

**Centre for Innovation, Research and Competence
in the Learning Economy
(CIRCLE)**

**A Centre of Excellence at
Lund University, Lund, Sweden**

Plan of Action, 2004-03-23

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1. CIRCLE

1.1 Introduction

This is the action plan of the Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE), a Centre of Excellence based at Lund University, Sweden, and partnered with Blekinge Institute of Technology, Sweden. CIRCLE is financed by the Swedish Agency for Innovation Systems (VINNOVA),¹ Lund University and Blekinge Institute of Technology. Established in July 2004, CIRCLE has a mandate to conduct multidisciplinary research and education on the following issues:

- Long-term perspectives on innovation, structural change and economic growth.
- Entrepreneurship and venture capital formation with a special focus on new ventures.
- The dynamics of R&D systems and technological systems, including their impact on entrepreneurship and growth.
- Regional innovation systems in different national and international contexts.
- International comparative analyses of national innovation systems.
- Policy design based on policy learning.

This orientation reflects the capabilities of the founding partners and points to factors of particular importance for understanding the consequences of R&D investments for innovation and growth. This orientation also implies that we will focus on the socioeconomic and policy aspects of three kinds of learning: innovation, research and development and competence building. The result of this research is expected to be of major relevance to academia as well as to potential users and policy-makers interested in the dynamics of innovation and economic growth.

The multidisciplinary structure of CIRCLE, with six founding partners in different but strongly related fields of research, will generate 'value added' qualities in the research, teaching and communication of results already being pursued by the founding partners (see section 1.3). As will be demonstrated in this plan of action, the research focus of CIRCLE is designed to make the most of possible synergies created by researchers of different disciplines exploring similar fields of research. The partners of CIRCLE are active within the fields of innovation studies and management, economic geography, business administration, economic history, research policy and regional economics.

¹ VINNOVA, Swedish Agency for Innovation Systems, integrates research and development in technology, transportation and working life. VINNOVA's mission is to promote sustainable growth by financing R&D and developing effective innovation systems.

CIRCLE will start operating in July 2004. It will be funded for three years with a likely extension for another three years. If the extension is granted, a 'reconfiguration' of activities will be made. The general direction of activities will remain the same. However, the research will be redesigned and reorganized in light of progress and results achieved in the first period. Thus, this action plan describes strategies for the next three years as well as anticipated directions for the whole six-year period.

1.2 CIRCLE at Lund University – partners and regional context

CIRCLE is based at Lund University, Sweden. Founded in 1668, Lund University is the largest education and research unit in the Nordic countries, and has a long-standing reputation for solid knowledge production and distribution in almost all academic fields. Lund University has about 41,000 students, 3,200 Ph.D. students and 6,500 employees (among whom two thirds are active in research and teaching). The wide range of areas researched and taught at Lund University is demonstrated by its faculties: Technology (Lund Institute of Technology, LTH), Social Sciences, Economics and Management, Science, Law, Medicine, Liberal Arts and Theology, and Performing Arts. Within Lund University, there are also inter-faculty centres, including among others Industrial Environmental Economics, the Food Centre, and the Centre for European Studies. The size and quality of Lund University will benefit CIRCLE.

The founding partners of CIRCLE come from the Lund Institute of Technology, the faculty of Social Sciences at Lund University, the School of Economics and Management at Lund University, and the Centre for Territorial Development Planning at Blekinge Institute of Technology. The partners of CIRCLE are all represented by internationally well known researchers with solid academic track records. Prior to the establishment of CIRCLE, there had been cooperation and close contact between members of some partner institutes. The establishment of CIRCLE will create an opportunity to deepen such collaboration and secure the potential synergies of more intense collaboration and exchange of ideas and perspectives. The six partners in CIRCLE are:

- The Division of Innovation, Department of Design Studies, Lund Institute of Technology, Lund University (Professor Charles Edquist).
- Department of Social and Economic Geography, Faculty of Social Sciences, Lund University (Professor Bjørn T. Asheim).
- Department of Business Administration, Lund University School of Economics and Management (Professor Hans Landström).

- Department of Economic History, Lund University School of Economics and Management (Professor Lennart Schön).
- Research Policy Institute (RPI), Lund University School of Economics and Management (Reader Mats Benner).
- Centre for Territorial Development Planning, Blekinge Institute of Technology, Karlskrona, Sweden (Professor Jan-Evert Nilsson).

CIRCLE will be one important element among Lund University's many efforts to concentrate activities in the field of innovation.² The Vice Chancellor of Lund University, the Dean of the Faculty of Social Sciences, the Dean of the School of Economics and Management, and the Dean of Lund Institute of Technology have together given their support to the establishment of CIRCLE. This support is intellectual and organizational, as well as economic.

Lund is situated in the Øresund Region, the dynamic border region between Sweden and Denmark. Being located in Lund, CIRCLE will benefit from the regional knowledge potential. Lund University is, for example, a member of Øresund University, a network including twelve universities and university colleges on both sides of the Øresund. Within Øresund University, about 130,000 students and 10,000 researchers are active within a wide spectrum of disciplines.

As implied above, CIRCLE will be characterized by extensive contacts with users outside academia (further discussed in sections 2, 5 and 6). The Øresund region is a dynamic context for these kinds of activities. Commercial, industrial and academic life in the Øresund region is experiencing a dynamic integration phase, following the building of the bridge between Denmark and Sweden and the first steps taken towards the establishment of a functional region around Øresund. A great interest in the field of innovation and learning is shown by a number of different actors in the Øresund region.

For further development of the international contacts of CIRCLE, guest researchers will be invited for extended periods to create an exciting international research and teaching milieu. The establishment of an International Advisory Board (see section 6) will offer the possibility of inviting its members to Lund as guest researchers or to give seminars and lectures within the framework of CIRCLE. This will benefit not only researchers and students, but also interested user groups.

