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Knowledge, Creativity and Regional Development

Charlie Karlsson[1] and Börje Johansson[2]

([1]CISEG and CESIS, [2]CESIS and JIBS)

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By Charlie Karlsson (CESIS and CISEG) and Börje Johansson (CESIS and JIBS)

The understanding of economic development in regions in developed countries has gone through a fundamental change during recent decades. Nowadays, regions are increasingly looked upon as independent, dynamic market places that are connected via flows of interregional and international trade. Regional development is driven by changes in the economic specialisation, which can be explained by two different, but complementary theoretical frameworks for analysing location and trade, one old and one new.

The old theoretical framework assumes that changes in the economic specialisation of regions depend upon changes in the supply of durable and semi-durable regional characteristics. The new theoretical framework, known as the new economic geography, assumes that changes in the economic specialisation of regions are driven by the dynamic interaction between regional market potentials and rational firms experiencing increasing returns. In their pure form, these theoretical frameworks can explain changes in regional economic specialisation and consequently regional development without any reference to knowledge creation and other changes in knowledge assets. This is certainly a bit odd for a period of history often referred to as the era of the knowledge economy. So, does knowledge have no role to play as a force driving regional specialisation and regional development? Or, is it so that the traditional "knowledge free" explanations of changes in regional specialisation and regional development are missing important points?

In this chapter, we claim that knowledge infrastructure, human capital, talent, creativity, knowledge generation, knowledge protection, knowledge accumulation, knowledge appropriation, knowledge flows, etc. as well as the creative use of knowledge are basic drivers of the specialisation of regions and hence of regional development. The purpose is to discuss the role of knowledge and talent in regional development seen in both a regional and a global context.

The paper is organised as follows: In Section 1 we introduce the concept of creative regions and discuss their role. This discussion is followed up in Section 2, where creative regions are treated within a framework of trade and location. Section 3 deals with the international system of creative regions and the links between them. The special role of large urban regions as creative regions is highlighted in Section 4. In Section 5, we highlight the role of spatial product cycles for regional development. Section 6 presents the conclusions.

1. Creative Regions

Several decades ago, social scientists pointed out that the developed economies witnessed fundamental changes during the post-war period. Different authors have used different concepts to characterise what see as the most basic aspect of these changes. Thus, concepts such as the information society, the service society, the post-industrial society, the knowledge society, etc. have been introduced. Already, in the 1980's the Swedish economist Åke E. Andersson started to describe the dynamics of the long-term changes in western societies and analyse the underlying driving forces (Andersson, 1985 a & b, 1988 & 1989; Andersson & Mantsinen, 1980; Andersson, et al., 1984; Andersson & Strömquist, 1989; Matthiesen & Andersson, 1993). According to him, the major driving force in the modern economy is creative activities, which generate new knowledge spurred by culture and communication. Development, handling and presentation of new knowledge and information employ a steadily increasing share of the labour force and are assumed to have strong spillover effects on industrial activities in manufacturing as well as in service production.

In the picture painted by Andersson, economic life is under steady change towards more dynamic product competition. The resource base in developed economies is no longer natural resources, energy, etc. but education and assets based on creative activities. The development in these economies is based upon new complementary infrastructure. Traditional means of transportation are complemented and sometimes also substituted by the communication networks created by modern information technology. Among the traditional means of transportation, road and air transport gradually get a more and more dominating role. Access to material and immaterial networks is becoming more and more critical.

To be able to understand, predict and/or influence regional development in the creative society it is, according to Andersson (1985a), necessary to understand how the economic system can be divided into game or play and scene or arena. The economic and the political game with rapid and sudden changes is played on an arena where changes are slow. The arena consists of material infrastructure (transport systems, buildings, etc.), immaterial infrastructure (knowledge stocks, knowledge networks, etc.) and institutions (formal and informal behavioural rules, property rights, etc.).

A fundamental difference between the knowledge society and earlier societies is that its infrastructure in a profound way consists of many inter-connected layers. The material infrastructure not only consists of road, rail, air, and sea traffic networks. Rail, for example, serves local, regional, national as well as international transport demand. The rail traffic is complemented with successively more and more advanced information systems for traffic control as well as for planning and booking trips even in combination with other means of transport. The immaterial arena consists of knowledge and information assets. What is typical for the modern society is that knowledge and information flows are distributed over many different media and that electronic media increases its market share rapidly.

As regards institutions, the trends seem to go in different directions. On the one hand, there is an increasing stress on patents, copyrights, etc. to protect property rights. On the other hand, there are signs that property rights are becoming less and less interesting in a rapidly changing society, which is illustrated by the increased reliance on

'open innovation' (Chesbrough, 2003). What seems to matter more and more is the position of individuals, firms and regions in different networks, i.e. what access they have to relevant knowledge and essential information.

Already, Andersson, Anderstig & Hårsman (1990) have demonstrated how industrial development and income growth in a region is positively influenced by a combination of universities and other research institutions, which grow synergetically with telecommunications and good accessibility to rapid transport systems in the form of air and road transport. The creative society comes through and creates growth and prosperity in a number of regions, which contain this kind of potentials.

In earlier phases, the military played the most important role internationally for stimulating creativity and innovation (Hall, 1990). In more recent phases, other sources, such as experiences, entertainment, health, environment, and food, have become more and more important in generating a demand for creativity and innovation.

Fujita and Thisse (1996) suggest that human activities can be divided into two categories: production and creation, where the former represents routine methods of production. Creation, on the other hand, stands for the generation of new ideas, new knowledge, new technologies, new products, etc. Andersson (1989) has analysed what characterises dynamic creative activities. Successful dynamic creative activities are large logistical networks of small, creative units. The creative units have a non-hierarchical structure and are often self-organised. This implies that economics of scale are combined with, and complemented by economies of scope. These characteristics have strong implications for the development of the system of functional regions[1].

The difference between knowledge- and information-rich, and knowledge- and information-poor regions tends to grow. Regions with company R&D and research universities are centres for the development of fundamental research results, whether it occurs within the laboratories of universities or private companies. Such regions also offer deeper and more versatile knowledge, competence, and supply of specialists as well as rich opportunities for personal contacts. There is a greater probability for spin-off growth, if the regional milieu is information-rich (TV, radio, press; Internet, interregional and international information networks, etc.) compared to information-poor milieus. It is also vital to have activities within the region, which demands scientific results and can pay the price for the new innovative products. With an intraregional demand, spin-off effects occur, which stimulate further growth. There are breakaways from existing institutions and activities, since progressive inventors start their own business and become entrepreneurs.

For a creative region to grow and develop, it is important that the transport systems have high quality and high capacity (Matthiesen & Andersson, 1993). Such systems allow for the import of and contacts with new knowledge and innovations from other creative regions in the rest of the world. It is much better for a region to be an import centre than an export centre, even if exports also contribute to growth and prosperity. The reason is that the majority of all those ideas, which generate new activities in a region, get inspiration from other regions. Irrespectively of how strong a region is in

[1] A functional region is distinguished by its concentration of activities and its infrastructure, which facilitates high factor mobility within its interaction borders. In particular, a functional region has an integrated labour market, in which commuting as well as job search is intensive (Johansson, 1998a).

terms of R&D, it only produces a tiny share of all new knowledge in the world. Most of the ideas involved in a given activity come from other creative regions. They are imported, they are used, they are developed, and they generate new production. The production of new goods or services places a firm among those firms, which are product-competing industries and which have a capacity to pay high wages and salaries.

General import activities and knowledge importing organisations are confined to a limited number of urban regions in each country. Production, which is based on imports, is generally no high-risk activity. That something has been imported implies that it has been possible to produce somewhere else and to sell. In a second round, the new products in the import regions spread to other (export) regions and thereby their exports are renewed (Jacobs, 1969 & 1984).

