Strategies for Regional Innovation

Systems: Learning Transfer and Applications

Philip Cooke

Centre for Advanced Studies
Cardiff University
Cardiff CF10 3BB

January 2001

Prepared for UNIDO World Industrial Development Report (WIDR) 2001
Introduction

The concept of Regional Innovation Systems is relatively new at the level of policy, though it has been discussed and written about since the early 1990s (Cooke, 1992). Lundvall (1992) one of the authors promoting systems of innovation thinking early on, mentioned regionalisation in relation to globalisation, and referred to regional networks, but dismissed the idea that regions had anything significant to offer innovation compared to national systems, even in respect of such geographically contingent processes as tacit knowledge exchange. He further suggested that transnational innovation interactions were likely to gain in importance over national ones, but that regional processes were unlikely to. It is interesting to reflect that at the time this view was being developed, the European Commission was developing and implementing inter alia, Regional Technology Plans and Regional Innovation Strategies precisely because of the weaknesses of national innovation systems in the European Union in producing competitive rates of innovation to those of the USA (CEC, 1995). Porter (1990; 1998) showed that the USA’s competitive lead in innovation was predicated on the existence of regional and local innovation systems based in ‘clusters’. This has been shown to be particularly true in ‘new economy’ sectors like biotechnology and ICT in regions like Massachusetts and California, or new media in big city districts like Hollywood, Los Angeles and ‘Silicon Alley’ in New York (Cooke, 2001).

By the turn of the millennium, governments practically everywhere in the advanced economies were promoting regional innovation and cluster-building policies as ways of boosting national competitiveness. One of the clearest cases of this approach was that of Germany which, in 1995, announced the BioRegio contest which sought applications from regional bodies for funding support to build innovative, regional biotechnology clusters and help to drag Germany up from its poor competitive position in biotechnology commercialisation. The winning regions were Munich in Bavaria, Cologne-Düsseldorf in North Rhine-Westphalia, and Heidelberg in Baden-Württemberg (Dohse, 2000). In the UK, government industry policy since 1998 is to build a ‘Knowledge Driven Economy’ by strengthening regional development bodies
and co-fund growth of innovation through supporting regional cluster-building strategies. Much of this thinking was influenced by reports on enhancing the global competitiveness of UK biotechnology (DTI, 1999a; 1999b).

This is by way of a very partial illustration of the recently realised importance for economic development policy of regional innovation systems. In the first part of this paper a presentation will be made of some of the conceptual thinking behind the idea of Regional Innovation Systems. In doing this reference will also be made to thinking about clusters as specific sub-systems operating within regional innovation system-settings. Reference will be made both to the support systems of innovation, from the private actions of the market to the interventions of governments with programmes and schemes, and to the ways in which well-functioning systems and clusters may have their own formal or informal ‘governance’. Following that there will be a section on strategies adopted by development authorities to support cluster and innovation enhancement. Examples given will be from less-favoured regions as far as possible. At each point, efforts will be made to reflect on the global processes that are making regions essential organizing focii for innovation and the strengthening of competitiveness. Moreover, the implications for developing countries will be studied, as will examples of ways in which government policies might be designed to stimulate regional innovation systems. Finally, some inferences are drawn about the general lines of appropriate policy action for enhancing regional innovation by balancing market and public policy relationships.

1. Description of Regional Innovation Systems

The increasing globalisation of markets has changed the competitive environment of most companies drastically. Not only on foreign markets but also on their home market they are confronted with intensive price, time and quality competition. To stay competitive they have to restructure their business organisation, including innovation activities as well as consumer and supplier relationships. Obviously such companies are much more successful in regaining global competitiveness, if they benefit from the specific advantage of their environment. Companies that have reacted specifically to different environments have been more successful than others who believed in “one
best way” of organising business (Kern and Schumann, 1984). Due to intensive global competition, companies are forced to look for the most supportive environment world-wide. Their restructuring process is therefore directed by the concept of product specialisation. Economists like Krugman (1991) notice this when their statistical analyses show them the importance of intra-industry trade, that is import and export of different qualities of, say, cars or different parts of the value-chain in electronic or ICT components. Of course, developing countries are deeply implicated in intra-industry trade through offshore sourcing by advanced economy multinationals. This is not only true for multinational companies but also for medium sized firms. Companies organise their production and innovation processes on a global scale, taking advantage of the specific resources of different territories. New transport and information technologies facilitate the organisation of companies’ global production networks and innovation processes (Gereffi, 1996).

As production becomes more science based, advantages such as developed research infrastructure, a highly qualified workforce or an innovative culture are becoming more important than natural resources, which means that a supportive environment for innovative companies can deliberately be created. To become attractive for companies territories can set up specific institutions to support their innovation strategies. In an increasingly borderless world the nation state, logically, loses some strategic economic capabilities, despite Lundvall’s (1992) defence of it for innovation, for as we have seen, the region is now the more natural economic zone. Regions, especially when they have developed clusters and appropriate administrative machinery for supporting innovative enterprise, represent more meaningful communities of economic interest, define genuine flows of economic activities and can take advantage of true linkages and synergies among economic actors. Regions have to seek competitive advantage from mobilising all their assets including institutional and governmental ones where these exist, or demand them where they do not. As regions become more specialised and pull the institutional support structure along so foreign direct investment seeks out such centres of expertise by following domestic investment as part of global location strategy (Cooke, Boekholt & Tödtling, 2000). Thus it is important to show how the to and fro of adjustment between companies, markets, public authorities, research institutes, training institutions and social partners
is transforming each, while creating the elements of an innovative framework that may encompass and stabilise them all. For conceptualising Regional Innovation Systems three terms denoted are important to analyse: that is, region, innovation and system. In the following these concepts will be discussed in more detail.

1.1 The Concept of Region

Although it has been realised that regional economies are becoming more important, still no general understanding exists of how to define a region (Harvie, 1994). It is important to mention that a regional classification is an intellectual concept. It exists only in terms of the criteria by which it is defined. Often four criteria are mentioned to define a region: (1) a region must not have a determinate size, (2) it is homogeneous in terms of specific criteria, (3) it can be distinguished from bordering areas by a particular kind of association of related features, and (4) it possesses some kind of internal cohesion. It is also important to mention that the boundaries of regions are not fixed once for all; regions can change, new regions can emerge and old ones can perish. Therefore to analyse a region, criteria must be found that define a functioning unit within a specific time.

