary education practically comprises almost all youngsters in the corresponding age-group. In principle, secondary education gives access to higher education, and a 50% enrolment of the age group in tertiary education is a government policy target. The system has been criticized for forcing all students into a strait-jacket of theoretical learning. In the mentioned article representatives from LO pleaded for a renewed interest in the upgrading of vocational training at the secondary level.

Myths in the Debate on STI Policies in Sweden?

Anders Granberg, RPI at Lund University and Staffan Jacobsson, Chalmers University of Technology, have scrutinized some dominant beliefs in the Swedish science policy debate. They conclude that the map based on these beliefs is “misleading in that it depicts Sweden as a nation:

1. that has an outstanding volume of academic research, whereas (they) suggest that Sweden is but one of many OECD countries in that respect. Given the peculiarities of the Swedish R&D system and the multiple functions assigned to the academic sector. Indeed, the use of time expenditure is an alternative indicator that opens up for the possibility that Sweden may even have a lower volume of academic research than some other OECD countries.
2. where ‘curiosity-driven’ research dominates, whereas (they) suggest that the direction of knowledge and competence development is largely in the hands of external funding of ‘needs-driven’, or ‘strategic’ research. In addition, at least at

technical universities, block funding allows for virtually no ‘curiosity-driven’ research, exploratory research.

3. where ‘curiosity-driven’ research is a threat to innovation and economic growth, whereas (they) argue that not only is the dichotomy between such research and ‘needs-driven’ research misleading but that these forms of research are complementary.
4. where there is a distance, or a substantial gap between academia and industry, whereas (they) argue that there is much evidence that suggest the opposite, although (they) agree that more can and should be done to exploit the complementarities.” (Granberg and Jacobsson p 334)

Regretting that the imperfect map has resulted in a “simple-minded focus on the ‘commercialization’ issues” they point to three policy challenges. They suggest “that academic research may not have the volume required to provide an attractive location for industrial R&D efforts but that there are still opportunities to pursue an offensive cluster-focused policy. Such a policy needs, however, to go much beyond simply increasing the volume of ‘needs-driven’ R&D.” Secondly, “the depletion of block funding has gone so far that it is likely to be harming the ability of the Universities (at least the technical universities) to fulfil their mandate and to be effective in implementing a cluster-focused science policy. The balance between external funding and block funding needs to be redressed.” Thirdly, they point out that “the ability of the Universities to play a role that is truly complementary to that of industry is threatened and has to be safeguarded. If that ability is reduced, universities may fail to live up to perhaps the most important part of their mandate, namely to be ‘responsive’ to scientific and technological opportunities and generate capabilities before industry articulates a demand for a ‘needs-driven’ science policy” (Granberg and Jacobsson, *Ibid.*).

The Swedish Association of Graduate Engineers, represents an important group in the Swedish system of innovation, and from another perspective than Granberg and Jacobsson, they reject the often discussed dichotomy between ‘curiosity-driven’ basic research and ‘needs-driven’ research. Pointing at MIT and its outward orientation that commenced some 100 years ago they maintain that ‘needs-driven’ research often leads to basic research, and that this creates new openings between different research areas (Civilingenjörersförbundet, p.15).

The Swedish paradox is a frequently discussed topic. How is it that Sweden, that statistically spends more on R&D and other factors of growth than perhaps any other OECD member, gets so little in return in the form of innovation and long-term growth? Olof Ejermo and Astrid Kander, from Centre for Innovation, Research and Competence Building in the Learning Economy (CIRCLE) at Lund University, have analysed this problem. They e.g. point out that there are no good theoretical or empirical reasons to expect a strong linear relationship between R&D and growth. (Ejermo and Kander pp 4-8) “Doing first-class research is not sufficient for excellence in innovation.” It has been argued that, “the dominance of US firms in the basic innovations in the Fifth and embryonic Sixth Kondratieff to have a lot to do with the *entrepreneurial* quality of

American research institutions”. Jochen Röpke speaks of a “mutation of the traditional research and teaching university into an entrepreneurial university”.

“*An entrepreneurial university* can mean three things:

1. The university itself, as an organization, becomes entrepreneurial.
2. The members of the university faculty, students, employees - are turning themselves somehow into entrepreneurs.
3. The interaction of the university with the surroundings, the ‘structural coupling’ between university and region, follows entrepreneurial patterns.”
(Röpke, pp.1-2)

Some issues with special relevance for the concept of *the entrepreneurial university* and the Swedish debate are presented below:

a) *The Question of Intellectual Property Rights*

Very few universities in the United States had developed patent policies prior to the late 1940s. At that time public universities were more frequently represented in the patent statistics than the private. This began to change after 1970, when private universities substantially increased their share of patenting. Lobbying by research universities was one of the factors behind the Bay-Dole Act in 1980. “The Act facilitated university patenting and licensing in several ways”, and “was part of broader shift in US policy toward stronger intellectual property rights” (Mowery and Sampat, p.228). However, according to Mowery and Sampat the act has so far not proven to have any (neither positive nor negative) effects. They say it cannot be proven empirically that the often claimed positive effects of the law have resulted in increased university patenting and licensing (Mowery and Sampat, pp.229-232).