² Elements of these efforts by Lund University include the recent establishment of 'Innovationsforum' (which works with other actors in the region to coordinate and facilitate the commercialization of research results), of CIRCLE, and of undergraduate education in the field of innovation. There is also the Industrial Liaison Office of Lund University, established to facilitate interaction between commercial/industrial life and the university as well as to stimulate university employees to collaborate more with industry.

CIRCLE will complement the regional and national knowledge infrastructure by becoming a world-leading Centre of Excellence dedicated to the fields of innovation and learning. Such an establishment is much needed, in both the Øresund region and Sweden – as, for example, when it comes to developing expertise on the policy dimension and strategies to improve the functionality of the innovation system in a national and regional perspective. Even though the research conducted within CIRCLE will primarily focus on questions concerning the national innovation system and its regional elements, the competence structure and contacts of the partners of CIRCLE will make possible a future expansion of the research focus to include more sector-oriented studies of innovation systems.

1.3 The value added achieved by creating CIRCLE

The structure, characteristics and objectives of CIRCLE imply that it will create value added in relation to research, teaching, public service ('third task') and other relevant activities performed in the separate founding units. This value added can be summarized as follows:

- Thanks to its structure, CIRCLE will be multidisciplinary, i.e., exploring the same research area from different angles. This will be manifested in joint projects involving participants from the different founding units of CIRCLE (see section 3).
- CIRCLE will also cross faculty boundaries, as mentioned earlier. This means that the socio-economically oriented research and teaching carried out at CIRCLE will be closely connected to technically oriented research and education.
- The combined world-class competence of the founders and guest researchers invited to CIRCLE will contribute to international excellence with regard to research. Guest researchers will complement our in-house competence and contribute to bridging the gaps between research on the different kinds of learning.
- Research on the three kinds of learning in focus at CIRCLE (innovation, R&D and competence building) is already being conducted at the founding institutes and elsewhere. In addition to these studies, CIRCLE will strongly emphasize the systematic study of the relations between the three; researchers specializing in studying different kinds of learning will interact and learn from each other. This important synergy cannot be reaped solely at the level of the individual units. Moreover, it is crucial to combine research on the three kinds of learning since they are closely related in the real world, i.e., innovation is closely related to both R&D and competence building.
- Through teaching activities at CIRCLE, the integration mentioned above will be achieved at both the master's ('magister') and Ph.D. levels.
- Researchers and students connected to CIRCLE will have a physical co-location at Algatan in the very centre of Lund. This is seen as important for creating an authentic research and learning

environment beneficial to all actors, especially M.A. and Ph.D. students. The physical co-location of the researchers and students connected to CIRCLE will contribute to achieving the synergies mentioned above.

2. State of the art and specification of research problems

2.1 Background

In recent years, more and more attention has been paid to the concepts of knowledge and learning. The notions of ‘The Learning Economy’ and ‘The Knowledge-Based Economy’ reflect the fact that knowledge has become the most important factor of production in the modern economy and society. There has also been a growing interest in innovation, entrepreneurship and technological change, and their impact on regional and national economic development and welfare.

In the academic community, interest in better understanding and conceptualizing innovation has been great. In recent years a dominant view, the *Innovation System* (IS) approach, has emerged. The IS approach deals with the *determinants* of innovation – stressing the interactive learning processes between different organizations (actors/individuals, players) and emphasizing the importance of institutions (rules of the game) influencing organizations in their pursuit of innovation. It is a holistic approach, putting emphasis on the interdependency between the various elements of the system (e.g., the production structure and different parts of the knowledge infrastructure), as well as on the processes of interactive learning occurring among these various elements.

We would, however, like to stress that the term *innovation system* can be understood in different ways. A narrow definition of the innovation system stresses the R&D functions of mainly universities, research institutes and companies. We also intend to use the term innovation system as a broader concept, manifested in the interest of CIRCLE in a greater number of factors and conditions affecting the dynamics of innovation. This line of reasoning makes it possible to take into account a wider scope of factors affecting the conditions of innovation and learning.³ The dynamic between the market and public sector research can be seen as the interplay between three ‘spheres’ of society – industry, government and the higher education sector – with a ‘triple helix’ as one model and metaphor for this relationship. In the triple helix model as well as in the systems approach to innovation based on the interactive learning model, innovation is increasingly seen as an evolutionary process of complex, interactive, non-linear learning processes inside firms and between firms and their environments.

³ For a discussion of the definition and characteristics of innovation, see Edquist (1997; 2004).

The IS approach to the dynamics of innovation and economic growth needs to be developed in a number of ways. First, the system of innovation has to be put in a wider framework to explore the consequences of R&D and R&D-based innovation on productivity growth and economic growth (increased GDP/capita). Second, the IS approach needs to be developed into a more encompassing and consistent theory, in order to be used for predicting relations between variables. Third, the IS approach needs to broaden its focus beyond innovation processes to cover other forms of learning, such as R&D and competence building, understanding that each of these forms of learning requires the others in different relations in order to be instrumental in creating economic growth.

One major consequence of the discussion of innovation systems and technological change has been to locate, implicitly or explicitly, learning and knowledge creation at the centre of the debate (Edquist 1997; 2004). Thus the concepts and models of analysis concerning 'innovation' and 'knowledge' are often considered of great interest, not only to researchers and the academic community, but also to policy-makers and actors in commercial and industrial life. We would like to emphasize that there are close relationships among the concepts of innovation, entrepreneurship, technological change, economic growth and public policy. 'Innovation' and 'economic growth' are interrelated policy areas.