To define a region from an economic perspective, sometimes the concept of industrial cluster is used (Porter 1998). Clusters can be characterised as a dense network of economic actors, who work together very closely and who have intensive exchange relationships. All economic actors, who directly contribute to the dominant production process of a region are partners in this network, including manufacturing companies as well as supply and marketing companies, financial institutions, research institutes and technology transfer agencies, economic associations and unions, training institutions, the regional government and even informal associations. It is important to mention that the cluster concept can be distinguished from traditional, industry-specific analysis, as it concentrates on industry overlapping co-operation with the governance system. Of course regions can have more than one economic cluster, Silicon Valley is a large complex including ICT and biotechnology clusters, if we define it economically. The Ruhr region in Germany, likewise, is an economic ‘region’ with long-established coal, steel, and engineering clusters (Rehfeld, 1995).
The political region of Tuscany in Italy has many clusters or ‘industrial districts’ in clothing, furniture-manufacture, and so on (Dei Ottati, 1994).

We cannot expect to find well-established industrial clusters in all regions. Regions may differ in the closeness of co-operation and in some regions the administration or public governance system may be rather weak while in others it may be difficult to find a well-established supportive institutional set-up. In the last case national institutions may be more important than regional ones, if those exist at all. However, in the current state of regionalisation it is more appropriate to speak existentially of regions as political governance systems below the national but above the local level of public administration. Federal states or provinces are appropriate vehicles as are ‘autonomous communities’ as in Spain, where such entities exist. These have the administrative legitimacy and capability to develop policies for supporting enterprise, especially small and medium in scale (SME). Among these might be such instruments as cluster or regional innovation system-building policies. Where the private sector organises itself regionally it can become part of the regional governance structure for industrial development purposes. Therefore it is important to distinguish between different types of regions and to find out how they function and how well they are doing (see below: National and Regional Innovation typologies and actions, Tables 1-3). It is also important to analyse how national and regional innovation systems are related.

1.2 The Concept of Innovation

The concept of innovation is used in connection with the analysis of processes of technological change. Traditionally the process of technological change was characterised as consisting of three different stages: invention, innovation and diffusion. Invention is the stage of the production of new knowledge, innovation is the stage of the first application of the existing knowledge within production, and diffusion in this model means the broad use of new technologies. The model can be characterised as a “trickle down” or “cascade model”; it is assumed that the extent of fundamental research substantially influences the opportunities for technological innovation within a territory, which in turn determines the growth rate of the social
product. It is assumed that in the case of an adequate level of fundamental scientific research the distribution of resources towards this stage of technological progress makes it possible to initiate a process of economic growth. However, this cascade model has often been criticised as being based on a functionalist argumentation. First of all technological change does not take place according to the linear logic of this model, on the contrary, technological change must be conceptualised as a process which - concerning the outcome - is not determined but rather open; it is impossible to discover a sequence of clearly delimited stages that have to be passed one after the other (Lundvall 1992). Instead we have to be aware of the fact that particular innovative activities can both be cause and result, consequence and prerequisite. Therefore a broader definition of innovation is nowadays typically used, which includes all activities of the process of technological change: problems of awareness and definition, the development of new ideas and new solutions for existing problems, the realisation of new solutions and technological options as well as the broader diffusion of new technologies.

It is also important to bear in mind that innovations are not very exceptional phenomena; on the contrary, they can take place at any time in all areas of the economy. They therefore have to be conceptualised as ubiquitous phenomena (Lundvall 1992). If we use such a concept, then there is no need to associate innovations only with major changes, incremental changes are also included in the concept of innovation. Using such a broad definition, it is useful to focus on the process of learning through which knowledge and new technologies are created, distributed and used in specific areas. Learning is defined as a collective process shaped by the existing structure of production, by organisations and by institutions. It is assumed that the characteristics of such a learning system are central to questions of growth, employment and competition. In this context it is useful to distinguish between different processes of learning: first, learning in a more narrow sense; by doing and by using. Learning in the narrow sense takes place within the production process; therefore it might be called learning by producing, indicating that its basic components may be though of as learning-by-doing, by using and by interacting in relation to normal production activities (Johnson 1992).
Second, searching and discovering are more complex learning processes, including activities of problem definition and problem solution, which take place in specific institutions. Searching means a process of deliberately choosing and recombining existing knowledge to develop new products and processes. Searching therefore takes place within specific technology paradigms (Dosi 1982). Exploring, on the other hand, means the production of new knowledge for newly defined problems; this learning process does not produce knowledge that can be transformed directly into new technologies. On the basis of such a broad concept of innovation it is possible to identify science-intensive high technology regions and those lagging behind. An important question is to what extent regions learn from each other to become more competitive?

1.3 The Concept of System

In the literature on innovation the meaning of the term system is not analysed in great detail. Some general definitions of a system of innovation exist (Nelson and Winter 1982, Lundvall, 1992, Edquist, 1997); for example Lundvall defines a system of innovation as being constituted by a number of elements and by the relationship between these elements. It follows that a system of innovation is constituted by elements and relationships that interact in the production, diffusion and use of new and economically useful knowledge (Lundvall 1992). It becomes quite clear that an innovation system is a social system, which means that innovations are the result of social interaction between economic actors. And it is an open system, which interacts with its environment. Here the feedback mechanism is of importance, which means that by producing new knowledge and new technologies the innovation system not only has an influence on its environment but also on the external conditions of its own functioning.

Still there is a need to distinguish between “operational” and “conceptual” systems. If we talk about an operational system we are referring to a real phenomenon; a conceptual system represents a logical abstraction, a theoretical construct that consists of principles or laws that explain relationships between and among variables. In the latter meaning the term system is related to a specific methodological approach, it is
an analytical framework. Using the systems approach we construct entities but they do not represent the totality of a real phenomenon. The scientific approach is to look for the constituent elements and their specific characteristics, the relationships between these elements, the boundaries of this system and the interaction with its environment. Defining the system concept as an analytical tool, we do not need to assume that innovation systems always consist of tight linked actors and that they have clear-cut boundaries. We also do not need to expect that all innovation systems consist of the same actors performing the same function. On the contrary such an understanding of a system approach is open for flexible interpretation.

In using the systems approach it might be possible to overcome the weaknesses of case studies, because a common and analytical framework is used. Its advantage is that it allows for a systematic comparison of innovation activities in various regions. At the same time we are able to compare the existing structure of production, organisation and institutions of different regional innovation systems in relation to criteria of efficiency such as growth, employment and economic competitiveness. Doing these comparative studies, one might also find some functional equivalents for specific problems within the innovation process.