There is a debate in the literature whether diversified or specialised economic milieus offer the best conditions for creativity and innovation. Already Vernon and Hoover (1959) and Vernon (1960) have stressed the role of the diversity in the New York region for its economic development. Thus, diversity seems to be an important aspect of creative regions (Jacobs, 1961 & 1969). Other important aspects of creative regions, according to Andersson (1985a), include

- flexibility in terms of social conditions, economic activities but also in terms of land use planning,
- willingness to overcome political, language, cultural and physical barriers, and
- a socio-cultural milieu marked by great openness and an atmosphere of tolerance.

Not least, the last aspect enhances the attractiveness of creative regions for creative talent and makes them an inspiration for cultural producers, etc. A marked social and cultural variety and openness, therefore, represents a specific cultural capital of a creative region, which makes it highly attractive for the actors of the creative economy. At the local level, this cultural capital of a creative region might also be characterised as a specific sub-cultural capital of particular districts within the region, i.e. creative activities might be highly localised within a creative region. These thoughts support the thesis advocated by Florida (2002), that the economic growth of creative regions is driven by the locational choices of creative people – the holders of creative capital – who prefer places that are diverse, tolerant and open to new ideas.

Andersson (1985a) summarises the characteristics of creative milieus.[2] Many different factors work together in a creative milieu. The creative process can be seen as a form of dynamic synergy. To initiate a creative process many factors must be able to influence each other in a mutual ongoing interaction. This concurrence and this interaction imply great demands on the regional milieu. It appears that the regional milieu must be of large scale but still culturally versatile, rich in deep original knowledge and competence and characterised by good communication possibilities internally and externally.

[2] The concept of creative milieu can be compared with the concept of "milieu of innovation" introduced by Castells (1989, 82). "By a milieu of innovation we understand a specific set of relationships of production … based on a social organisation that by and large shares a work culture and instrumental goals aimed at generating new knowledge, new processes and new products."

For the intraregional communication, physical nearness seems to be of great importance, since personal communication within groups of individuals sharing common interests seems to be a vital input to creativity (Jacobs, 1969; Lucas, 1988). To achieve considerable synergy effects there is a need for manifoldness and variation. The different activities in a creative region are often of small scale as individual activities. Industries do grow not by quantitative growth of the existing activities but through the emergence of new activities. The following seven factors seem to be fundamental conditions for creative processes, according to Andersson (1985a):

1. Benevolent or tolerant attitudes towards experiments.
2. Versatile composition of knowledge and competences.
3. Versatile and relatively unregulated financial basis for science, entrepreneurship and cultural life.
4. Good possibilities for spontaneous and informal personal contacts between different parts of the region and with other regions.
5. Many-sidedness rather than functional division of the social and physical milieu.
6. A feeling that the needs are larger than actual resources or possibilities.
7. A flexible social and economic organization, which sometimes goes beyond the borders to structural instability.[3]

It seems, according to Andersson (1985a), as if structural instability is a necessary condition for creativity from both a micro and a macro perspective. During the major part of each research, design or development process, the activities are mainly routinised, i.e. they proceed within a structurally stable equilibrium process. However, in a parallel process an internal instability in the main process may develop. Inconsistencies at a logical plane may become more and more obvious concurrently with the attempts to increasingly generalize the basic ideas. Exceptions from basic principles may be discovered. Now the process might stagnate and come to an end, if there is a lack of people with original, deep and varied knowledge and competence. However, if there are enough people with the right background and with possibilities of active communication between each other, the process can turn into a powerful bifurcation or a phase of structural instability with great uncertainty about the future development path and thus a great potential for creative acts.

Such a structural instability can be perceived as a period of fundamental uncertainty about the future development at the regional level. Trend extrapolations do not work. However, this uncertainty also brings an advantage as well as a risk. Due to the lack of stability within the system also smaller groups of people can influence the system and thus chose a new stable course, which may open up for several different stable courses. Of course, it is troublesome for the regional planning and policy that creativity demands structural instability, manifoldness and uncertainty. In addition, it may be difficult to combine creativity with short-term productivity. Furthermore, creativity at the regional level and social security can be assumed to be in opposition to each other.

Until now, we have not provided any definition of creativity. Andersson (1985a) defines creativity as the ability to combine knowledge, i.e. familiarity and insights, and

[3] Rasulzada (2007) stresses that the social and organisational context often affects the level of creativity.

competence, i.e. the ability to use knowledge for one or several purposes, to create something new.[4] This implies that change is at the centre of creativity. It is possible to make a distinction between different types of creativity (cf., Florida, 2002): (i) scientific creativity, (ii) technological or innovative creativity, (iii) economic or entrepreneurial creativity[5], and (iv) artistic or cultural creativity. These different types of creativity are probably to a certain extent mutually dependent in the sense that they may stimulate and reinforce each other when located to the same urban region. However, it is well known that artists, such as painters, may develop a high level of creativity when forming artistic colonies also in peripheral rural regions.

An understanding of the creative region presupposes some degree of understanding of the creative processes at the micro level, i.e. within individuals or small teams of individuals working together. Unfortunately, the knowledge about creative processes at the micro level is rather limited. The human brain has, however, certain abilities, which are interesting (Andersson, 1985a):

- The heuristic ability
- The ability to remember
- The ability to detect deep structures
- The ability to see and to use ambiguity and manifoldness
- The ability to appreciate paradoxes and surprises
- The ability to use disequilibria
- The ability to use fundamental uncertainty.

Another important question relates to why people are creative. This question is also discussed in Andersson (1985a), and he makes a distinction between the individual intrinsic motivation and social motivation. It seems as if internal reinforcement mechanisms have greater importance for explaining the total creativity level of individuals than simple reward or coercion arguments. This possibly implies that it is difficult to stimulate the creative output of individuals, and that the creative output of regions depends upon the total number of creative persons. It is also important to observe that exaggerated demands for discipline and organization might strangle the creative potential. Concerning the social motivation for creativity it seems as if the right to take own initiatives, little of work supervision and employment and income security, if creativity fails, is important for generating creative working conditions.

There must obviously be rewards for creativity, since the creative process is a costly, uncertain process that includes the risk of failure, stress and other negative effects. Creative ideas challenge established norms and might bring disorder. This implies a risk for creative people, since they tend to be met by resistance and scepticism, which is typical not least within science (Kuhn, 1962) but also within e.g. the arts, music and poetry (Boden , 2004), where the orthodoxy works as a constraint on novelty and new means of individual expression. On the other hand, to change the established norms might be the intrinsic motivation for creative people.

[4] Amabile (1996) defines creativity as the development of new ideas that are potentially useful. i.e., that can be embodied in products, practices, services or procedures. It is important to observe here that creativity also develops ideas such as nuclear bombs and cluster bombs!

[5] Sternberg & Lubart (1999) also look upon entrepreneurship as a form of creativity. As remarked by Baumol (1990) not all entreprenurship is productive. Some of it is pure rent seeking and some of it is criminal.

2. Trade, Location and Creative Regions

Drastic changes have occurred in the geography of creative regions in over the past few centuries. Logistical revolutions have initiated periods with a high level of creativity, which generated fundamental structural changes in the world economy (Andersson, 1985a & 1993). These periods have coincided with and been mutually dependent upon fundamental changes in institutions, technology and culture (Andersson, 1995). Different large city regions have been able to take advantage of the special conditions during each period, which led to the emergence of new centres of creativity in the world economy during each logistical revolution.

The current epoch, which goes back some thirty years, has been characterized as the fourth logistical revolution (Andersson, 1985a). It involves the realization of a systems society, where computer and telecommunications systems make it possible to integrate the business community to a logistical system with a very rapid pace, but also with substantial risks for increased vulnerability.