If innovation policy is to be developed as a major area of practice in Sweden, policy learning from attempts made in Sweden and other countries will be of great value. Since systems of innovation constantly undergo changes, continuous analyses of innovation systems at different levels in Sweden as well as internationally should be carried out in order to provide the necessary theoretical and empirical basis for the formulation of an effective innovation policy. Problems and their causes have to be identified to find adequate means for problem solutions.⁴ Innovation processes have to be put in the centre of such analyses, even if factors within other policy areas also influence innovation processes. In this way CIRCLE will be able to contribute policy relevant knowledge and analyses promoting economic growth and welfare.

2.2 Specification of research problems

The notion of 'the Swedish paradox' has a central role in current Swedish discussions of R&D and innovation policies. It originally refers to the fact that although investments in R&D have been very large in Sweden, the pay-off in terms of the proportion of R&D intensive products in industrial production has been meager (Edquist 2002:33-36). This paradox is related to insufficient

commercialization of research through innovation processes carried out by entrepreneurs. There might, however, be obstacles of other kinds in the process of transforming R&D into economic growth. As the VINNOVA program on 'Innovation System Research on R&D and Growth' has emphasized, in order to increase the economic growth benefits of R&D it is essential to identify these obstacles and explore the nature of the paradox. A central task of CIRCLE will be to integrate research on different levels of the process, from R&D and innovation to economic growth.

The aim of CIRCLE is thus to combine research that covers both micro and macro processes, regional, national and international levels, competence building and learning processes involved in R&D and innovation, and apply to these a systems approach as the framework for analysis. In doing this, the research will focus on:

- The socioeconomic aspects of learning processes with a strong emphasis on the public policy and firm strategy aspects.
- The dynamics of innovation, R&D and competence building at the micro level (firms and networks), the meso level (regional or sectoral) and the macro level (national, international), stressing the dynamic complementarities between the forces of growth.

At the core of the processes leading from R&D to economic growth, we can distinguish at least three different kinds of learning:

- *Innovation* (in new products as well as processes) which takes place mainly in firms.
- *Research and Development (R&D)* which is carried out in universities and research organizations as well as in firms.
- *Competence Building* (e.g., training and education), which is done in schools and universities (schooling, education) as well as in firms (in the form of training, learning-by-doing, learning-by-using and individual learning, often throughout life). Competence building is the same as enhancement of human capital. The main focus of CIRCLE here will be on economic aspects of competence building, and not on schooling/educational studies.

The relations among the three kinds of learning are very seldom addressed. At CIRCLE the three kinds of learning will be studied as such, but there will also be strong emphasis on their interdependencies and the socioeconomic and policy aspects of learning processes.

⁴ For a discussion on innovation policies and problems associated with the Swedish innovation system, see Edquist (2002). See also Benner (2001) on the development of Swedish R&D policy during the last decade.

At the micro level, the firm is a central agent of R&D, innovation and economic growth. In this perspective, the role of the entrepreneur is important. Entrepreneurship includes not only entrepreneurship at universities and in large companies (corporate entrepreneurship, intrapreneurship), but also individual entrepreneurship. The central focus of entrepreneurship research is on how business opportunities that bring into existence ‘future’ goods and services are discovered, created and exploited, by whom and with what consequences (Shane and Venkataraman 2000).

The turbulence of the ‘new competitive landscape’ that we have seen during the last two decades creates an uncertainty and disequilibrium that constitute a favourable milieu for new business opportunities and new venture creations. Politicians and decision-makers collectively see new businesses and entrepreneurship in existing organizations (corporate entrepreneurship), and especially business opportunities based on R&D and innovations, as main contributors to growth (Landström 2000; Sexton and Landström 2001). In this context, there is a growing emphasis on the importance of venture capital to finance innovative entrepreneurship.

The creation of innovations and exploitation of business opportunities rely in many cases on the formation of territorially based innovation systems (national and regional). It is acknowledged today that regions supply a basis for competitive advantage, increasingly important for achieving economic growth in a globalizing economy. This demonstrates the complementarity of firms and regions/nations, and underlines the important relation between firms and regions/nations. Porter’s notion of ‘competitive advantage’ usually refers to nations⁵ while innovation is usually associated with firms. It is one of CIRCLE’s challenges to develop knowledge about the formation of national and regional competitive advantages through innovation.

A central question in this research area is the relative importance of local (regional) and non-local (extra-regional) factors for the promotion of innovativeness and competitiveness of regional clusters. For more than twenty years a strong case has been made that territorial agglomerations are growing in importance as competitive locations of economic activities in post-Fordist learning economies.⁶ The main argument has been that spatial clustering provides the best context for the promotion of localized learning and endogenous economic development in regions, which could be further stimulated by the formation of regional innovation systems and learning regions.⁷

As a consequence of policy-makers’ increased interest in the theories and concepts of innovation systems, attempts have and will continue to be made, in Sweden and elsewhere, to ‘build’ or actively

⁵ As in for example Porter (1990).

⁶ For an overview of this field, see Asheim (2000).

⁷ For an overview of this field, see Cooke (2001) and Asheim and Gertler (2004).

promote the emergence of regional innovation systems. Detailed studies show that the creation of regional innovation systems is a complex process hard to control.⁸ However, studies are required to gain more extensive knowledge of the dynamics of emerging systems of innovation. Such studies, carried out within the framework of CIRCLE, will address not only the policy dimension but also important questions such as the role of leadership and the dynamics of learning and competence building in emerging regional innovation systems.