1.4 Theoretical Approaches

The systems approach, as has been said earlier, only provides an analytical framework, but is not itself a substantive theory. Therefore to analyse regional innovation systems it is also important to integrate those substantive theories. For this, evolutionary economic theory, regional science, the industrial district concept, the theorising of rationalisation strategies, and the governance concept are seen as important substantive theoretical elements. The theory of an evolutionary economy consists of very different approaches. However the idea of distinguishing between a basic techno-economic paradigm on the one hand and specific trajectories on the other seems to be important (Dosi 1982). Depending on the particular kind of social embeddedness (Granovetter, 1985) a techno-economic paradigm can lead to different development paths. The Fordist paradigm for example led to different national production models shaped by the specific institutional environment.
Perez (1987) emphasised the importance of the connection between techno-economic process and societal change for economic growth and international competitiveness in specific territories. Before a new technological paradigm can lead to any substantial rise in productivity, it is argued, a crisis of structural adaptation must be overcome. A mis-match occurs between new technologies and the old social model of production. As old institutions and cultural patterns are corresponding to the requirement of the outdated technological system, they have to change if the new paradigm’s productivity potential is to be fully exploited. Institutional change refers to work organisation and management practices as well as to the education system, the financial system, the industrial relation system etc.

The problem of an institutional gap is also taken up by the concept of “lock-in” (Grabher 1993). It is argued that path dependence may lead to political, structural and cognitive (ideas) lock-ins, which then become a hindrance for the search for a new technological paradigm. In an economic crisis however there are opportunities to carry out major changes, as it becomes obvious that to overcome the crisis within the traditional development path will not be possible. The distinction between adaptative and innovative learning is also important in this context (Nystrom and Starbuck 1984). In the case of adaptive learning only a better exploitation of the options of a specific techno-economic development path is possible, while innovative learning leads to fundamental changes caused by a new techno-economic paradigm.

The concept of regional science is important because it explains the ways regional economic processes operate to produce agglomeration, urbanisation and industrialisation. Economists have recently re-discovered the crucial importance of this field and labelled the discovery ‘new economic geography’ (Krugman, 1991) The related sub-field of industrial districts (Zeitlin 1992; Pyke and Sengenberger 1992) describes the characteristic patterns of successful regions by pointing to the following elements: the existence of a strong SME sector, intensive horizontal cooperation between companies, a highly qualified work force and flexible work structure, a dense infrastructure of supportive institutions and organisations and an innovative regional culture as well as an active regional government. The concept however also
distinguishes between high road and low road regional strategies, which means that an innovative system can be created deliberately by economic actors (Pyke and Sengenberger 1992; Cooke, 1995).

In regional science and industrial innovation studies the focus has traditionally been on new rationalisation strategies within companies. It was argued that, because of the rigidities and inflexibility of the Fordist production model, new rationalisation strategies, making use of the full productive and innovative potential of human beings, were needed. Those new production models were characterised by the following concepts: Post-Fordism (Hirst and Zeitlin 1991) New Production Models (Kern and Schumann 1984), Flexible Specialisation (Piore and Sabel 1984) and Lean Production (Womack et. al. 1990). More human relations-focused work also stressed the importance of systemic rationalisation (Altmann et. al. 1992), which means that the whole value added process, including supplier and customer relationships becomes the object of rationalisation strategies. More recently, though, the model of Japanese industrial organization that underlay these concepts has itself been brought into question (Porter, Takeuchi & Sakakibara, 2000). They argue that Japan suffers from the legacy of learning from the West and placed too little public investment in the basic scientific research that enabled the Internet and the human genome to be such paradigmatic innovations. Japan has an innovative ‘hidden’ economy of small-firm clusters, but its large-firm dominated, traditional sectors are no longer competitive, these authors argue.

1.5 Governance

The analysis of governance regimes (Lindberg, Campbell and Hollingsworth 1991; Hakanson and Johanson 1993; Hooghe, 1996; Marks et al, 1996; Cooke et al, 2000) developed, at least in some measure from economic network analysis. Economic network analysis is a key part of innovation systems analysis. Governance includes the organisational forms and processes through which economic activities in a specific field are co-ordinated and controlled. Hierarchy, markets, networks and culture are seen as the most important type of governance. The governance concept is applied to companies as well as to their economic environment. Both governance structures are
very much intertwined with each other. Therefore the economic success of companies
not only depends on the intra-organisational mechanisms of co-ordination and control
but also on the fit between them and the regional governance structure. It becomes
quite clear that, to analyse regional innovation systems and their transformation,
besides the general analytical framework, provided by the system concept, substantive
theories are also needed. However so far, no single scientific discipline covers the
whole topic. Therefore an interdisciplinary approach is needed to link the different
system-dimensions.

1.6 Policy Issues

There is a growing awareness amongst regional authorities that the economic growth
and competitiveness of their region depends largely on the capacity of indigenous
firms to innovate. Offering the appropriate support to indigenous firms to become
more competitive through innovation is a rising star on the regional policy agenda.
Policy makers on various local and regional levels are formulating regional
technology strategy, sometimes embedded in their economic development policies,
sometimes separate from other policy domains. There is a clear need for support in the
design of regional innovation policies, both from an analytical perspective and based
on experiences and best-practices in regions around the world.

There are several issues at stake:

- regional authorities do not have access to the full scale innovation policy instruments
  available on the national or supranational (e.g. EU) levels, due to limited
  budgets and responsibilities;
- it is only a recent phenomenon that regional policy makers are developing strategic
  technology plans, they have not been able to gain much experience or establish
  best-practice yet. Many regional initiatives are individual projects, without a
  coherent policy back-up.
- very often the innovation needs of the firms in the region have not been
  systematically assessed. This results in an insufficient interaction between
industry and the innovation support system. The effectiveness of the innovation support system, in terms of its economic contribution to growth, could be improved when this mismatch is overcome.

One of the assumptions of the regional innovation systems approach is that many innovative firms operate within regional networks, co-operative and interacting not only with other firms such as suppliers, clients and competitors, but also with research and technology resource organisations, innovation support agencies, venture capital funds, and local and regional government bodies. Innovation is a learning process that benefits from the proximity of organisations that can trigger this process. Regional authorities have an important role to play to support this learning process by offering services and other mechanisms that augment the inter-linkages between all these actors. The diffusion of knowledge, information and technologies are for a large part transferred through regional channels, alongside national and international channels. The character of these networks and their geographic scale differ between industrial sectors and between regions. They are not static but adapt to the strategic needs of the firms and can expand or decrease. This makes for a good understanding of the changing environment of the global economy in which the regional firms operate.

There are three key policy areas where public authorities perceive a need for policy development towards regional innovation systems.