The upgrading of intellectual property issues in the new US legislation had an impact on several other OECD member states, and Sweden is a case in point (Mowery and Sampat p. 232). Sweden is a staunch defender of intellectual property rights in international forums, notably concerning patents. In the Swedish university system, “researchers have long had ownership rights for the intellectual property resulting from their work, and the debate has centred on the feasibility and advisability on shifting these ownerships from the individual to the institution”. (Mowery and Sampat p 232) Several official reports have analysed the issue whether the ownership now granted to teachers and researchers at the universities (“professor’s, or university teacher’s exception”, i.e. an exception from Swedish legislation indicating the employer’s right to the inventions of his employees) should be maintained. This was most recently done by VINNOVA in the report Vinnforsk (VP 2003:1). VINNOVA concluded that the individual researcher should have a right to report patentable inventions and computer programs to the university or university college, where he or she is employed. Secrecy, at the full disposal of the researcher, should be connected to this, and the researcher should be recognised as the inventor (patent) or author (computer programme). It should furthermore be considered if the university should have a right to a reasonable refunding from the net revenue from e.g. patentable inventions. For the report,

VINNOVA consulted a number of important actors in the Swedish innovation system. A selection of their conclusions are presented below:

In a comment, Lund University wrote that the report had treated the question too superficially, and advocated unequivocally, that “the teacher’s exception” should be abolished. It was *inter alia* maintained that much research is conducted in research groups, where individual researchers often are not participating for the whole duration of a research project, and it is then a difficult task to judge the contribution from these individual researchers. The principal objection however, was that making research results useful, closely connected with the academic institution as they are, should not be a private matter.

The Royal Institute of Technology and Chalmers University of Technology were both of the opinion that “teacher’s exception” should be maintained in the short-run, but saw the need for changes in the longer run. Göteborg University held that an effective innovation system in the longer run would lead to the abolishment of the exception, and that it is not sustainable to view the rights of research results as solely a matter for the individual researcher.

Teknikbrostiftelserna (7 regional foundations designated to develop linkages between academia and industry, now integrated with *Innovationsbron* AB) argued, with one exception, for *status quo*, and so did *Företagarna*, the national organisation for SMEs. The Confederation of Swedish Industries (larger companies), on the other hand, advocated for an abrogation.

The Swedish Trade Union Confederation pointed out that, in the light of ongoing attempts to strengthen efforts to make use of research results, it is natural to give research institutions ownership to these results. SACO (The Swedish Confederation of Professional Associations) and SULF (Swedish Association of University Teachers) both wanted the exception to remain. So did TCO (The Confederation of Professional Employees), but wrote that future efforts should be directed at changing the Swedish science system so that the teacher’s exception can be abolished.

The Swedish government has appointed a committee, led by a law professor, to investigate the legal effects of an abrogation of the teacher’s exception. This means that an abrogation is the principle alternative for the government in this much discussed matter. (Government bill pp 160-164) Recently, the committee presented its final report. It was suggested, that if it would be decided by the parliament to abolish the teachers exception, the researcher should get a certain bonus and a right to a third of the commercial profit. That alternative was strongly rejected in a newspaper article written by some academic entrepreneurs in Lund. Their most important argument was that it would damage innovation if the individual researchers/entrepreneurs would have to buy back inventions from the university if they decided to change career, to start a company and become entrepreneurs of their own. (Sydsvenskan January 15 2006).

b) *The Question of University Holding Companies*

Holding companies: The Swedish Parliament gave in 1994 a right to universities and university colleges to establish holding companies to procure, hold in trust and sell

shares in project and service companies engaged in R&D. Later they were also given a right to have companies with the purpose of arranging commissioned education. Such holding companies have so far been established at 14 universities and university colleges. These companies have evolved in somewhat different ways in accordance with differences in specialisation, size and the structure of the local business environment. According to *Vinnova* (Vinnforsk VP2003:1) the Swedish research institutions have already sufficient funds to support and strengthen the incentives for the commercialization of research results. The primary weakness in the system is rather insufficient financial resources in the holding companies. *Vinnova* consulted also on this issue a number of actors and stakeholders. Most of these agreed with the findings and conclusions of *Vinnova* on a general level, but some of them pointed at a lack of resources and competence, and at negative attitudes toward commercialization of research results as highly potent obstacles for the institutions.