The current logistical revolution coincides with the increasing dominance of the knowledge society. A rapidly increasing knowledge stock and an increasing number of highly educated people boosts the creative potential in society and in the business community. Creative manufacturing and service industries imply that the number of new products and varieties of old products increases continuously. However, this changes gradually the basic conditions for the interregional and the international division of labour. At each point in time, certain large urban regions are centres for creativity in culture and industry. Due to their superior accessibility to demanding customers with a high purchasing power, they also become centres for innovation of new products. Thus, we can say that certain large urban regions will be the motors of the global product cycles, whose speed of change is regulated by the size of the R&D investments. However, the relative importance of different urban regions as creative centres changes over time so we must also ask what processes that might bring about such changes.

Johansson (2000) suggests that at a fundamental level one may make a distinction between producer-driven and consumer-driven processes. A suitable starting point for producer-driven processes is Ricardo's model of comparative advantage. In general, conditions in regions differ such that it is possible to identify how individual regions have a comparative advantage in the production of one or more products. Specialisation of production, exports and imports may then be assumed to follow the advantage patterns. The advantage can be defined using an opportunity cost argument:

'A region has a comparative advantage in producing a product *z*, if the number of units of other products, *y*, that has to be given up to produce one extra unit of *z*, is smaller in the particular region than in other competing regions.'

This basic idea was put forward by Ricardo about 200 years ago. The critical question is, however, how such advantages are generated. This question was analysed by Ohlin (1933). Ohlin's message was – in modern terminology – that patterns of comparative advantage are based upon the durable characteristics of each region, i.e. resources and other conditions, which are "trapped" or change at a very slow time scale. In the lit-

erature, the following four different causes of comparative advantages are put forward: (i) technology gaps between regions, (ii) spatial product cycles, (iii) differentials in the relative supply of production factors, including natural resources, and (iv) demand differentials, based upon variations between regions in the willingness to pay for products. In addition, variations between regions to take advantage of internal and external economies of scale influence comparative advantages.

The first aspect refers to region-specific conditions, which influence the capability of firms to generate, adopt and apply new technical solutions. Spatial product cycles represent a dynamic version of the technology gap theory. In such models, firms in different regions get different stimuli from their pertinent economic milieu to develop and initiate sales of products with new attributes, i.e. to be creative and to innovate.

Regional differences in the supply of production factors, such as capital and labour, require that there is a certain degree of friction, making the supply of these factors in different regions semi-fixed (Johansson, 1998 b). This implies that they are given exogenously in the short run and that they change on a slow scale only (Johansson & Wigren, 1996). Production capital, such as buildings but also to a high extent machines are region-specific for extended periods. In a similar manner, households with varying knowledge and competence may have a low mobility, i.e. slow adjustment to regional differences in labour market conditions. In particular, this is true for mobility between countries. What can one say about regional differentials as regards demand? The composition of household consumption varies between regions due to variations in income levels and culture. However, there is also another source of demand emanating from firms and entire industries located in a region. When a region is specialised in certain sectors, e.g. due to the existence of external economies of scale, this will generate a particular composition of demand for inputs, i.e. for goods and services.

In a modern version of the Ricardo model one could consider the educational level – the human capital, of the inhabitants in regions – as a specific production factor. Human capital can also be seen as a durable or semi-fixed resource in economies where household migration adjusts to regional differentials in employment opportunities and wages at a low pace.

This naturally takes us to the consumer-driven processes. We identify two types of consumer-driven processes. The first comes from the Tiebout model, in which households are assumed to migrate without friction (Tiebout, 1956). According to this model, individuals or households migrate from one local jurisdiction to another in response to differentials as regards the supply of local public goods and local taxes. Different mixes of local public goods and taxes in different local jurisdictions will attract different types of households.[6]

According to Tiebout's formulation, households are voting with their feet, while simultaneously revealing their preferences and promoting an efficient differentiation of the supply of public goods across local jurisdictions. Of course, if all households are different, efficiency requires that there are many municipalities. This will not be pos-

[6] This form of competition was suggested by Tiebout (1956) to improve the multi-regional allocative efficiency. However, there are some technical problems with the Tiebout model, which will not be touched upon here (Bewley, 1981; Stahl & Varaiya, 1983).

sible if there are increasing returns to scale in the supply of public goods. The latter may, for example, require significant investments in the public infrastructure.

The second type of consumer-driven processes has been advocated, among others, by Quigley (1990). He argues that the driving forces shaping regional development to a high extent comes from the spatial pattern of household location and the housing opportunities offered by different regions. One important condition behind this is the changes in the character of economic activities undertaken in advanced western societies:

- Manufacturing has become less important, and business services have become more important,
- Technical progress has reduced the optimal scale for a great many types of economic activity
- Advances in transportation, communication, and computation technology have eroded the traditional locational advantages and created new opportunities for outsourcing and off-shoring of activities within the overall supply chain in booth goods and service production.

As a result, larger firms can fragment their business activities both within and between regions. The confluence of these important trends on the production side has made new sites within regions and new regions suitable or even preferred as locations at the same time as firms have become much more foot-loose, i.e. have got much more freedom to choose location inter-regionally as well as intra-regionally for their different types of activities.

Another important background condition is the changes taking place in the factors influencing household locational choices:

- The dramatic increase in female labour supply making the two-worker households with two spouses the norm
- The reduction in transport costs and the advances in computer and telecommunication technology
- The rapidly rising real incomes of households

This implies that households have become less sensitive to commuting costs and commuting distances due to, among other things, increased opportunities for distance-work. At the same time, they have become more sensitive to variations in housing quality and housing amenities in choosing residential location. In particular, highly educated and high-income households seem to be very sensitive when it comes to choosing regions as well as residential areas within regions.[7] Hence, we can see, once more, households voting with their feet and making distinct choices about where they prefer to live. Large urban regions have a special competitive advantage in this respect since they in general offer a higher density and a larger variation of amenities of importance to attract highly educated and creative individuals and households (Glaeser, Kolko & Saiz, 2001).

[7] Quality of life variables seems to play a major role in determining the migration patterns of households (Rosen, 1979; Roback, 1982).

In combination, the two conditions described above suggest that in competition for skilled and highly educated labour, firms will choose to locate in close proximity to their potential labour force instead of trying to attract the same labour to old established locations. This idea has later been adopted by Florida (2002), who has put forward the argument that the companies, the technologies and the venture capital of knowledge intensive economic activities move to or form in places that have the skilled and talented people. He (ibid., p.7) emphasises in particular the socio-cultural properties which make certain regions particularly attractive to the creative class as a place for living and working: "Creative people … don't just cluster where the jobs are. They cluster in places that are centres of creativity and also where they want to live." Thus, lifestyle attributes of the creative class and a supportive socio-cultural milieu are at the centre of an urban region's attractiveness in the creative economy. The argumentation has several implications:

- Urban regions or parts of such regions with unusually desirable natural, cultural and consumption amenities will experience continued competitive advantages in attracting firms employing highly qualified labour
- Urban regions or parts of such regions in which highly qualified workers already reside are prime candidates for the location of new employment in activities intensive in the use of highly qualified workers
- Public resources devoted to improving amenities in urban regions may reap rewards over and above their initial impacts upon the well-being of current residents

3. The International System of Creative Regions

The study of creative regions is always exciting. However, it also involves certain risks. One major risk stimulated by the focus on localised knowledge spillovers is concentration on the individual creative regions. The focus risks overlooking the fact that large urban regions are closely connected in many ways and engaged in an intense inter-regional interaction. As Johansson (2005) explains the focus has probably been much more on proximity externalities than on network externalities.