1. The concept helps public authorities to focus on their present industrial strengths and to develop a strategy for the future based on those strengths. In addition to the study of traditional indicators for innovativeness, such as R&D intensity of the firms, amount and character of R&D expenditures, the presence of New Technology Based Firms and so on, the systemic approach looks at the linkages between firms and between firms and the Science & Technology (S&T) infrastructure. It thus distinguishes ‘clusters’ of innovative activity, in industrial sectors that are not necessarily known as ‘high-tech’, but with good competitive potential. The study of potentially strong inter-firm clusters within the region offers the public authorities a framework to focus their support efforts, alongside generic support actions.
2. A systemic and integrated analysis of both the firm side (global competition challenges, innovation needs) and the supply side (innovation support in its widest sense) contributes to the design of a coherent public policy strategy. Since the experience with regional innovation policy is relatively young in many regions, present efforts are often a collection of one-off initiatives. Furthermore, in the last decade the insights from evolutionary economics and innovation policy literature have shown that innovation policy involves much more than R&D funding alone. Particularly in the case of SMEs, the support needs range from technological assistance, innovation management, access to risk capital, access to R&D (results), short term access to tacit knowledge, information on patents and licences, to name a few key aspects of the innovation process. For each region the appropriate mix of public and private support agencies that can offer assistance in these areas is different. An analysis of what type of support is available for regional firms reveals whether the region should extend its ‘package’ of innovation support in areas which are disregarded up to now.

3. The concept also helps to clarify what type of support is to be set up at which policy level (local/regional/national/transnational) and what the possibilities for inter-regional co-operation are. Each type of industry has different support needs, different geographical scopes for their production networks and for their links with the innovation support system. Firms operating on an international scale will easily find access to R&D on the national or even international level. For the regional authorities it is important to have a clear view of the geographical level at which the firms in their regions operate. In times of increased global economic integration and tighter public budgets, it seems ineffective when regions aim to duplicate small scale ‘national innovation systems’ within their boundaries. Again a closer look at the character of the innovation needs and competitive challenges on the firm level, combined with the geographical scope of the clusters in the region, provides arguments about what regional authorities should offer themselves, what could be done in co-operation with other regions or be left to the market or some higher levels of authority. In addition, cross-border regional co-operation could appear to
be a good option for those regions where firms are closely interlinked with suppliers or customers just outside the country borders.

2. Regional Innovation Strategies, Policies and Programmes

2.1 Governance and Experimentation

In some development contexts, centralised control of innovation infrastructures may mean that systemic linkages do not develop sufficiently because other economic priorities such as exchange-rate policy or macro-economic policy suffer fluctuations which make the regularity of systemic relationships of embeddedness difficult to develop. In other cases, where take-off has been achieved, nevertheless the same kinds of pressures can make central government sclerotic regarding innovation. Regional innovation, in contexts where regional governance exists, may come to be seen as a key source of policy experimentation, along lines argued in the ‘laboratories of democracy’ theme of Osborne (1988) and Osborne & Gaebler (1992). Detailed analyses of emergent regional innovation systems in South Korea by Hassink (1999; 2000) reveal a political perception that regional experimentation should be stimulated to correct atrophy in innovation at the centre. Part of the Porter et al (2000) analysis points to the importance of federalising the administrative mind, something adumbrated in a study of regional innovation in Japan’s Tohoku region (Abe, 1998).

A strong, regionalised innovation system is one with systemic linkages between external as well as internal sources of knowledge production (universities, research organizations), intermediaries (government and private innovation services) and firms, both large and small. Most regions do not have these systemic innovation characteristics. Also, some small countries have equivalent weaknesses in their national systems. Broadly speaking, the key dimensions of a regionalised innovation system are: first, the processes and policies supporting education and knowledge-transfer, second, arrangements for the governance of innovation; third, the level of investment, especially in R&D, fourth, the type of firms and their degree of linkage, and communication, in terms of networking, sub-contracting, presence or absence of supply-chains and degree of co-makership between customers and suppliers. These dimensions of regional innovation systems analyses will be deployed in the empirical
studies contained below (Tables 1-3). Essentially, and with significantly less control and more complications, a functioning regional innovation system replicates the organizational capability internalised in the large corporation in the externalised relationships of supply chains, horizontal networks, university-industry relationships and the host of marketised and public intermediaries that sell or supply innovation-relevant services. However, the focus on innovation, rather than the panoply of functions involved in industrial organization more generally, means that it is possible to have regional innovation strategies that build towards more systemic regional innovation.

Regional administrations vary in their nature and degree of autonomy, especially in developing countries where they are often weak. The strongest in developed country settings, such as States in the USA or Australia, for example, or the länder of Austria and Germany are associated with rich, regionalised intermediary governance organizations such as chambers of commerce, trade associations, regionalised union branches, banks etc. They also tend to have active innovation policies. Elsewhere regions are weakly developed or, as in Italy, democratically controlled but with limited innovation support capacity and, in most cases, a passive stance towards it. Most small countries are weakly regionalised, may well have a government science and technology policy but linkage with industry may be weak or focused on traditionally leading, large-firm dominated sectors. This is especially so in “mission” rather than “diffusion” oriented systems (Ergas, 1987).

2.2 National Innovation Trajectories

Regional economies vary in their typical firm-size structure; some are overwhelmingly dependent on SMEs, others have a mix of large firms and SMEs. Inter-firm interaction, too, varies from the tight small-firm networks typical of industrial districts to “arm’s-length exchange” relationships commonly found in laissez-faire settings. Where a reasonable presence of larger companies is found there may be strong vertical supply-chain relationships such as those associated with the Japanese keiretsu and South Korean chaebols, or there may be few interactions with indigenous SMEs, as typically has been the case in “branch plant” economies. In
Table 1, an attempt is made to stylise some key innovation system indicators, highlighting diverging degrees of interaction for innovation at the national innovation system level. South Korea and Brazil are selected as examples of economies with distinctive innovation trajectories in the 1980s and these are provided primarily for illustrative purposes. The key policy and interactive practices acted as conditions for the different innovation and competitiveness trajectories at that time. Thereafter, changes occurred, with both economies severely caught-up in the financial meltdown of 1998, out of which, especially in the Korean case, a regional innovation systems perspective emerged more strongly, although in Brazil too, more co-operative forms of competition are now evidenced (Schmitz, 1999; Altenburg & Meyer-Stamer, 1999; Bell & Albu, 1999).