Uppsala University, Göteborg University, the Faculty of Engineering at Lund University, and The Royal Institute of Technology argued that the role of research institutions must be strengthened. Others pointed to the fact that these institutions are part of a larger system with many different types of actors and that a suitable delimitation of their functions must be elaborated (e.g. Linköping University, Blekinge Institute of Technology and the Swedish Energy Agency). “Teknikbrostiftelsen” in Linköping held that universities are unsuitable to “godfathering” innovation systems, and that they are a very natural actor in the first part of the process but that they do not have enough knowledge or position for such a task. Furthermore, they pointed out that the problem is not the lack of financial resources, but a lack of clarity on what the holding companies shall accomplish.

The *Confederation of Swedish Enterprises* and other organisations representing the private companies have underlined the importance of an increased co-operation between the universities and the private sector. Several actors, such as Uppsala University, Göteborg University, The Royal Institute of Technology, the airplane and car manufacturer SAAB and The Swedish Trade Union Confederation wrote that the holding companies could be made more useful in developing the innovation systems of the learning institutions and for the first steps of commercialisation, e.g. through legal and business consultancy services.

The *Knowledge Foundation* (KK-stiftelsen) is working to enhance Swedish competitiveness by supporting e.g. new universities and university colleges and competence development in industry. They stressed that every institution should have the right to establish holding companies, but that this should not be mandatory. To be effective these companies demand a high degree of experience concerning commercialization, business development, patenting etc., and that it would be difficult for many to sustain such competence. It should be explored if one could find ways for co-operative structures between such companies at different learning institutions. (Government bill pp 168-169)

c) *The Need for Venture Capital*

Joseph Schumpeter underlined the importance of financial capital for the entrepreneur to carry out new combinations, (Schumpeter pp 95-127 and *passim*). As already

indicated, financial actors are important elements in the STI approach, and individual entrepreneurs often regard access to capital, particularly in the early stages of the innovative process as their main problem. For this reason there has been a continuing demand to improve the system for access to such capital. The problem was accentuated with a dip in the business cycle beginning in 2001 and new companies in ICT and biotech were hit particularly hard, which in turn led to a sharply decreased access to venture capital. The Royal Swedish Academy of Engineering Sciences (IVA) has argued that it is important that the State has clear responsibility in the field of seed financing. IVA has initiated a project, CONNECT, which brings together risk capitalists, various experts and innovators to stimulate the development of growth companies and convey competence and capital (IVA 2003, p.13). In an article in the daily newspaper Dagens Nyheter in January 2005, the Minister for Higher Education, Thomas Östros, presented to the public a government plan to use 2 000 million SEK to strengthen the ability of Swedish companies to commercialize research results. The programme was implemented shortly thereafter and intends to secure access to capital for companies, as well as to strengthen competence building and to develop networks. A mother company, *Innovationsbron Ltd.* (Innovation Bridge), has been created with seven regional affiliates in close collaboration with the universities in Uppsala, Lund, Göteborg, Stockholm, Luleå, Umeå, and Linköping). VINNOVA works closely with the new company and has been given the task to establish new incubators (DN Debatt, February 18, 2005 and www.innovationsbron.se).

d) *Regional development*

Systems of innovation, clusters and business networks are to some extent related concepts and perhaps in some cases in the real world not easy to distinguish from one another. Academia, industry and policymakers are the three critical types of actors for networking and interaction in the Triple Helix-concept, and for clusters and systems of innovation relevant actors must be extended with at least two additional types: financial actors and intermediary organisations. Asheim and Gertler point at the regional level as important for successful innovation. As important parts of knowledge are tacit and “sticky”, and as “learning through interaction” often is crucial for innovation, geography matters in spite of the communications revolution (Asheim and Gertler, p. 293).

Swedish policies for developing clusters and systems of innovation have been directed to involve the regional level (Sörvik and Ågren, p.63). On a more general level, the Regional Development Programs (RUP) and the Regional Growth Programs (RTP) have been of significance for regional clustering and for the development of regional innovation systems.

Vinnväxt is a program led by VINNOVA (Swedish Governmental Agency for Innovation Systems). The aim of the programme is to develop dynamic regional innovation systems within specific areas of growth. It addresses companies, research institutions and policymakers that recognise opportunities in co-operation for the development of effective and internationally competitive innovation systems. The

programme has competitive character, and each year winners are selected for future support.