Over seven decades ago, the Swedish location economist Palander (1935) had observed that one of the most remarkable features of modern urban structures was the frequency and extension of the interactions between the activities carried out in different cities. Today the situation is very different in the sense that the infrastructures connecting in particular large urban regions are much more developed and advanced, offering superior accessibility to other large urban regions. As a result, human interaction in particular between large urban regions has increased in intensity but also in complexity (Karlsson & Westin, 1994). One fundamental force behind the "new accessibility" and growth in complexity is found in the development of communication and information systems. The information and communication technologies revolution has lowered the marginal costs of information exchange between different locations to levels very close to zero (Karlsson & Klaesson, 2002) and the evolution of national and international air travel has significantly reduced travel costs and travel times. Furthermore, the international scientific community is organised as a large number of big international knowledge networks, relying, for example, on scientific conferences and journals. Large multinational firms, not least within their R&D organisation, link often a large number of large urban regions together. Still, it is often

claimed that interregional and in particular international knowledge spillovers are limited in geographical scope (Jaffe, Trajtenberg & Henderson, 1993; Audretsch & Feldman, 1996). However, there are a few authors who claim that the interregional and international knowledge spillovers have been underestimated, since there are abundant evidences that information and knowledge networks that enhance business efficiency can be and often are widely diffused geographically (Hansen, 2000).

It is obvious that creative regions throughout the world are closely connected and that they stimulate each others' creative processes and knowledge production processes.[8] The stimuli have two major forms: the flow of 'pure' knowledge and the import of products embodying new knowledge.

Knowledge flows take place in specialised interregional networks, i.e. 'knowledge networks' (Batten, Kobayashi & Andersson, 1989; Kobaysahi, 1995). These consist of a set of nodes and a set of links connecting them. The nodes are represented by human settlements, such as towns, cities and metropolitan regions, providing different instances of functional regions. The nodes can be characterised by their endowment of knowledge production capacities and related activities including knowledge infrastructure such as universities, meeting infrastructure, stocks of knowledge and human capital, local knowledge networks, and so on. The links include transportation as well as communication channels.

No matter how large or creative an urban region is, it will fetch its strongest and most frequent impulses for new ideas, new products, improved production methods and new consumption patterns from import flows from other large urban regions in general and from creative regions in particular (Johansson, 1993 a). The underlying reason is of course that the size of the R&D resources and the number of innovations in each individual region is only a tiny share of all R&D and all innovations in the world economy. Swedish economist and economic historian Eli F. Heckscher coined the expression that 'imports are more varying than exports'. Import flows provide information about 'news' developed in different creative regions around the world. Varied imports and dense import networks provide strong stimuli for innovation and imitation. Import flows stimulate firms in the import regions to develop new products and to develop substitutes and complements to the imported products. Thus, there will be a strong tendency for new product cycles to be initiated in large import regions. However, as we will show in later sections, import regions also play a central role in, in principle, all innovation processes in an economy and thus form a vital component in any innovation system.

It is generally observed that imports dominate exports in the large rich regions. There are two explanations. Imports are attracted to the richest regions with the highest purchasing power. However, a region also develops economic precedence by being an import node for a surrounding territory. It is from a development and innovation perspective that imports play their strategic function. 'News' are transmitted via imports. Imports, in particular, to large urban regions have a focus on development, new tech-

[8] The same is true for cultural activities as pointed out by Lloyd (2006, 162). "The social world of cultural production privileges particular locales. … Such locales are not self-contained, bounded entities, but rather operate in multiple networks of exchange – of products, ideas, and human capital – with other key sites, preceding the eventual dissemination of selected cultural commodities into the global marketplace."

nology and investments. Especially, do imports play an important role when a firm or an organisation is about to change and improve its technology, increase its capacity and/or change its line of business. The manifoldness of imports is mirrored in the fact that the number of import firms is much larger than the number of export firms in large urban regions. Import flows generally contain a much higher share of innovations than export flows. Thus, import flows give stimuli to start producing goods that are new to the importing region in the sense that they have not been produced there before.

There is a lot to gain for each region to follow product development and technological progress in the world economy. Observations of the 'news' in the import flows bring quite special information to the importing region. The 'new' products in such a flow have passed two tests: Firstly, it is made clear that there exist technical possibilities to produce the good in question. Secondly, the import flow shows that there exist customers in the region, i.e. there is a market in the region and/or its hinterland. Thus, the imitation of import products is a rather safe innovation strategy.

A focus on qualitative imports, i.e. imports with a high share of 'news', is a form of regional specialisation. Normally it is a small number of regions within each country, which are responsible for the lion's part of the total import value and for the import of 'news'. This is, in particular, true for import firms importing and reselling new technology, new equipment and knowledge. The import firms in these regions support customers in all parts of the country with import products by their customer networks.

Our main point in this section is that it is impossible to understand the role and function of creative regions without also acknowledging that they also are specialised import regions with an open attitude to ideas, knowledge and technologies developed elsewhere. This also implies that among the critical knowledge and competence factors in creative regions are the knowledge and competence to scan the world economy for 'news' and to evaluate the potential of these 'news' to be the starting point for new product cycles.

4. The Role of Large Urban Regions as Creative Regions

The discussion above shows that the creative potential is not evenly distributed across space. In the preceding section, we illustrated that there are self-reinforcing processes working, where regions well equipped with highly educated labour function as an attractor for firms with activities critically dependent upon good access to highly educated labour. As more firms move into these regions, the demand for amenities as well as for highly educated labour stimulates investments in amenities as well as the immigration of highly educated labour. Thus, virtuous cycles might emerge stimulating agglomeration of knowledge and creative potential.

In particular, the large urban regions in developed economies can be comprehended as large, knowledge intensive production systems. In most developed countries, a dominating share of all production takes place in the large urban regions. Most of the international and interregional trade takes place between the large urban regions. However, still more important are their functioning as nodes in the international networks for knowledge generation and knowledge and information transfer. Milieus for creativity and innovation are largely found in large urban regions and, in particular, in those

large urban regions that are characterised by manifoldness and small-scale activities. One important reason behind this is that the new technologies that are developed have such a high complexity that the knowledge involved in their creation is dispersed and distributed over many individuals and organisational units (Karlsson, Flensburg & Hörte, 2004). Thus, only large urban regions offer a broad enough knowledge base for developing these new technologies.

Versatile large urban regions offer great advantages when it comes to introducing new economic activities. Large urban regions with their concentrations of human capital function as 'incubators' of creativity and innovation (Thompson, 1965). The role of (large) cities in concentrating and spurring human creativity was initially recognised by Park, Burgess & McKenzie (1925). Cities function as 'open systems', which attract talented people from various backgrounds and stimulate their creative capacities (Jacobs, 1961). Jacobs' ideas was later formalised by Lucas (1988) into a basic theory, which argues that cities function as collectors of human capital, thus generating new ideas and economic growth through human capital externalities. However, the economic history of urban regions shows that such a relative advantage is easily lost and this loss has often a connection with the development of long-term product cycles (Andersson, 1985a).

The product cycle theory is an attempt to develop a pure dynamic explanation to the division of labour between regions and nations (Vernon, 1966). As such, it is a necessary complement to the classical theory of comparative advantages. The theories of long-term product cycles involve three types of industrial dynamics: (i) technological development, which introduces new products or changes the function or design of products, (ii) the introduction of new or improvements of old production processes, and (iii) changes of the market organisation via the creation of new market channels or changes in pricing and marketing policies. Karlsson & Larsson (1990) say that evolving product cycles involve a fourth type of dynamics, namely a change in competition strategies from product competition to price competition. Product competition signifies market behaviour where the individual supplier uses the combination of attributes of own products including delivery conditions and sales and after sales services as the most important measure to attract customers away from his competitors (Johansson, 1988). The two competition strategies correspond to two innovation strategies (Anderstig & Karlsson, 1989):

- Dynamic innovations, which are measures taken by firms as a part of product competition strategy, measuring the perceived quality of its old product(s), or that introduces totally new products on the market, and
- Cost innovations, which are measures taken by a firm as part of a price competition strategy, reducing its production costs for existing products.