<table>
<thead>
<tr>
<th>Indicator</th>
<th>South Korea</th>
<th>Brazil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Expanding universal system, high tertiary and engineering graduate output</td>
<td>Deteriorating education system with lower output of engineers</td>
</tr>
<tr>
<td>Knowledge Transfer</td>
<td>High imports with local integration and rising firm R&amp;D</td>
<td>High imports from US but weak local integration and firm-level R&amp;D</td>
</tr>
<tr>
<td>Business R&amp;D</td>
<td>Rising to &gt;50% of all R&amp;D</td>
<td>Remains below 25% of all R&amp;D</td>
</tr>
<tr>
<td>Linkages</td>
<td>Strong science and technology infrastructure linked to firm R&amp;D</td>
<td>Weakening science and technology infrastructure and poor firm linkages</td>
</tr>
<tr>
<td>Investment</td>
<td>High and supplemented by Japanese inward investment. High learning from Japan</td>
<td>Decline of US investment, low internal investment and low learning from abroad</td>
</tr>
<tr>
<td>Communications</td>
<td>High investment in advanced telecommunications infrastructure. High growth in electronics, high exports and user-feedback</td>
<td>Slow development of modern telecommunications. Weak electronics, low exports, low learning</td>
</tr>
</tbody>
</table>

Table 1: Divergence in National Systems of Innovation in the 1980s (after Freeman, 1995).
The narrative here is rather clear in that a large part of the explanation for divergence between these economies (and this can be extended to East Asia/Latin American economic performance contrasts, more generally) is assigned to fundamental financial and property-ownership reforms in South Korea, absent in Brazil, that created a larger entrepreneurial class and through universal education, thorough structural and technical transformation. This enabled the entrepreneurial class to access the capital to invest in innovation. Of course it has since become clear how deeply the South Korean state was implicated in financing the growth strategy using the *chaebols* as the financial and production vehicle. It is noteworthy that only Krugman (1994) queried the sustainability of the East Asian growth model, seeing the large investments associated with universal education and consequent corporate innovation as a one-off ‘catch-up’ mechanism that could not again produce the same rapid rates of productivity increase. Interestingly, from a globalisation viewpoint, the Korean strategy had pervasive effects in advanced economy regions that had targeted Asian inward investment from Japan, and later Korea, a case in point being Wales (UK), but it also applied to Catalonia in Spain, another of Europe’s hosts to the likes of Sony etc.

Arrival of Sony and other Japanese consumer electronics corporations like Hitachi, Aiwa and Panasonic (Matsushita) in Wales in the 1970s, with stimulus from the regional administration and development agency, led to the beginnings of a regional innovation strategy in which ‘embedding the branch plants’ through assisting sourcing and supply-chain development, thus building ‘global production nets’ was a part. Supplier firms were helped by customers and public intermediaries to reach the exacting new requirements of Japanese production. Where indigenous firms left gaps, supplier transplants were encouraged in subsequent rounds of inward investment. Panasonic’s consumer electronics components arm was one such firm to transplant, supplying both the Panasonic TV assembly plant but also non-Panasonic customers. The exacting interaction between customers and supplier rested on the quality-cost pressure applied whereby suppliers like Panasonic would be required constantly to reduce their ‘parts per million’ defects while also offering a 3-4% annual cost
reduction. Eventually, Panasonic had to vacate the market for many components and were substituted by Korean suppliers. It was widely understood in the industry that the latter were able to do this at less than Japanese cost because of massive subsidy by the South Korean government. The recovery in regional component prices after the Korean economic meltdown has since caused Panasonic and Sony drastically to cut their workforces in Wales and seek suppliers and new plant locations in Eastern Europe (Cooke & Schall, 1997; Cooke, Boekholt & Tödtling, 2000).

We can look into examples of regional system-building to enhance innovation and competitiveness of firms by exploring recent accounts of efforts made in the specific regions of Kyongbuk-Taegu in South Korea and Santa Catarina in Brazil. Subsequently comparative accounts will be drawn to indicate regional innovation system variety from Northern Ireland, a politically conflicted and economically peripheral part of the UK, and Féjer region, a successful development region in Hungary where market processes have been more important than regional public intervention in the transition towards systemic innovation capability. It is important to have in mind the fact that regional innovation systems are both rare in the sense of being found in many countries, but that where they exist or have many characteristics of systemic interaction focused on innovation, they are diverse in nature (Cooke, 1998). They may be dominated by a major industry, such as aerospace in Midi-Pyrénées, France, with its strong regional supplier linkages and connections to public or private research laboratories and higher education. Alternatively, as with many industrial district regions there may be relatively few direct links to research laboratories but many to various intermediaries and service providers, including regional and local public providers. In such distinct circumstances the ‘collective order’ or governance of the system may be animated by a large corporation or group of larger firms, or by mainly private chambers of commerce and business associations, as in the ‘white’ or conservative regions of Italy, like Veneto, or, alternatively, more collective, associational partnership arrangements between firms, governments and intermediaries as in ‘Red Emilia’ (Cossentino, Pyke & Sengenberger, 1996).

2.3 Kyongbuk-Taegu
Kyongbuk-Taegu is located in the heavily industrialised south-eastern part of South Korea. The region is dominated by two industrial complexes, led by chaebol, in electronics and textiles in one location (Kumi) and steel in the other (Pohang). The former consists of numerous branch-plants while the latter has a large steelworks and numerous steel-consuming customers clustered around it. National government policies of supporting large corporations were mostly responsible for the region’s development profile. It has lower than average unemployment (6.3% compared to 7.4%) but lower R & D personnel and university expenditures. However, the regional public expenditure on Science & Technology is close to the average of 2.6% at 2.5% of budget. Hassink (2000) distinguishes three stages of innovation support; general information, technological advice, and joint R & D projects. The first two are met, to a large extent, by the Small & Medium Business Administration (SMBA) set up by the central government Ministry of Trade & Industry in 1996. The network of eleven regional offices runs support initiatives and co-ordinates SME policies from other Ministries, such as the Ministry of Science & Technology. Another agency concentrating on the support and information function is the Small & Medium Industry Promotion Corporation (SMIPC), a not-for-profit agency also of the Ministry of Trade & Industry, dating from 1979. It now is subordinate to SMBA but firms use its services more, notably for technical assistance.

Stage-three services are supplied by three Regional Research Centres, in High Quality Automated Electronic Parts, High Sensitivity Polyester Products Development, and Automotive Parts Technology. These were established by the central ministry of Science & Technology. They aim to upgrade research facilities at universities, encouraging them to partner SMEs in research projects. Hence, the RRCs are rather more visionary in providing an innovation infrastructure supply ahead of demand, whereas the earlier-stage support and information agencies are meeting a pre-existing demand. Other Ministry of Trade & Industry measures applying to this region are the SMBA-managed Industry-University-Government Research Institute Consortium encouraging use of university and other laboratories by SMEs, and two Technoparks to add to the existing Science Town at Taejon in the region. Municipalities help fund two specialist industrial research institutes, in Textile Dyeing and Textile Development.
It can easily be seen that this is a regional innovation architecture with systemic linkages within specific industry agglomerations that is almost wholly dependent upon central government *dirigisme*. The role of the market is relatively limited except insofar as other firms supply most technical assistance for innovation mainly through the supply-chain. This is an interesting indication of regionalisation of public services to assist innovation upgrading in SMEs in contexts where, hitherto relatively closed *chaebol* were the main initiators and carriers of innovation. Even in relatively successful Newly Industrialised Countries such as South Korea, market forces are poor at recognising and taking early steps to create demand for innovation services. Hence the central state is forced to play the role of ‘ideal collective capitalist’, something that was hotly-debated in Italian regions when the Berlusconi government of the early 1990s began questioning the existence of public innovation support systems in politically left regions, supported by the national business association *Confindustria*. This was rejected, notably in ‘Red Emilia’ as pure political opportunism from an entrepreneurial class that had failed to anticipate the growing importance of knowledge-intensive services to business. Nevertheless, to offset possible legislative intervention from the centre, auditing and competitive tendering for service centre status were introduced along with other ‘efficiencies’. South Korea generally, and Kyongbuk-Taegu, in particular have somewhat different industrial structures from those of the Third Italy, but it is nevertheless notable that public innovation service-provision has taken precedence over market processes in both cases. This is unlike the case in high technology districts like Silicon Valley or Cambridge (UK) where venture capital is abundant and private services thrive even though risks are high (Keeble & Wilkinson, 1999). In South Korea generally, Hassink (2000) says that heavy centralisation has meant SME networks are remarkably weak.