CIRCLE applies the broad definition of innovation systems (mentioned earlier) as the starting point for studying competence building. The research will focus on integrating learning and innovation through organizational innovations. It will promote learning organizations, based on broad participation, within firms, and among firms in networks. On the regional level it will support learning regions in order to stimulate cooperation and social capital building.⁹

At the macro level, the relations among R&D, the diffusion of innovation within the economy, and economic growth are a key focus at CIRCLE. One vital aspect of these relations is complementarity (i.e., the property whereby the increase in one production factor improves the marginal return from another factor). This is a central feature in Dahmén's concept of 'development block' as a tool for understanding the impact of innovation on the economy. Complementarity is important both in the narrow and wider senses. Within the production process complementarity between capital and skills seems to be prevalent primarily with the introduction of new technology, which involves both increased returns of human capital and learning processes with productivity gains. In a wider sense, there are complementarities in the interplay among activities in different areas during the diffusion of innovations – e.g., among branches and at a more social level among production, infrastructure and institutions. These aspects also emphasize the importance of economic policy in the chain from innovation to economic growth.

The concept of development block also provides a link between micro behaviour (within firms) and macro results in economic growth, with a particular edge to the so-called productivity paradox (i.e., the observation that periods of high innovative activity have been characterized by rather slow economic growth). The transformation of the economy with the diffusion of radical innovations may in the short run cause bottlenecks while the productivity-enhancing effects are released in a somewhat

⁸ For an empirical analysis of such a process see Nilsson (2002).

⁹ For an overview of this field, see Asheim (2001). See as well the new initiative from VINNOVA on 'innovation and learning', which aims at developing dynamic innovation systems through broad participation and active research collaboration. This has resulted in a Swedish-Norwegian research project with the provisional title 'Benchmarking Nordic Innovation Systems'. Its main focus is on studying the links between organizational and technical (process and product) innovations. Another initiative from VINNOVA related to this area of research is the establishment of 'Dahmén centres', which aim at promoting learning, competence building and leadership in regional innovation systems in order to strengthen the competitiveness of regions.

longer perspective under more stable conditions (Schön 1998; 2000). To identify the impact from different structures or institutions, studies need both a long-term historical perspective and an international comparative perspective, which will be supplied by CIRCLE.

Thus, at CIRCLE we will study innovation, research and development as well as competence building in a perspective of economic growth. An important part of this work will relate to firm strategies and public policies with regard to innovation, R&D and competence building. To a large extent these analyses will be comparative, i.e., various systems will be compared in detail. If such analyses reveal weaknesses with regard to resource input or resource use (performance), this points to public policies required to mitigate the problem or weakness identified. However, there must also exist an ability to pursue such policies on the part of the public sector – otherwise any attempt to intervene will end in failure. Policy design in the fields of R&D, innovation and competence building must be built on a sophisticated knowledge base. International ‘policy learning’ is crucial.

3. Planned research

The research within the framework of CIRCLE will be focused on four research areas. Specific research projects will be formulated in these fields, which may change over the years of CIRCLE’s operation. The four areas presented below constitute core areas of CIRCLE research. As will become obvious, the research areas are closely related. Additional areas within the general research focus of CIRCLE may also be added at a later stage.

3.1 Research area 1: Learning in systems of innovation and the effects of R&D and innovation on growth

At CIRCLE the ‘transformation’ of R&D and innovation activities into economic growth will be of primary interest and hence not treated as a black box. Analytically two major steps have to be taken – to develop further the innovation systems approach, and to integrate this into growth analysis.

The systems of innovation approach has diffused surprisingly rapidly and is now widely used by academic analysts, policy-makers and – increasingly – firm strategists. This is because compared to alternative approaches the systems of innovation approach has many strengths, such as placing innovation and learning processes at the centre of analysis, adopting a holistic and interdisciplinary perspective, employing historical and evolutionary perspectives, emphasizing interdependence and non-linearity, encompassing both product and process innovations and emphasizing the role of institutions.

However, the approach is also characterized by conceptual and theoretical weaknesses. It can be argued to be ‘undertheorized’. Therefore one of the goals of CIRCLE is to increase the approach’s rigour and specificity. This will be done by focusing on the main components (organizational actors and institutional rules) in the approach and hypothetically identifying the main functions or activities in the systems (a process which has not previously been done in a systematic manner). Among these activities we will find R&D as well as competence building. Hence, the systems of innovation approach focuses upon three kinds of learning of economic significance: innovation, R&D and competence building, and we will address the relations between them. In this research area we will increase the consistency, coherence and specificity of the SI approach. This work will mainly be conceptual and theoretical.

On this basis, we will focus upon the growth effects of learning. In a first stage we will concentrate upon the consequences for productivity growth of R&D and innovation. It is generally accepted that innovation is a major, if not the most important, source of productivity growth and that R&D is also very important in this respect. This is a view held by most economists – including those outside the innovation studies community – and also by many others who have reflected on the issue. However, when it comes to knowing in precise detail the interconnections between R&D, innovation and productivity growth, we get less clear answers. It is simply very difficult to distinguish innovations and R&D from other sources of productivity growth. It seems that statements about the importance of innovation and R&D for productivity growth are based on calculations requiring strong simplifying assumptions or on arguments of a long-term historical and common sense character. We will begin by synthesizing existing approaches to analyzing the growth effects of R&D and innovation, and produce an account of this research area’s state of the art.

This synthesizing work will be supplemented with detailed empirical analyses of the role R&D and innovation play in relation to other determinants of growth. On one hand, there are the traditional inputs used to calculate total factor productivity or technological shifts in the production function, i.e., fixed capital, labour, human capital, energy, etc. On the other hand, there are measures or indicators of innovative activity such as R&D, number of patents and technological level of production. There are certainly interrelations or strong complementarities between these factors. Thus, growth effects from R&D are likely to involve investments in new machinery as well as changes in the labour force composition with increases in the stock of human capital.