All versions of the product cycle theory are founded upon a number of basic premises (Karlsson, 1988): (i) tastes differ with income, (ii) communication costs within the firm, and between the firm and the market, are significant and increase with distance, (iii) as the product cycle of any new product unfolds, the product and its production technique pass through successive stages of standardisation, (iv) that these stages will be associated with dynamic shifts in comparative advantage of predictable direction, and (v) the market for technical knowledge is imperfect.

The spatial product cycle theory is based upon the assumption that every new product with a high probability will be launched in one of the most advanced urban regions in the world after a phase of R&D, testing and production in a small test scale. Such regions offer dynamic comparative advantages, i.e. they are characterised by high R&D investments at the same time as they have good access to a human capital rich labour force. As a result, the first production of the new products will normally take place in the region where they were developed.

In the initial phase, other regions will import the new product. However, the knowledge about the characteristics of the new product and its production technology will diffuse to other regions when they start to import the product. As the demand for the product expands, it is possible to introduce large-scale production technologies. The initiating region may then lose its comparative advantages over time, as the production process is simplified and/or automated. The term process here comprises all the operations or activities of a firm as suggested by Nelson & Winter (1982) who convincingly that a firm has a set of interdependent sub-process routines, which combine to form a compound process. The compound process includes the following sub-processes: (i) distribution, (ii) production, (iii) 'routinised' design and construction, and (iv) management, administration and commercial activities. Improvements in all the above sub-processes are recognised as process innovations. Improvements here refer to reductions of costs and/or improvements in quality and accuracy (Fischer & Johansson, 1994). Only by ongoing development of the product's function and design, can the initiating region continue to keep its advantage.

According to the basic assumptions of the product cycle theory, the production of new products can start to diffuse when they have become standardised. The degree of standardisation of a product group has a major influence on the market structure and innovation behaviour of firms. It is possible to distinguish two basic levels of standardisation (Fischer & Johansson, 1994):

(i) A product group or, in other words, a market consists of product variants. The product group is standardised if all of the variants are equivalent to the extent that price is the only criterion for the decision-making of customers.
(ii) A firm may supply a standardised product, which at the same time competes in a market with either (a) standardised products, or (b) differentiated products.

In neither of the above cases does the individual firm adjust its deliveries and product attributes to customers who specify individual requirements or preferences with regard to attributes. In case (ii, b) the firm has selected a particular market segment, i.e. a specific customer group. The first case refers to mass markets and mature products, including staple goods. In such markets price competition prevails. A firm, which supplies non-standardised products, adjusts its product attributes to each specific customer group. Each delivery may be unique. For firms of this type, the capability to adapt product characteristics to specific requirements becomes an essential aspect of their everyday production activity. This makes them dependent upon high accessibility to customers with a high enough willingness to pay for specific product characteristics in the own region and in other regions as well as to the relevant knowledge sources and qualified labour. In these markets, price is just one of several criteria, which influences the decision-making of a customer.

Product standardisation and process routinisation are key notions in the model of product cycle dynamics developed by Johansson & Andersson (1998). Along a product cycle path, knowledge intensity is high when a product is non-standardised and the production process is non-routinised. Standardisation and routinisation implies reduced knowledge intensity. This indicates that in the spatial product cycle theory, the change processes are influenced by the characteristics of the entire labour force and the knowledge accessibility in each region (Johansson & Karlsson, 1986). Such overall regional attributes describe the economic environment of individual firms and indicate their possibilities of acquiring knowledge and information pertinent to their production segment. The regional attributes also show which possibilities a firm has to adjust the competence profile of its staff. Regional labour market characteristics are closely related to the location of R&D activities, cultural opportunities and regional infrastructure.

Two aspects of the interaction between structural economic adjustments and pertinent changes in the labour market in individual regions and a system of regions are analysed in Johansson & Karlsson (1987). First, changing sectoral composition, new products and the introduction of new techniques affect the demand for different types of employment categories, i.e. types of jobs. This is a process with comparatively visible, direct and fast impacts. The second aspect comprises a process, which operates on a slower time scale. In this case, the gradual change in the competence profile of a region's labour force affects the location advantages of the region over time. This profile may change in such a direction that the region develops into an advantageous environment for product development and the creation of new production techniques. However, the labour force composition may also develop in such a way that the region gradually moves into a state of an economic periphery with unfavourable future employment perspectives.

The spatial product cycle theory is based upon an assumption concerning the existence of economies of scale, making association with the static theory of comparative advantages difficult. In fact, the existence of economies of scale strengthens the advantages of trade and regional specialisation. A region can, without having any comparative advantages in the classical sense, still gain from uniformly developing one line of production among many possible lines and consequently benefiting from the economies of scale.

Economies of scale are not a special case for new products. They are the normal case. New products are normally introduced and tested in small markets. It is obvious that they have strong advantages of an expanded production scale. Thus, R&D generating new products is a factor, which through economies of scale can drive the specialisation of regions much further than what is motivated by traditional economies of scale.

Summarising the discussion so far makes it obvious that the spatial product cycle theory contains three basic elements, which go beyond the traditional theory of comparative advantages: (i) R&D to generate new products and production processes, (ii) investments in a new market organisation, and (iii) returns varying with the production scale.

The most critical part of a dynamic analysis using the spatial product cycle theory concerns the determination of which regions with a high probability will function as recurrent creative milieus. As soon as a new product has been introduced at a national or an international market, the spatial product cycle theory predicts a spatial development over time of the type illustrated in Figure 1.

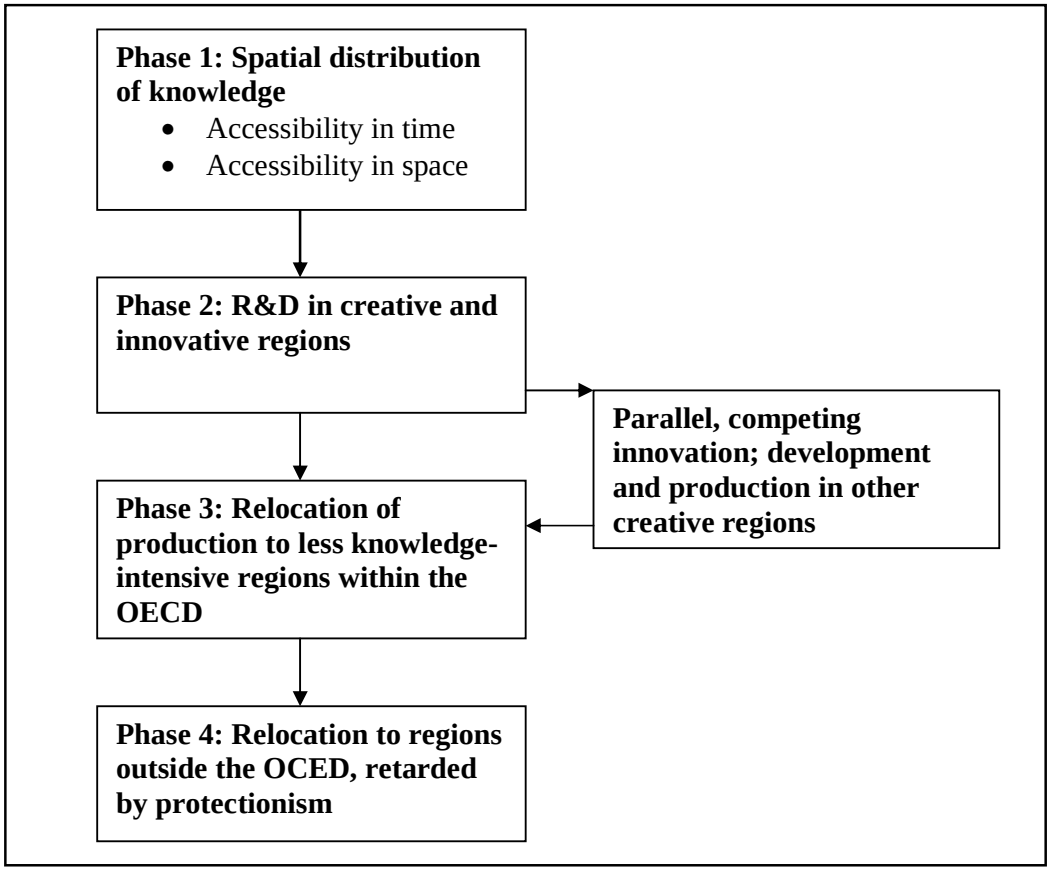

Figure 1. The spatial location of production over time
Source: Andersson (1985a)

In the introductory course of the product cycle, the initiating region has a monopoly through its unique competence. As the production scale increases and the production technology is successively improved, it becomes easier for other regions to adopt the product and its production technology. Often this is facilitated by the fact that production equipment is produced by specialised producers of machines and other equipment. In connection with the diffusion of production units, the production is routinised and simplified and the knowledge requirements reduced to a similar extent. The knowledge intensive R&D regions often have a high general wage level and can thus not compete with regions with a generally lower competence level and hence, also a lower wage level. Those conditions that in the early phases of the product cycle give the R&D regions their location advantages turn in later phases into disadvantages.