2.4 Santa Catarina

Regional innovation in Brazil tends to be rather dependent on the presence of industry clusters, especially those in touch with foreign markets. The case of the textiles and garments, and other clusters in Santa Catarina is taken as an exemplar by Altenburg & Meyer-Stamer (1999). In 1997 many firms were experiencing acute competitive
pressures and massive losses were being incurred amongst a business community that had hitherto had no strong interest in systemically interactive innovation practices, but rather had succeeded by individualistic competitive means. The crisis caused the state-level industry federation to engage the Swiss Institute for Management Development (IMD) to assist in the generic organizational innovation of international benchmarking. This showed the best seven firms at the level of Europe’s laggards in the equivalent industry. Innovations were envisioned by such firms but often not successfully implemented. One reason for this was insufficient attention to the value of collective. Unlike the Korean example, support and intervention was initiated by the regional industry federation. An International Trade Centre supplies the level 1 and 2 information and advisory services supplied by regionalised public bodies in Kyongbuk-Taegu. In also supplying international trade statistics, the Centre monitored and advised on technical standards such as ISO 14000 regulating environmental standards.

Firms frequently suffer skills deficiencies that cannot satisfactorily be overcome by individualistic methods. This problem faced the electro-mechanical engineering cluster in Santa Catarina. In this case the local Chamber of Industry and Commerce deployed good network linkages with the training infrastructure to encourage a federal polytechnic to establish specialist courses to tackle areas of skills deficiency. With regard to upgrading innovation capability the ceramics cluster and the regional industry federation established, in co-operation with the Federal University of Santa Catarina, a Centre for Ceramics Technology modelled on that set up by the Valencia Regional Administration in Castellon, Spain (itself modelled on that in Sassuolo’s ceramics district in Emilia-Romagna, Italy). The university relocated a laboratory to the Centre. This is intended to provide testing and certification services but will eventually be fully-engaged in technology development.

Clearly, there is much more of a ground-up feel to the actions taken to upgrade different aspects of the business of these three Santa Catarina clusters. The federal and regional states are noticeable by their absence from involvement. Initiative is taken in a rather ‘grassroots’ way by representative private-sector bodies although the federally-funded higher education sector was brought in as a solvent of at least two of
the problems that caused collective action to be explored in contexts where ‘arm’s length exchange’ was culturally more the tradition. Importantly, the small systemic elements focused around clusters showed receptivity to international experiences, hence this can be considered to be a set of localised industry clusters open to the influences of economic learning and institutional borrowing. It is difficult to argue that Santa Catarina represents a fully functioning regional innovation system, but at sub-system levels centred upon clusters it reveals a consciousness of the value for global competitiveness of an open disposition towards collective action for systemic innovation. Between them, Kyongbuk-Taegu and Santa Catarina represent virtual polar opposites in respect of the nature of innovation pursued and the ‘governance’ model by means of which actions could be taken forward. The contrast between top-down and ground-up, public action and private action, large and small firm clusters could scarcely be more pronounced.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Kyongbuk-Taegu</th>
<th>Santa Catarina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Universal system, lower than average tertiary-level expenditure</td>
<td>Skills inadequacies needing collective action and response</td>
</tr>
<tr>
<td>Knowledge Transfer</td>
<td><em>Chaebol</em> branch plants, but public funding for SME innovation infrastructures</td>
<td>Openness to international learning, advice and exemplars</td>
</tr>
<tr>
<td>Business R&amp;D</td>
<td>Private lower than national R&amp;D expenditure, public S&amp;T expenditure average</td>
<td>Low and dependent on collective public provision of research facilities</td>
</tr>
<tr>
<td>Linkages</td>
<td>Public science and technology infrastructure linked to cluster specialisms</td>
<td>Crisis of competitiveness produced more collective output and inter-firm associativeness</td>
</tr>
<tr>
<td>Investment</td>
<td>Central state ‘guided capitalism’ moving to regional support for innovation in SMEs</td>
<td>Industry losses reduced investment but led to search for co-operative investment infrastructure</td>
</tr>
<tr>
<td>Communications</td>
<td>Electronic networks installed but socio-economic networks weak among SMEs</td>
<td>Industry federation well-linked to global advice and information, and advising SMEs accordingly</td>
</tr>
</tbody>
</table>
Table 2: Regional innovation policies and actions in South Korea and Brazil
(Based on Hassink, 2000, and Altenburg & Meyer-Stamer, 1999)

2.5 Northern Ireland

The foregoing has already alluded to the variation between the administratively
decentralised but institutionally highly centralised public mode of innovation
governance in the Korean case, and the rather localised, private and associational
mode of innovation governance in Santa Catarina. Northern Ireland is interesting
because, although it is a territory of the UK, a developed country, it has been one of
Europe’s less-favoured regions, riven by political strife for many years and recently
given devolved powers by the UK government in a power-sharing Assembly. Until
this occurred, the regional innovation system, to the extent it existed, displayed a
strongly pyramidal structure, something that is changing a little with devolved
governance of innovation. This means it remains heavily dependent on public policy,
public intervention through grant allocation mechanisms, and public agencies
determining the actions deemed appropriate to achieving strategic goals. There is
consensus for goals of modernisation through an emphasis on building clusters in
advanced industries like aerospace, ICT software and biomedical engineering.