A time-series investigation of these relationships extending back to the mid-1960s is essential for a number of reasons. Different time perspectives will be important in delineating the growth effects of innovations, bearing in mind that radical innovative activity may have a rather long time lag from first

implementation to eventual spurts of growth. Strong transformation of industry and intense innovative activity may even coincide with a slow-down in productivity growth as noted in the 'productivity paradox' (David 1990; Schön 1990). Long-term series, in addition to an international comparative perspective, will also facilitate analyses of impacts from institutions and economic policy upon the R&D growth effects, which would otherwise be skewed as shifts in economic policy and institutional arrangements occurred unevenly internationally in the 1970s and 1980s. Furthermore, growth effects from R&D are likely to be influenced by differences in economic or industrial structure, e.g., differences in knowledge intensity or technological level, while at the same time influencing such structures, which is a process over time.

There will be a synergy with research at the Department of Economic History in establishing internationally consistent measures of value added and of inputs into the production process. Such time series are essential to analyze changes in total factor productivity and the contributions of different factors to growth. A research team headed by Professor Lennart Schön is very well experienced in the construction of historical data series. International comparative projects are currently running, investigating investment and growth performance as well as energy systems and long-term growth. Such long-term analyses will also provide platforms for prospects on future growth performance. The relations between technology shifts (i.e., the introduction of so-called General Purpose Technologies), R&D and growth at an international level will be addressed in particular. Processes of forging ahead (creating technological leadership) and catching up (following) as well as patterns of divergence-convergence of growth rates will be analyzed in relation to different forces of growth. A particular focus will be on the role of the three kinds of learning (innovation, R&D, competence building) in generating and responding to growth.

The analysis is performed with both qualitative and quantitative methods. Thus time-series econometrics is employed, and in particular co-integration technique that can handle the multidimensional causal relationships in growth processes.

As research in the different program fields of CIRCLE develops, the growth analysis will integrate other factors, such as variation in entrepreneurial activity, regional structures, policies of competence building, etc.

Research area leaders are Charles Edquist and Lennart Schön. Two post-docs and one Ph.D. student will also be involved.

3.2 Research area 2: Studies of regional innovation systems

At CIRCLE research on the formation, role and structure of regional innovation systems will have a strong policy focus in order to provide insights relevant to policy making aimed at improving regional innovation systems in Sweden. The issue of regional innovation systems will be studied through international comparisons as well as process analyses.

In order to advance an understanding of which types of regional innovation system represent effective innovation support for different kinds of industries in different regions analyses must be contextualized by reference to the actual knowledge base of various industries as well as to the regional and national institutional framework, which strongly shape the innovation processes of firms. In the research that will be carried out we shall distinguish between *analytical* and *synthetic* knowledge bases. A distinction can be made between ‘traditional’ clusters where regional innovation systems are built in order to support innovation and localized learning, and the existence of relations between clusters and regional innovation systems which have emerged as a necessary part of the cluster’s development. The first category is nearly always to be found in contexts of industries with a synthetic knowledge base (e.g., engineering-based industries), while the second will normally be identified with industries based on analytical knowledge (e.g., science-based industries such as IT and biotechnology).

Furthermore, the relationship between regional, national and international innovation systems will be addressed through a multi-level governance perspective on the supporting regulatory and institutional frameworks. Of special importance is the linkage between the larger institutional frameworks of the national innovation and business systems, and the character of regional innovation systems. A distinction will be made between the traditional regional innovation system (which could be referred to as the institutional regional innovation system – IRIS) and the new economy innovation system (NEIS), which could be called an entrepreneurial regional innovation system (ERIS). The traditional IRIS (more typical of German regions or regions in the Nordic countries whose leading industries draw primarily from synthetic knowledge bases) is characterized by the positive effects of systemic relationships between the production structure and the knowledge infrastructure embedded in networking governance structures regionally and supporting regulatory and institutional frameworks at the national level. In contrast NEIS or ERIS (found in the US, UK and other Anglo-American economies) lacks these strong systemic elements, and instead gets its dynamism from local venture capital, entrepreneurs, scientists, market demand and incubators to support innovation that draws primarily from an analytical knowledge base. In making these arguments about a general correspondence between the macro-institutional characteristics of the economy and the dominant form and character of its regional innovation systems a link is provided to another useful body of literature

on ‘varieties of capitalism’ and national business systems, which relates to studies of national growth regimes in research area 3.1.

The central importance of highly educated people in the production of innovations in a knowledge-based economy in general and in analytically-based industries specifically means that the relatively small number of regions that offer the most attractive employment opportunities for highly skilled people and star scientists, as well as favourable conditions for academic entrepreneurs, will be preferred over others that cannot provide work at the cutting edge for well-known firms or research institutes. Moreover, such regions often offer a high quality of life in addition to attractive career opportunities, and thus have an even more marked advantage in the global competition for talent. Hence, it is an interesting question whether we will find the highest geographical concentration among industries with the most talented and creative people, which from a human capital perspective would provide optimal conditions for well-functioning regional innovation systems.

From the point of view of a process perspective regional innovation systems are looked upon as a social process involving continually changing elements and relationships. The innovation system has to be regarded as an operational system, as a real phenomenon, which raises the need for an alternative analytical approach to the systems of innovation approach presented in research area 3.1. To capture the complexity and dynamics of the process researchers have to follow and be part of the process. The researchers and actors involved have to participate in a joint and concurrent learning process, which means the researchers have to work alongside the actors of the regional innovation system. Such a participatory research approach will be problem oriented, dialogue based and adapted to the context. In their joint efforts to develop a regional innovation system they are parts of an instant and reciprocal learning process. Together they learn from their combined experiences and produce knowledge of the dynamics of the innovation system. The role of the researcher is to formulate and reformulate relevant questions, not to present prepared solutions. We plan to use this approach in studying a number of efforts and initiatives to build regional innovation systems.

Regional systems of innovation include organizations from different spheres of society. In the triple helix framework at least three different spheres – university, industry and government – are expected to interact in an innovation system. What characterizes a successful interaction between actors from these three spheres, which are based on different logics of action? What barriers have to be overcome to develop such an interaction?