Even if it is possible to delay and sometimes also to counteract this cyclic process by ongoing product development, i.e. improved design and function, it is a basic hypothesis that later stages of the product cycle involves a shift towards process development and market investments at the expense of product development. In connection with the spatial diffusion of production and the increased competition, R&D activities gradually are driven more and more towards labour and general factor saving technological changes and improved logistical and distribution systems. In a parallel process, the demands for protective political measures increase.

Andersson & Johansson (1984 a & b) use microeconomic models to show how product cycle assumptions generate location and relocation processes (see also Johansson & Karlsson, 1987). They also demonstrate how clusters of product cycles can be observed empirically in the form of aggregate specialisation patterns, which describe a time-space hierarchy. These results are in Johansson & Andersson (1998) reformulated into a more coherent framework, where new direction for this type of model formulations are emphasised.

Within rich countries, a number of large urban regions have developed into international centres for R&D and product development. All these regions are characterised by a very good international accessibility by air, and a high intraregional accessibility to purchasing power, and to a diversified and highly developed R&D capacity. The development and the market introduction of new products presuppose a good intraregional accessibility of two reasons. The first is that the first market introduction of a completely new product normally is done as a trial and locally. In this initial phase, it is essential that the unit costs can be reduced rapidly by a rapidly increasing production and sales volume. A substantial sales volume can in the initial phase only be achieved in a region with a large regional population and a large number of firms with a high purchasing power and an interest in new products. The second reason is that the development of new functions and new designs can only take place under synergistic and catalytical conditions, which implies that researchers, product developers and designers must be able to move in a simple manner between different research and cultural milieus (Andersson, 1985 a). Contact needs of such an almost accidental nature can only be fulfilled in large and dense urban regions.

A large share of the goods production can be decentralised, the products transported with effective logistical systems and production co-ordinated by modern computer and telecommunications systems. This applies for goods and for financial and technical data of a routine nature for which the transport and the transmission costs are low. For knowledge generation and transfer, creative and innovative processes and negotiations, the conditions are different. In such processes face-to-face contacts are always important (Karlsson & Manduchi, 2001; Saxenian, 1994). They are particularly important for situations characterised by substantial changes, which marks negotiations, research and development aiming at new designs and new functions of existing products or very new products. In a similar manner, the transfer of knowledge and competence demands effective educational systems with frequent opportunities for face-to-face contacts. This implies that in the transfer of knowledge and competence, creative processes and negotiations demand social milieus larger than a certain minimum scale in terms of individuals (with the relevant knowledge and competence). Furthermore, creativity in the form of research and development of new products and new processes needs manifoldness and a high probability for random contacts in the

regional milieu. A limited number of the large urban regions in the advanced countries fulfils at the same time all the necessary criteria in terms of size, purchasing power, knowledge and competence level, manifoldness and general accessibility to the extent that they can function as international centres for R&D, creativity and innovation for extended periods.

The birth of new products is normally located to a limited number of large urban regions among the advanced countries. When the product has been introduced in its region of birth it is frequently strongly dependent upon continued development and improvements of its functions and design. Regularly, the production at this stage demands special professional skills, which opens opportunities for continuous changes of the characteristics of the products. Thus, it is necessary to keep production close to the R&D units. This implies that it is profitable to keep the production of the new products within or close to the creative regions, as long as the R&D efforts are substantial. Not until a later stage, when the product has come closer to a more final form and function can the production process be routinised. Then competence can be built into the machinery equipment. At this stage, cost considerations make it possible to decentralize production to regions with lower knowledge, competence and wage levels. However, it is also important to observe that the development of product concepts, experimentation with young products, and routinised processing of mature and aging products, all constitute distinct categories of activities. Each of these activities has its specific interaction characteristics and thus demands for particular combinations of infrastructure attributes to the built environment, which has implications for both location and relocation of activities (Johansson, 1993b).

Hence, the basic hypothesis says that as a product matures, it gradually uses less and less of the competence, knowledge and creativity dependent production factors, and more and more of standardized inputs. These standardised inputs are accessible at substantially lower costs in other regions within the country or in other countries with relatively lower knowledge and competence level and with fewer possibilities for many-sided, informal and fast face-to-face contacts between persons with a high and varied knowledge and competence level.

An application of the spatial product cycle analysis in rich countries is illustrated in Diagram 1. In the diagram, different products are characterized according to their relative static and dynamic role among the rich countries. The diagram assumes that new products are born in the upper left corner, which delimits products with a high and non-declining specialization in these countries. This product group mainly consists of R&D-intensive, distance-sensitive high-income products, which needs a well-developed infrastructure. Such infrastructure-dependent or systems-oriented product or production processes can only be successfully localized in highly developed urban regions in the rich countries with well-developed transport and communications systems, labour markets with a rich and varied supply of well-educated labour and good access to material and non-material infrastructure.

That products mature in a technical sense is identical with that the R&D share of the total costs. Investment costs decline, at the same time as the demands concerning the educational level of the labour force are lowered. On the other hand, this phase of the technological development is often connected with high capital intensity. In the lower left corner of the diagram, products, which earlier have contracted substantially in the

rich countries, are accumulated. For employment and other reasons, the production of some of these products may be protected from international competition. However, it is obvious that the total share of the production protected in this manner among the rich countries cannot be larger than certain politically accepted protection levels. Thus, it is obvious that most of these products after a quarantine period with political protection will move into the lower right corner in the diagram. Earlier defence policy could transfer products to the lower left corner.

• R&D • New products	The product specialisation is stable in the OECD area	The product specialisation is falling in the OECD area
High specialisation level for the products in the OECD area	• R&D-intensive products • Knowledge- and competence-intensive products • Infrastructure-dependent processes • System products • Design-intensive products • Distance-sensitive products	• Capital-intensive processes BUT • Not R&D-intensive • Not knowledge- and competence-intensive • Not infrastructure-dependent • Components
Low specialisation level for the products in the OECD area	• Politically protected products • Products protected by market organisation	• Not R&D-intensive • Not knowledge- and competence-intensive • Not infrastructure-dependent • Components • Labour-intensive • Raw material-intensive

Diagram 1. The spatial product cycle applied on the OECD countries
Source: Andersson (1985a)

The speed of the spatial structural change is to a high extent dependent upon the level of R&D investments in the rich countries. The part of the diagram, which contains product development, can be seen as the driving force in the spatial product cycle. When the share of the value-added, which is invested in product development increases, the speed of the spatial structural change increases. Regions and nations among the rich countries are forced to improve their mutual division of labour and to accept a more rapid relocation of production to regions in countries outside the group of rich countries. This is a painful process and there are plenty of examples how rich countries try to protect their own production.