The Department of Economic Development’s ‘Strategy 2010’ document encapsulates
the shared aims of government and industry, with most of the former and many of the
latter being directly touched by tactical initiatives to implement aspects of it.
The Industrial Research and Technology Unit (IRTU) is important because it has
innovation as one of its major remits. It is relatively small and at the limits of its
capabilities to match what will soon be a significantly growing demand for its
services. It is likely IRTU will have a strategic role in a new integrated economic
development body for Northern Ireland because innovation is indeed the ‘golden
thread’ running throughout the future knowledge-driven economy. From innovation
come competitiveness, productivity growth and rapid new firm formation, all things
badly needed in the economy. It will require enhanced budgetary and staffing resource
to meet the imperatives of the knowledge-driven economy now emerging in Northern Ireland.

The innovation pyramid narrows towards the top because innovation becomes attenuated as the firm sector is approached. A large ‘tail’ of innovation underachievers occupies a sizeable segment of the industrial structure, but in terms of innovation it is small. Multinationals have a central economic role but not all are innovative although those that are can be near the global leading edge, yet not much of that innovation content is sourced in Northern Ireland as yet. One exception is the case of Short’s, acquired as a viable commuter aerospace company by Bombardier of Quebec, Canada. Old economy innovators, especially in clothing and textiles (Northern Ireland was once a major world-leading linen producer) are interesting, but few in number, as are new economy innovators. A case of innovation in a global supplier network between Northern Ireland and Asia shows how the demands of complex organization require local technical solutions, in this case from engineers at Colombo University, Sri Lanka (Cooke, Roper & Wylie, 2001).

Desmonds is an old-established Northern Ireland family firm dating from 1885 with sixteen plants managed from its head office in Derry. Most output supplies Marks & Spencer, the troubled UK retailer. A small portion of output is contracted to the Ralph Lauren and Tommy Hilfiger labels. Some 2,400 are employed in Northern Ireland, 1,750 in overseas joint ventures and a further 1,250 in overseas strategic alliance firms. Overseas partners are predominantly in Sri Lanka, Turkey and Bangladesh with trials under way in South Africa. Desmonds is a registered member of the Ethical Trading Initiative. Northern Ireland’s Queen’s University incubator firm Kainos innovated a global trading software system for the company with research funding from IRTU. Accordingly, production turnaround from fabric arrival to garment dispatch has been cut from four weeks to four hours. Other product innovations like bonded fleece were developed with Hong Kong firm Golden Sky, taking the latter’s concept to the product development stage. The pace of change means that innovation can be hampered where an overseas affiliate finds it difficult to respond swiftly to market shifts. The firm successfully commissioned Colombo University’s textiles
engineering department to produce local solutions to the need to increase supply-chain efficiency in response to the new, faster ordering system. This satisfies its aim to remain in Northern Ireland because of all the business re-engineering it has undertaken, allied to its embeddedness in the regional innovation support infrastructure involving IRTU, and the universities, along with support from the UK government in lobbying the EU to stop discriminating against Sri Lankan production. But it also highly values established links to the textile production-engineering centre at Colombo University.

Thus Northern Ireland’s innovation pyramid has its base broadly and deeply in government, including governments and markets in foreign locations. Through Universities there are growing links between incubators and new economy innovators. These are capable of developing new sectors, such as software, themselves but they can find solutions to ‘old economy’ problems, with innovative implications worldwide. But locally, the capability to compete through innovation also requires the emergence of a new dimension to the public innovation pyramid. This involves University research, spinout firms, incubation facilities and venture capital to fund new firm growth. This is in place and is being augmented by the Northern Ireland Science Park Foundation that will help establish growth firms in different parts of Northern Ireland. The private sector is fully engaged in this, led by local venture capitalists, who syndicate with other investors, also with banks if loans are required, and who frequently involve public grant subsidies as part of the investment package. In this way, the traditional public, centralised funding and governance of innovation are being complemented and changed by the demand for more market-oriented innovation support actions to respond to global competition. This is a pointer to a more flexible, responsive and swift-moving model of regional innovation governance, especially in rather dirigiste settings like Kyongbug-Taegu, but also in possibly more receptive private-sector systems such as Santa Catarina.

2.6 Főjér Region

Located to the south-west of Budapest, this region has been one of Hungary’s successful locations for western transplants seeking production and marketing bases in
Central & Eastern Europe. By 1993, GDP was modest but rising and foreign investment was already substantial from firms like Ford, Opel, Audi and Keiper-Recaro in automotive engineering and Philips, Nokia, and IBM in electronics. Alcoa was also there producing aluminium. The region has a few decentralised offices but could not be said to have a meaningful public base of regional innovation institutions. It has a Regional Development Council, an Economic Development Marketing Office and a branch of the national technological Development Committee, responsible for co-ordinating research activities and financing innovation in firms and research institutions. Together, though, these governance mechanisms had been sufficiently valuable to have enabled these ‘blue-chip’ foreign investors to perceive Féjer as receptive location. One key way in which this has occurred has been through the elaboration of local supply-chains of firms in tune with the exacting requirements of these corporate giants. Though numerous smaller, entrepreneurial firms pre-existed the arrival of the inward investors, rapid upgrading of organizational and technical capabilities has been successfully effected. A branch of the Hungarian Development Bank charged with financing targeted sectors such as automotive and electronic engineering SMEs had already begun playing an important role in the upgrading process.