Another important issue is the leadership of regional innovation systems. Appointed leaders cannot manage regional innovation systems consisting of a network of actors and organizations representing different spheres. Strategic leadership in such networks normally consists of a group of actors which

have established their position by taking initiatives and thus acquiring the support of other actors in the network. In this way there will be a struggle for leadership, and in many cases the actors constituting the leadership of an innovation system just do so temporarily. The issue of the dynamics of leadership in regional innovation systems still represents unknown territory, and thus studies of the dynamic interaction between actors involved in regional innovation systems and the leadership of such systems look promising from a scientific point of view.

A third important issue of the interactive approach is the learning process in regional innovation systems. Theoretical studies of systems of innovation usually conclude that an efficient learning process is a prerequisite for successful innovation systems. However, these studies discuss the effects of learning more than the actual learning process. An efficient learning process can, depending on the circumstances, look different in different regions. One aspect would be learning how to manage systems achieving expressed goals, defining efficient learning as increases in the ability to plan and control the system. Another perspective would be to improve the management of problems arising in the process. In these cases an efficient learning process is characterized by the goals as well as the measures being changed when new insights are acquired. The actors involved are participating in a process loaded with questions, but without any given answers. An interactive research approach can provide new insights in the characteristics of such learning processes and the mechanisms that may undermine learning.

Research leaders of this area will be Bjørn Asheim and Jan-Evert Nilsson (principal researchers) and Hans Landström. Four Ph.D. students will also be involved.

3.3 Research area 3: The entrepreneurial university and research-based ventures

The activities of this program area focus on the establishment and growth of research-based ventures. The work will cover the whole process from research and organizational issues to the market entry phase (and feedbacks between them). The program area takes as its starting-point the emphasis put on the academic system as an instrument of innovation policy in Sweden (and several other countries), and the recurrent statements that the commercialization of public R&D is a weak link in the innovation policy system. We aim to study the role of universities and academic researchers and research environments as 'hothouses' of new ventures and the mechanisms that relate academic research with corporate activities (both new and existing companies), to illuminate how the current system works and which potential commercialization models can be envisaged.

More specifically, the program area will cover the incentives for academic researchers to engage in commercial activities. This includes the study of entrepreneurial support mechanisms within the academic system, where the emphasis will be on individual and organizational incentives and motives for connections between research and entrepreneurship. An important part of the work will be of an exploratory nature, i.e., to develop a broad survey, and in the long term a database of commercial networks surrounding the academic system. This will feed into activities of both research areas 3.2 (especially the studies of regional policy structures) and 3.4 (as 3.2 is an intensive study of one aspect of innovation policy in Sweden).

A key issue for many research-based ventures is the supply of business competence, where the scientific and technological basis is complemented by entrepreneurial competence and experience (and vice versa). Here, we will study the entrepreneurial process from a ‘competence perspective’, including how scientific and technological competencies can be complemented by financial and organizational competencies (for instance, via business angles, venture capitalists, etc.).

Taken together, this program area will cover issues concerning the academic system and its norms, career paths and support structures in relation to entrepreneurship; the overarching organization of ‘needs-related’ research and the management of academy-industry relations among researchers and research groups; and the market-based support structures and their role in academy-industry interaction and entrepreneurship.

Research leaders of this area are Mats Benner and Hans Landström. Björn Asheim and Charles Edquist will contribute. Two post-docs and one Ph.D. student will also be involved.

3.4 Research area 4: Public policies in the field of innovation

The overarching goal of the work within this research area is to analyze the design, implementation and outcome of innovation policies. At a later stage the connections of innovation policy to other policy areas (e.g., policies for R&D and competence building) may also be pursued. The initial work will contain two parts: (1) innovation policy models will be analyzed from a theoretical and conceptual point of view, and (2) empirical studies of the development of innovation policy in Sweden will be carried out in an international perspective.

(1) The theoretical and conceptual part will describe and compare different innovation policy paradigms, which include neoclassical and evolutionary ones. There will be a focus on the criteria upon which innovation policy is designed, i.e., the rationales for public intervention in the process of innovation, including an analysis of the division of labour between private and public actors. The

analysis will also address the political economy of policy formation and the innovation policy implications inherent in the systems of innovation approach.

(2) The empirical part will focus on the emergence of different innovation policy regimes. Activities in this part of the program area will be divided into two broad activity fields: (a) a case study of the Swedish innovation policy paradigm, and (b) a comparative study of innovation policy design in several countries. The empirical studies will be divided into three stages: first, an analysis of the ideas, ideologies and historical trajectories of innovation policy; second, the institutionalization of the innovation policy ideologies in the form of policies, programs, regulatory bodies, etc.; third, the efficiency and outcome of innovation policy regimes. The first study area, the Swedish case, will examine current innovation policy, ideological basis, historical and institutional roots, and future development paths. This will be combined with a comparative study of the emergence of different innovation policy regimes, with focus on countries having an economic structure similar to Sweden (small, open economies). The comparative part of the activities will include studies of the role of various international agencies (the EU, OECD, WTO, etc.), think-thanks and ‘policy successes’ (such as Finland and ‘the Third Italy’) in the diffusion of policy models between countries and the transformation of national innovation policy regimes.

This combined theoretical (conceptual and classificatory) and empirical approach will enable a systematic understanding of the ideological roots, institutional forms and outcomes of innovation policies in Sweden in comparison with other countries. This, in turn, will relate research in this area to that of research area 3.2 and the study of ‘varieties of capitalism’. We also aim to relate the activities in this research area to that of 3.1., to enable systematic studies of the interaction between innovation policy regimes and long-term economic growth. Obviously research on the entrepreneurial university in research area 3.3. also has important policy implications.