5. Knowledge, Spatial Product Cycles, and Regional Development

The above discussion of the spatial product cycle dynamics is for natural reasons very stylized. In the abstract theoretical case, it is assumed that products always go through a sequence of R&D, product development, introduction in an R&D-region, continued improvements of function and design, improved and simplified production technology, routinisation, increased production scale, decreased needs for knowledge and competence, and relocation to regions and nations with lower educational and skills levels with or without protectionist retardation of the structural change process. The analysis above can be summarised in six statements:

- R&D capacity, knowledge and competence decide the initial location of production. Large knowledge demands in production leads to highly developed regions dominating the production of such products.
- Relocation of production from highly developed regions happens when large scale, routinised production becomes possible technologically, generally known and reasonable from an economic and a logistical point of view.
- When a product matures technologically, the relative importance of market investments increases. After a period of large investments in improved process, technology firms tend to relocate their immaterial investments from R&D to investments in improved market organisation and marketing.
- The spatial structural change is retarded by protectionist measures in rich countries and regions. When an industry approaches technological maturity and the market shares of these countries and regions declines rapidly, national and regional political bodies tend to introduce protective measures to retard the fall in employment, production and market share.
- R&D, product development design and other creative activities are mainly located in many-sided large urban regions with high internal and external accessibility for passenger transport. Professions dealing with creative activities primarily need a good intraregional accessibility, i.e. the milieu of a large urban region.
- Knowledge transfer via education or consultation has a somewhat lower need of being located in a large urban region.

The spatial product cycle theory offers an overall framework for understanding regional development in terms of changes in the specialisation of regions of different sizes and with different conditions and the role of knowledge in such change processes. However, the theory is less clear about the dynamic micro-economic processes working within regions and about the endogenous character of the general regional development processes. Comparative advantages are not given forever. They can be gained and they can be lost.

One important observation relates to the dynamic interdependence between a region's durable characteristics and the possibilities to exploit economies of scale (Johansson & Karlsson, 2001). We start by discussing how the existence of internal economies of scale influences the specialisation and growth of regions (Karlsson & Stough, 2002). For regions with distance-sensitive transaction costs, the relevant demand depends on the region's internal market potential. Hence, large urban regions with a high pur-

chasing power are the only possible locations for new products with a thin demand. Internal economies of scale are a consequence of technological features of an individual firm and are related to the existence of one or several fixed (indivisible) production factors in a firm's production (and cost) function. Furthermore, also research institutes and units are characterised by internal economies of scale. They tend to be tied to large urban regions not by the demand side but by supply side considerations. Only these regions can supply a varied and large enough supply of the highly qualified labour demanded for frontline research. The same is true to a high extent also for large research universities.

The concept of economies of scope is related to internal economies of scale. Such economies exist in their simplest form when the total costs for producing two different products within one firm is lower than the sum of the total costs of producing the two products in two different firms. Economies of scope, which arise in similar ways as internal economies of scale, are basically the result of several products using the same fixed resource within a firm. Hence, economies of scope are a basic motive for product differentiation within firms. However, it is also a motive for differentiation of research and higher education within research institutes and research universities making it rational for cost reasons to expand the scope and the size of such institutions, which adds to the motives to locate them in large urban regions.

In addition to internal economies of scale, a certain production activity may also be characterised by external economies of scale, i.e. agglomeration economies, along the lines suggested by Marshall (1920). External economies of scale appear when firms producing the same type of products (same industry or sector) locate themselves in the same region. Such external economies are therefore sometimes called location economies. Combinations of three major phenomena are assumed to cause external scale effects: (i) specialised labour markets, (ii) specialised neighbouring firms supplying inputs, and (iii) information spillover between the firms in the same sector.[9] Johansson (2005) deepens the analysis of external economies by making fundamental distinctions between (i) the source: proximity versus network externalities, (ii) the nature: pecuniary versus non-pecuniary externalities, and (iii) the consequence: efficiency versus development externalities.

External economies of scale normally refer to the advantages a set of firms producing similar products can have just by being located close together in a region. However, the same is true for knowledge generating activities within firms, research institutes and research universities. Karlsson & Andersson (2006), using a simultaneous equation approach, show that company R&D is attracted to concentrations of university R&D and vice versa. A cluster of research performers can attract to the region a rich supply of varied labour categories, which are specialised to suit the research activities in question.[10] A concentrated demand from R&D activities in the region also attracts neighbouring firms, which are first of all input suppliers (of various kinds). These specialised input suppliers may have their own internal economies of scale, and then it

[9] In line with Marshall's arguments, Duranton & Puga (2003) suggest three types of general microfoundations for agglomeration economies: (i) sharing, (ii) matching, and (iii) learning. It can be observed that these mechanisms not only explain the existence of agglomerations in general but also provide a micro-economic rationale for the continued expansion of large urban regions.

[10] We must observe given the discussion above that there is a high probability that the R&D activities from the beginning are located in urban regions with a good supply of highly educated labour.

is important to have accessibility to sufficient demand, which in this case is provided by the localised R&D performers. Neighbouring firms may in addition include specialised innovative firms of various sizes, which are attracted by the concentrated and varied supply of, in particular, new knowledge from the R&D performers in the region.

But why does it matter for these specialised neighbouring firms to locate in the same region as the R&D performers? The desire of the specialised input suppliers to be in the same region, as their customers, is determined by a frequent interaction with their customers and distance-sensitive transaction costs. The specialised innovative firms have similar motivations for being close to the potential knowledge suppliers. However, their motivation is even stronger since new knowledge is a very particular commodity – tacit (Polanyi, 1966), sticky (von Hippel, 1994), complex, uncertain, etc. – which implies that it in principle can be accessed only by means of face-to-face communication. A location in the region where the new knowledge is produced is more or less a prerequisite for being able to take advantage of it for product or process innovations or for future R&D. Even if much new knowledge is protected by means of patents, it is well-known that small firms are able to do a substantial amount of innovation without doing any R&D of their own (Acs & Audretsch, 1988). Obviously, it is possible for firms not doing any R&D to appropriate part of the new knowledge they generate, given that they are close enough to the sources.

This observation about distance-sensitive interactions brings us to the third factor, i.e. information spillover between firms. Part of the new knowledge is spread without being priced in an intra-regional neighbourhood, because in such a milieu it becomes prohibitively costly to privatize all information. Hence, some of it will spillover to other R&D performers and to specialised innovative firms.

A major concern here is that different products (and knowledge is a product) have different distance-sensitivities. This sensitivity is derived from the more basic properties of products, such as the contact intensity needed for their transfer between economic agents, i.e. the complexity and contact requirements of the transfer process. The assumption that products vary with regard to the contact or interaction intensity associated with their input and output transactions has a long history in economic theory (von Thünen, 1926; Lösch, 1943; Hirsch, 1967). These authors also make an additional assumption, namely that interaction costs are much lower when a transaction is made inside a region than when it is carried out between regions. New knowledge is transferred under complex and contact-intensive conditions, which may involve frequent and many varieties of nearby contacts. Consequently, the transfers of new knowledge can be assumed to have distance-sensitive geographical transaction costs and thus mainly take place within large urban regions.

Summarising the arguments in this section so far it is obvious that knowledge-generating, knowledge-using and creative activities have location advantages in large urban regions. The existence of scale economies in knowledge generation implies that large urban regions have a location advantage with regard to all types of knowledge generation with a thin demand. Thus, large urban regions can specialise in knowledge diversity and rely on the double force of internal and external scale economies in knowledge production. Scale economies are vital when we want to explain the existence if geographical concentrations of knowledge generation.