Visanu was a national programme for development of innovation systems and clusters as instruments for economic policy. It was a co-operation between three governmental agencies: Invest in Sweden Agency (ISA), Vinnova and Swedish Agency for Economic and Regional Growth (Nutek). The programme lasted, as planned, for three years (2003-2005), and parts of it are continued within the auspices of Nutek. The program was based on three main areas of action. Process support was given to promising regional innovation systems and clusters after a dialogue with representatives from the regions in question. Contributions were given in order to enhance competence and ability to manage initiatives for the development of such innovation systems and clusters. The overall target of this area was to enhance international competitiveness by financing business related co-operation between relevant actors. About 30 regional initiatives was supported within the programme. The second part of *Visanu* was knowledge development, which was carried out by collecting and diffusing insights that could support the development of dynamic innovation systems and clusters. Thirdly, international marketing was supported, and the main target of this area of activity was to stimulate regions to complementary, internationally competitive activities in a co-ordinated manner, so that they could be presented and used to attract international investors and international competence.

The “raison d’être” behind *Visanu* was to move from short-sighted, project-oriented efforts to a more process-oriented developmental perspective. For those regional actors that manages initiatives within innovation systems and clusters a national network of process leaders has been created. The network is organised by VINNOVA, *Visanu* (Nutek) and the Dahmén Institute (an organisation with the objective to unite researchers and practitioners for the development of innovation systems and clusters).

There is a clear connection between *Visanu* and other activities of relevant policymakers. *Visanu* has used its contacts within the Regional Development Programs to identify regionally prioritized initiatives. Many of these have participated in earlier phases of the *Vinnväxt* programme (Sörvik and Ågren, pp. 58-60)

The public debate on regional issues has largely been confined to two controversies. Firstly, a debate of a more general political character, on whether the regions should have additional political power. Sweden has no federal tradition, but pressure from the regions have increased since the Swedish adherence to the European Union. Secondly, there has been a debate on whether it is at all desirable to have active policies on innovation systems and clusters. The combatants have mostly been economists. At one extreme, the ultra liberals have maintained that there should be no such policies, since the market is always more economically effective. On the other extreme, some interventionists and protectionists have claimed that e.g. clusters can be created from practically nothing, and that self-contained clusters can protect from outside competition. Mostly however, the debate has been carried out between these extremes.

5. Concluding remarks and looking ahead

It would seem clear from the presentation that the Swedish academic system has been successfully expanded, maintained and adjusted according to policy targets in the post WWII period. Indicators on research input such as size of funding, as well as output such as number of patents and citation scores, point to the fact that the academic system produces research results of high international standards. Although there is a discussion as to the reliability of the indicators, most observers would agree that the Swedish universities hold their own against their counterparts in most other countries.

What is also clear, however, is that when the discussion centers on how the role and performance of academic institutions could be further enhanced to meet the challenges ahead, there is a great deal of confusion particularly on how universities can operate in tandem with the surrounding society and function as an engine of growth through providing innovations and entrepreneurship. One conclusion from a study on the attitudes towards the Third Mission of Swedish universities was that smaller university colleges by necessity are more integrated in the local community and regional development (Asplund and Nordman 1999, p. 30). Under favourable circumstances, such integration could ideally result in a symbiotic relationship between the private sector and the academic system in knowledge production and, possibly, the emergence or enhancement of local clusters. It would be interesting to follow this line of thought by examining and comparing the potential role of universities in a context of a local rather than national knowledge system.

For the UniDev project such regional approach could imply studying the region of Skåne in the Southern part of Sweden. Much of what is related to innovation processes and knowledge based economy can in this region be traced to the city of Lund and its internationally renowned university. In the early 1980s the Ideon Science Park was established between the Technical University and the School of Management and Economics, with the establishment of R&D departments for among others Ericsson and Astra Zeneca. The science park has been a great success and stands as model for other regions in Sweden and Scandinavia. Later on, much support functionalities have evolved, such as incubators, university owned patent bureaus that help researchers patent and commercialize their inventions, seed funding agencies, entrepreneurship coaching, etc. During the last fifteen years the other major cities of the region of Skåne have also opted for a similar infrastructure and there are currently university and college level education in Lund, Malmö, Kristianstad and Helsingborg, which also have similar support structures, even though some are coordinated from Lund.

In parallel to the development of the innovation infrastructure regional political system is working through their business development agencies to promote the regional innovation system and clusters. The region is working with coordination of; national level agencies for business support, funding and competence upgrading; the different universities and colleges; the incubators; the science parks, regional economic development tools, etc.

The region has been involved in winning the first Vinnväxt program with the agricultural and food cluster, Innovation in Border countries. This is collaboration between the Region, the Universities, and approximately 25 important food firms, which aims at enhancing and upgrading the region as the major Swedish food region.

To analyze the experiences of the stakeholders in the knowledge production system in this dynamic region, and to compare with other regions in the UniDev project, could provide valuable information on the process of formation of new knowledge as well as the efficiency of academic institutions as innovators and entrepreneurs.

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