Research leaders of this area are Charles Edquist and Mats Benner. Two post-docs will also be involved.

4. Relations to Ph.D., M.A. and undergraduate programs

The establishment of CIRCLE offers a unique opportunity to combine first-class research with education on different levels, within an internationally leading Centre of Excellence. The relationship between teaching and leading research is extremely important for creating the intellectually stimulating environment that will be realized within CIRCLE.

One important aspect of the activities of CIRCLE will be the training of Ph.D. students. While the founding partners have their own Ph.D. programs (except for the Research Policy Institute), a number of Ph.D. students will be active primarily within CIRCLE, although formally connected to the founding partners. With the establishment of CIRCLE, Ph.D. candidates connected to CIRCLE will be offered doctoral courses that constitute a common core. These courses will of course also be offered to other Ph.D. students on an international basis. The common denominator among the Ph.D. students associated with CIRCLE will be emphasized, creating an exciting interdisciplinary environment, enhanced by the physical co-location of CIRCLE.

CIRCLE will also establish a master's program, starting in 2005. It will be patterned on the ESST international collaborative M.A. program, which already exists. The ESST (European Studies in Society, Science and Technology) program follows a multidisciplinary approach in studies of the interrelations among technology, science and society. This is based on the view that studies of the evolution of technology and science must include economic, cultural, political and social dimensions.¹⁰ For example, one aspect the ESST program focuses on is the social and economic analysis of innovation. The ESST program is designed to offer training possibilities to academic students of different backgrounds, social scientists as well as engineers and humanities scholars.¹¹ Currently the ESST program is based on the international cooperation of 17 European universities.¹²

The founding institutes of CIRCLE provide bachelor's degree education in their respective fields. As well, Lund University, through Vice Chancellor Göran Bexell, has recently initiated the establishment of a bachelor's degree program in the field of innovation. This move is an indication of the great interest Lund University has in the field of innovation (as discussed in section 1.2). It is expected that CIRCLE will provide a source of competence to bachelor's education in the field of innovation and in other fields of learning. One of the founders of CIRCLE – Professor Hans Landström – is (together with Marie Löwegren) responsible for the development of courses in the field of innovation and entrepreneurship at Lund University. This program will start in the autumn of 2004.

¹⁰ Leif Hommen established and managed the ESST program at Linköping University for several years and will apply this experience with CIRCLE.

¹¹ www.unimaas.nl

¹² Aalborg, Athens, Bilbao, Brussels, Istanbul, Lausanne, Linköping, Lisbon, London, Louvain, Maastricht, Madrid, Namur, Oslo, Roskilde, Strasbourg, Tampere. The design of the ESST program is based on a two-semester system. Students spend the first semester at their home-university, during which all ESST universities follow a common curriculum. This facilitates student exchange during the second semester, at which time students choose a research specialization and write a dissertation. At this point, a student may travel to another ESST university offering the specialization selected by the student. From CIRCLE's point of view, participation in the ESST program secures a substantial amount of international exchange of both students and staff.

5. Expected results and communication of results

5.1 Expected results

After three years, CIRCLE will have contributed to knowledge of the determinants of innovation processes and the importance of innovations as factors influencing the possibility of attaining and sustaining competitive advantage in countries and regions. We will also have provided examples of the evolving synergies arising from the research, teaching and seminar activities within CIRCLE. An M.A. program will have been established and courses at the Ph.D. level will be offered. CIRCLE will also at this point have further developed contacts and collaboration with actors on national, international and regional scales. Further, CIRCLE will have become an active contributor to constructive discussions on innovation policy and economic development. This will be realized through the strategies for communication of results specified below.

At the end of the first three-year period, CIRCLE will, through its activities, have developed its international contact network further, adding to an already advanced basis. For example, one of the founders of CIRCLE (Charles Edquist) is the coordinator for the project *'National Systems of Innovation in a Globalizing, Knowledge-based Economy: A Comparative Study of Small Countries in Europe and Asia'*, which involves 35 researchers from the ten participating countries (Denmark, Finland, Hong-Kong, Ireland, the Netherlands, Norway, Singapore, South Korea, Sweden and Taiwan). Part of the research in area 3.2 will also be carried out through a comparative study of regional innovation systems in Canada and the Nordic countries based on the continuation of ongoing studies of Nordic and Canadian clusters and regional innovation systems at the Department of Social and Economic Geography at Lund University managed by professor Asheim, and at the Munk Centre for International Studies at the University of Toronto managed by professors Meric Gertler and David Wolfe, University of Toronto, as part of the 'Innovation Systems Research Network' in Canada. Through two of its founders, CIRCLE is also a member of the European Union network called PRIME (where Charles Edquist is a member of the Scientific Committee) and involved in the application for another such network called DIME, both of which are active in the area of innovation.

After three years of operation, CIRCLE will consist of a group of (at least) six full professors, six post-docs and six Ph.D. students. This group will provide certain specific deliverables. For example, at least 50 scientific articles or book chapters (or books, where one book corresponds to four articles) will be produced during the first three years. These publications will adhere to the four research areas outlined above. The publications will include works of a synthesizing character when called for. Starting in 2006, 15-20 masters' degrees will also be produced per year.

The founding partners are currently strongest with regard to research on innovation and R&D. After six years, however, CIRCLE members will have developed capability in research on competence building and will have proceeded substantially towards understanding the relations among the three kinds of learning and their respective roles for economic growth. CIRCLE will then be an internationally leading research unit, with competence in all three fields of learning and the relations among them. We will have been able to create, within CIRCLE and Lund University, a dynamic international milieu for research and teaching within the competence areas of CIRCLE. During the first six years we will also have been able to contribute to a better understanding of innovation and learning-related issues from a cross-disciplinary point of view. This means that it will be possible for important conclusions to be drawn concerning the functionality of the Swedish innovation system, providing an extended knowledge base for the formulation of more effective public policy measures and the development of firm strategies. By 2009, CIRCLE will have produced around six researchers with Ph.D. degrees. In addition, the founding institutes of CIRCLE will during the same period produce at least three times as many Ph.D. degrees in closely related areas of research.