Such is the influence of the multinationals that they are, in effect, the innovation governance institution for the region. Training and consultancy firms of modest scale in addition to the public bodies discussed work to meet the requirements of the inward investors. For innovation the multinationals had been typically self-contained, though the global move to out-sourcing was beginning to mean they were showing interest in any appropriate national innovation infrastructures by the end of the millennium. However regional resources, whether public centres of technology, universities or governance bodies, were not of great interest to foreign firms in the late 1990s. The regional vision was one geared largely to having the region play a development role as partners of large multinationals, assisting them to build a robust base in the region. To the extent this involved upgrading of local supplier firms (SMEs) there has been some partial innovation system-building, but there is always a risk with such reliance on transplants that if and when they go away, the system so painfully put in place is left high and dry.
It is this relative absence of connection between regional knowledge centres and leading global firms that so often characterises such externally-dependent system-building. Here the contrast with Kyongbuk-Taegu, Santa Catarina (Table 2) and Northern Ireland (Table 3) is pronounced. Although pursuing different paths, one more public, one more private, the other in partnership, each was trying to create space for innovation by indigenous businesses to some degree (less in Santa Catarina) independently of ‘old economy’ sectors. The opportunity for this in the Hungarian region is less because of its transitional nature. But attention to the prospects for less-dependent upgrading could be overdue. In Cooke et al (2000) Féjer regional colleges perceived they played a negligible formal role in innovation policy let alone innovation activity, something definitely untrue in, for example, Santa Catarina. But problems of transition included, \textit{inter alia} the dominance of foreign capital, the low-tech nature of the inputs required from indigenous firms by the multinationals, the lack of receptivity of colleges and universities to working with industry and the low value of their research to industry, accordingly. Creating a regional innovation system is also accorded a very low priority by regional authorities in Féjer region. Hence this is a good example of ‘enclave innovation’ where global businesses produce reasonably advanced, not necessarily leading-edge, products using lower value-added inputs from a dependent supply-chain that has been helped to upgrade by local private and public enterprise support services. Links between this sub-system and higher education are extremely weak and demand for such co-operation is as weak as supply. Nevertheless, this region is performing well in its enclave innovation role though how sustainable the strategy is remains to be seen.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Northern Ireland</th>
<th>Féjer Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Selective system, high quality elite attracts FDI, leaves long tail of lower skills</td>
<td>Technical skills universal and in demand but for lower-order FDI-led occupations</td>
</tr>
<tr>
<td>Knowledge Transfer</td>
<td>Through branch plants, but indigenous incubation from university research developing</td>
<td>Entirely branch-plant based with limited SME upgrading regionally</td>
</tr>
<tr>
<td>Business R&amp;D</td>
<td>Linkages</td>
<td>Investment</td>
</tr>
<tr>
<td>-------------</td>
<td>----------</td>
<td>------------</td>
</tr>
<tr>
<td>Low due to branch-plants and under-innovative SMEs. Public sector R&amp;D reasonably high</td>
<td>Public science and technology infrastructure linked to firm and cluster specialisms</td>
<td>Public sector ‘innovation pyramid’ moderating with spinouts and venture capital</td>
</tr>
<tr>
<td>Low because of branch-plant economy and lack of demand or supply in university research</td>
<td>Vertical through multinational supply-chains. No public research linkage</td>
<td>Foreign direct investment and limited indigenous Development Bank finance for SME upgrading</td>
</tr>
</tbody>
</table>

Table 3: Regional innovation policies and actions in Northern Ireland and Hungary (Based on Cooke, Roper & Wylie, 2001, Cooke, Boekholt & Tödtling, 2000)

**Concluding Remarks**

The strategic intellectual and policy concept of Regional Innovation Systems has been introduced, defined and put to work in analytical and action-related terms. It has been shown to be a relatively new concept, post-dating that of ‘national systems of innovation’, which has been intellectually important, if difficult to apply empirically except in small, ‘region’-scale countries such as those of Scandinavia. For some time, possibly because of this the idea of regional innovation systems was rather neglected, if not resisted. However changes in the macro-economy in the past decade mean that the idea of ‘national economic sovereignty’, if it ever had any real meaning, has certainly lost it with the rise of global competitiveness in a world order of liberal trade and instantaneous financial transactions flows. The new world economic order now tends to privilege the ‘regional’ as the correlate of ‘global’ because of the rise to prominence of globally competitive regional and local industrial clusters. These are
often telescoped versions of regional and even national innovation systems, especially where science-based, as with biotechnology and ICT. They have strong vertical and horizontal inter-firm linkages in supply-chains or for joint technology development. Such phenomena are quite pronounced in developing countries (Schmitz & Nadvi, 1999). But as they develop, at least in ‘new economy’ hot spots they draw on a rich infrastructure of consultants, lawyers, management-accountants, venture capitalists and other ‘knowledge-intensive business services’ or KIBS.

In less-developed settings such support infrastructures tend to be absent, the public sector substitutes with less effectiveness, perhaps, with grants, technology centres and business advice. This is because of market failure by KIBS to spot early evidence of demand, especially in clusters, hence the public sector has to be the innovative provider despite lack of experience and expertise. This is even more the case with regional innovation systems, operating at sufficient scale to cover many clusters and other forms of industrial organization, like agglomerations, company towns and multinational ‘enclaves’. In quite accomplished advanced economy regions, the regional administration, university funding, research funding, technology-transfer services, research institutes and the training system are all heavily dependent on public initiative. It is only the more knowledge-based and high-tech of regions, like California, Bavaria, the Thames Valley or Massachusetts where many services are private. So this is the trajectory. As regions develop and demand for sophisticated services (KIBS) rises, so such services will concentrate nearby. They may arrive later than public services, but they will ultimately rise to prominence over them. So what is sometimes called the ‘knowledge generation and diffusion’ sub-system which complements the ‘knowledge application and exploitation’ sub-system, becomes more and more a mix of private and public support, while that connected to knowledge application and exploitation becomes ever more marketised.

In applying this analysis to four developing regions in Asia, Europe and Latin America, it was instructive to note how variable specific regional innovation systems may look (even if they may not yet warrant being designated ‘systems’ but show signs of some kinds of co-operation or limited systemic interaction). There are different routeways along the trajectory to regional innovation system status, and maybe
different types of trajectory and destination. In brief, by looking at such dimensions as; education, knowledge-transfer, R&D, linkage, investment and communications, it is possible to detect more strongly public as against more marketised system ‘cultures’, Thus Kyongbuk-Taegu is at a slightly earlier stage away from the FDI/multinational dependency trajectory transitioning towards support for indigenous, innovative SMEs than Northern Ireland, while the latter is well short of, let us say, the UK’s Thames Valley. Equally, Santa Catarina could be said to be more advanced in some ways than Féjer region in Hungary because it had discovered the virtues of private-led institutional actions to build inter-institutional co-operativeness as governance mechanism, whereas Féjer’s governance order was happy to develop a kind of ‘handmaiden’ capability towards leading multinationals for innovation because of the undoubted economic benefits that accompanied ‘enclave innovation’ of the inward investing type. Féjer therefore has some ground to make up on all three of the other case-regions in terms of innovation governance. However, it is stronger than most, possibly even than the Korean example, in the nature and newness of the inward investment it has received. By combining the strong points of each case studied, policy-makers could produce an interesting, profitable and yet flexible vision of the role regional innovation systems-thinking can make to their regional economic destiny.

Abstract

The paper explains the concept of Regional Innovation Systems. It argues that global economic forces have raised the profile of regions and regional governance not least because of the rise to prominence of regional and local business clusters as vehicles for global and national economic competitiveness. In the paper key definitions are given and distinctions drawn. Then, by reference to a number of key dimensions characterising innovation such as education, knowledge-transfer, linkage and communications four regions from Asia, Europe and Latin America are contrasted. It is shown that regional innovation systems can be underdeveloped by being too dependent on public support, but equally, an over-emphasis on private infrastructures needs to be guarded against except at the most advanced developmental level. A
combination of public and private governance at regional level to promote systemic innovation is advocated.

Key Words: Regional, Innovation, System, Linkage, Investment, R&D, Knowledge-transfer.

Bibliography

Department of Trade and Industry (1999a) *Biotechnology Clusters*, London, DTI.


Krugman, P. (1994) The myth of Asia’s miracle, Foreign Affairs, November-December, 63-75