As the knowledge generating activities in a large urban region expand, productivity and output are enhanced and cost reduced due to internal and external scale economies, scope economies and improved input supplies with more and more specialised input suppliers. To the extent that this makes the price of knowledge fall, output will grow even further. The expansion of the output of new knowledge will stimulate the location and the growth of knowledge-using innovative firms in the region. A higher innovative activity in the region will stimulate income growth, which partly will be used to increase the knowledge generating activities. Thus, we can imagine an endogenous growth process in the large urban regions. As a modelling example, Kobayashi & Andersson (2004) propose a computable dynamic input-output model to examine the interactions between knowledge accumulation and economic growth with endogenous technical change. This model explicitly introduces new sectors called 'knowledge sectors' into the traditional dynamic input-output economic system. However, the regional growth may, at the same time, bring about congestion and increasing labour costs and land rents, phenomena that normally retard growth. Under these circumstances, economic activities in large urban regions must be more productive to cover those extra costs for labour, land and premises. This applies in particular to new economic activities that have to pay their 'full' costs and do not have the 'sunk cost advantages' of old economic activities.

However, the kernel of the innovative activities is that of stimulating the forthcoming of more and more valuable products, i.e. products for which the customers have a high willingness to pay. The firms producing these products can normally pay higher labour costs and land rents, since they produce valuable goods under conditions of monopolistic competition. Instead, the increasing costs and rents hit the production of somewhat older products, where competition increases, since the products and their production processes have become standardised. The firms producing these products now get incentives to move production partially or totally to locations with lower costs and rents in other regions within the country or abroad.

Thus, we can imagine a growth process where the continued knowledge driven growth in the large urban regions stimulates the renewal of production in other regions. However, scale economies constitute an equally important phenomenon for medium-sized and small regions. Here specialisation can take two basic forms. The first may be thought of as the classical Ricardian case, in which a medium-sized or small region hosts industries based on natural resources and for which internal economies of scale are important. If the natural resource is valuable enough, the necessary knowledge to exploit it can be obtained from larger urban regions by means of direct investments, since the knowledge to exploit natural resources is an established standardised knowledge. A similar case of large-scale specialisation in medium-sized and small regions may develop when the production of products is relocated from large urban areas during their growth phase as a part of the spatial product cycle. Such relocations also bring the necessary knowledge to produce the actual products.

The second form of specialisation and thus growth mechanism refers to Marshall's idea about external economies of scale. In this case, medium-sized and small regions may develop a specialisation in a self-organised way. In such a development, one can observe a narrow set of related industries or product areas, which are characterised by external economies of scale, i.e. localisation economies. The development may be

initiated by a relocation of production from large urban regions, imitation of products developed in large urban areas or in some rare cases on some original innovation. The cumulative sequence can be described as follows. Firms in the core industry with localisation economies locate together in a region. Input suppliers and labour categories, which are specialised with regard to the pertinent industry, are attracted to the region. Sometimes one can also observe how industry-specific customers are attracted to the region. The environment of industry-specific input suppliers and employment categories as well as the core firms themselves form an economic milieu, i.e. a cluster, which attracts industry-specific firms to locate and to expand in the region (Karlsson, Johansson & Stough, 2005). By means of development work within the core firms, learning-by-doing and complementary knowledge import from large urban regions, such industry-specific concentrations of firms can develop into a creative cluster generating industry-specific new knowledge.

Using the terminology developed by Myrdal (1957), the above sequence can also be referred to as cumulative causation. It represents self-reinforcing, circular dynamics, which is constrained by the development of the demand from the region and from its external markets. This form of positive feedback is in general constrained by the existing durable capacities in the form of built environment, accessibility based on transportation systems, production capacities and labour supply. For certain activities, these constraints may not be binding, whereas other activities require adjustments of the durable capacities. Generally, market potential can be assumed to adjust on a faster scale than the durable capacities. However, in the longer time perspective regional capacities and the economic milieu will adjust in a system of coupled feedback linkages. The interaction between scale economies and regional durable characteristics has the same nature in both medium-sized and small regions, although external linkages to other larger regions are more vital for smaller regions. For medium-sized and small regions, the adjustment of durable capacities may be assumed to be rather specific with regard to the narrow set of industries forming the specialisation nucleus of each region. This implies that there is always a risk that, in particular, medium-sized and smaller regions may develop a specialised material and immaterial infrastructure, which in the long run can be a severe obstacle to a necessary structural change (Johansson & Karlsson, 1990). Using the German Ruhr area as an example, Grabher (1993, 256) illustrates how an earlier innovative milieu may lose its innovativeness: “The initial strength of the industrial districts of the past – their industrial atmosphere, highly developed and specialised infrastructure, the close inter-firm linkages, and strong political support by regional institutions – turned into stubborn obstacles to innovation”. Hudson (1994) draws the same conclusion based on analyses of a large number of industrial regions.

So far very little has been said about durable regional characteristics such as infrastructure and production factors, which have a fixed or semi-fixed location across regions. Durable characteristics can be divided into (i) local and external markets, and (ii) durable capacities (Johansson & Karlsson, 2001). The latter consist of the supply of different labour categories, existing production capacities with their specific techniques, R&D organisations, institutions of higher education, and material infrastructure in the form of facilities and networks (Johansson, 1995). The durable capacities generate comparative advantages in the Ricardo sense and influence the specialisation profile of regions. Although these characteristics are more or less given in the short and medium term, a major part of the durable characteristics change gradually over

time and are largely created by investment and migration-like processes. Partly these processes are driven by the decision by firms and households but political decisions in many cases play a major role in reshaping the durable characteristics over time.

Turning to the size and the purchasing power of a region's local and external markets, we can observe that in the short and medium term the properties of markets are durable phenomena, which create comparative advantages in the pertinent regions. However, the dynamics of the interdependence between market size and economies of scale is essential. The interaction between market potential and the location of firms with scale advantages, which, in principle, can be seen as the initiation of new product cycles, is indeed intriguing. Firms with internal economies of scale are attracted to locate in a region with a large market potential and a region in which firms want to locate develops a large market potential. This observation is further emphasised if we note that for many activities, internal and external economies of scale coexist.

If we study the process of specialisation on a slow time scale, the size and composition of a region's market potential becomes a variable, which evolves in a dynamic process. Similarly, we can observe an evolutionary process in which the specialised labour supply gradually adjusts in concordance with the specialisation profile of the region. In a sense, the insights about this type of basic cumulative endogenous course of events are not new. They can be traced back to the contributions by Marshall (1920), Myrdal (1957) and Kaldor (1970).

With this view of the world, the location of a particular industry is history-dependent, due to the prevalence of multiple equilibria. This also implies that policy matters. However, it is by no means certain that policies always can change the ongoing processes. Once a pattern of specialisation is initiated, for whatever reason, the pattern tends to get "locked in" by the cumulative gains from trade and specialisation. Thus, there is a strong tendency toward "path dependence" in the patterns of specialisation and trade between regions. Since knowledge generation is cumulative, path-dependent and subject to increasing returns to scale and since knowledge diffusion is subject to spatial frictions, spatial knowledge monopolies might very well emerge with asymmetric knowledge access (cf. Akerlof, 1970) between regions, making it possible for urban regions to keep their constructed competitive advantages for extended periods.

6. Concluding Remarks

The purpose of this paper was to discuss the role of knowledge and talent in regional development in both a regional and a global perspective. Our starting point was the idea that knowledge infrastructure, knowledge flows human capital, talent, creativity, and the generation, protection, accumulation, appropriation and creative use of knowledge are basic drivers of the specialisation of regions and thus of regional development. We have discussed the characteristics of creativity and of creative regions, how human capital and knowledge-dependent firms are attracted to creative regions, characteristics of the international system of creative regions, the special role of large functional regions as creative regions and as initiators of new product cycles and how knowledge-driven spatial product cycles function as motors in regional development.

Even though we at a more general level are able to describe theoretically how knowledge and creativity are at the kernel of our understanding of regional development within both a regional and a global context, we still need to learn more about the underlying processes. A prime example is that we need to learn more about the relative importance of learning and selection processes in regional development.

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