As indicated previously in this plan of action, the results will be produced by means of collaboration between representatives of various disciplines, which profoundly exploits the partially different competence bases of the participants in CIRCLE. This is indicated by the fact that synergy is created by mixing different individuals in all the research areas. These 'new combinations' of competencies will be reinforced by the location of CIRCLE in an office separate from all the founding departments.

5.2 Dissemination of results

The results of the research conducted at CIRCLE will be communicated in a number of ways intended to address both the academic community and potential users, such as policy-makers and members of the business community. With regard to the academic community, the means of communication are:

- *Articles in scientific journals.* The results of the research conducted within the framework of CIRCLE are to be published in leading international, peer-reviewed scientific journals.
- *Books.* In addition to articles in scientific journals, the results of the projects will be reported in books published by international publishers.
- *Dissertations (Ph.D. and M.A.).*
- *Conferences.* CIRCLE intends to hold an international conference every third year.
- *Workshops.* In the fields of the four different research areas within CIRCLE, occasional workshops will be arranged.

- *Seminars.* On a smaller scale, a seminar series will be arranged, with seminars taking place twice a month.
- *Web page.* A web site will provide updates on research progress and upcoming events.

An important aspect of the activities within CIRCLE will be the communication of research results to users and other interested groups in society, via so-called ‘third task’ activities. A number of activities will be designed to secure the communication between CIRCLE and users, including relevant policy actors:

- *Reference Group of Users.* The reference group will be of strategic importance when it comes to the third task activities of CIRCLE. The suggested members of the reference group have extensive contacts within the business community and public administration in Sweden and internationally. The establishment of the reference group will give ample opportunities to establish a dialogue between CIRCLE and users concerning the research conducted at CIRCLE.
- *Dahmén-institute.* The Dahmén-institute will be a key vehicle in the dissemination of policy relevant research results. Lund is in a privileged position as it has a Centre of Excellence (CIRCLE), is a leading partner in the Dahmén-institute and hosts a Vinn-Växt project. Two founding partners of CIRCLE are strongly involved in the Dahmén-institute, Mats Benner as part-time director and Bjørn Asheim as member of the research group of the institute. An important aim and focus of the Dahmén-institute is to advise, support and evaluate the development of regional Vinn-Växt projects as well as to furnish the consultants advising the projects with synthesis reports of relevant research. In addition, the institute will promote competence building and innovative leadership regionally in cooperation with especially local SMEs and relevant regional industrial development organizations such as Region Skåne.
- *Innovationsforum.* The dialogue with regional users will also be facilitated through the existence of Innovationsforum at Lund University (described in section 1.2). The first Director of CIRCLE is a member of Innovationsforum.
- *Publications and other activities specified above.* Publications and other activities of CIRCLE will not only be relevant to the academic community but also of interest to a wider group of users. The results will be made accessible to a larger public by popularization of research and debate articles.
- *Public lectures.* The staff of CIRCLE will give lectures in various fora outside academia.
- *Exchange with policy-making organizations.* CIRCLE is offering the staff of organizations involved in innovation policy-making to stay at its premises for short or long periods, in order to develop a dialogue with various policy actors. In some instances this may be an extension of previously initiated discussions, as work within the research areas naturally includes close relations

with policy-makers, e.g., the process analyses carried out in research area 2. CIRCLE staff might also be collaborating with policy organizations in other ways, including serving as advisors.

6. Leadership and administration

CIRCLE will be established as a cross-faculty research centre within the so-called ‘Tenth Area’ at Lund University (with a partner at the Blekinge Institute of Technology) and organizationally placed directly under the Vice-Chancellor. CIRCLE will also receive matching funding directly from Lund University, the faculties of Lund University involved in the centre (Lund Institute of Technology, Faculty of Social Sciences and the School of Economics and Management) and the Blekinge Institute of Technology.

CIRCLE will have a *Director* who will be appointed for 3 years at a time, with a possible prolongation to two terms. Professor Charles Edquist will be the first Director of CIRCLE. He has initiated and led several research programs involving 10-12 researchers each at Lund University and Linköping University. He has also initiated and managed several large international research programs involving 25 and 40 researchers respectively. Charles Edquist has also served as the Chairman of the Department of Technology and Social Change at Linköping University during two periods (1992-94 and 2000-02). This has involved academic, economic, social and personnel leadership of an organization with 60-70 employees. He is currently the Director of the Division of Innovation at Lund Institute of Technology. He has also been extensively involved in communicating the results of his research and the research of others to different user groups – for example, policy-makers. A recent example is the publication of ‘Innovation Policy for Sweden – Objectives, Reasons, Problems and Measures’ (Edquist 2002).

Representatives of the six founding partners will form the ‘*Ledningsgrupp*’ of CIRCLE to provide the director with leadership advice.

All senior researchers within CIRCLE have well-established international contacts. This makes it possible to create, within CIRCLE, an international milieu of benefit to researchers and students as well as other users (thereby fulfilling the objectives of the ‘third task’ activities of CIRCLE). An *International Advisory Board* will be formed in connection with CIRCLE, and will convene once a year to keep informed of CIRCLE’s activities and to give recommendations for further development. Between meetings of the Board, CIRCLE will keep up a continuous dialogue with the members.

A *Reference Group of Users* will also be formed. This group will be established to give a regional/national input concerning the questions researched and taught at CIRCLE, and to secure the relevance of the research and the communication of research results to potential users.

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