

# **INDUSTRIAL CLUSTERS: SCOTLAND'S ROUTE TO ECONOMIC SUCCESS**

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## **INTRODUCTION**

Following the publication of **The Competitive Advantage of Nations** in which Michael Porter (1990) illustrated the link between industrial clusters and economic success, 'clustering' has become a widely adopted regional development strategy in the United States (HUD 1996; EDA 1997). Recently, clusters have become more fashionable in the United Kingdom. (DTI 1998; Swann et al 1998). Despite this growing popularity, the basic concepts and policy implications remain poorly understood. However, as a means of strengthening, developing and diversifying Scotland's main industries, a cluster approach offers some highly relevant ideas for both the policy and practice of economic development. Essentially, clusters are a means through which companies can form beneficial relationships with customers, suppliers, research institutes, education and the wider business community. These relationships, properly organised and focused, improve company performance, increase the business birth rate, generate innovation and attract knowledge-based inward investment.

Scotland has been in the vanguard of using clusters as a practical approach to economic development. Porter's Monitor company undertook a study of Scotland's potential clusters in the early 1990s followed by more in-depth work on the Information Technology (IT) and Oil and Gas clusters. While the findings were implemented only partially, elements of a cluster approach have been applied through partnerships such as the Scottish Electronics

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Forum. This approach, it can be argued, has helped Scotland establish a leading global position in the emerging system-on-chip technology through the attraction of Cadence Design Systems, a major IT design company. (Scottish Enterprise 1998).

Over the past two years, Scottish Enterprise has given greater priority to supporting clusters. 'Pilot' cluster strategies for semiconductors, oil and gas, food and biotechnology are nearing completion and, working with partners, further cluster strategies will be developed and implemented over the next few years. In the spirit of stimulating debate, the purpose of this paper is to explain the cluster concept, draw out some of the policy implications, describe Scottish Enterprise's approach and outline why clusters could be a route to long-term competitiveness and economic success for Scotland.

## **ECONOMIC CONTEXT**

Despite the decline of its traditional manufacturing industries, Scottish GDP has risen from £19bn in 1955 to £45bn today (at 1990 prices). With the growth of electronics, the service industries and oil and gas, much has been achieved. Nevertheless, concerns remain. Growth in manufacturing has been driven by inward investment. While output continues to grow rapidly in electronics, it remains largely assembly and manufacturing with relatively little research, design or product development (RD&D). Outwith electronics, there has been little growth in manufacturing output. Within Scotland's indigenous sector, relative to the UK average, both the business birth rate and innovation remain low. This seriously limits Scotland's ability to generate new employment. Consequently, over the past fifty years the Scottish economy has grown less quickly than the UK average, generated fewer jobs and experienced a prolonged period of relative economic decline<sup>1</sup>.

Furthermore the world is changing. The continuing improvement in communications and reduction in trade barriers are opening up more and more industries (including the services) to international competition. For industries which are competitive, this offers an opportunity. For those which are not, this represents a serious threat. At the same time, competition for inward investment is becoming more intense. With the entry of Eastern European countries into the European Union, Scotland will be less able to

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<sup>1</sup> For example between 1955 and 1997, Scotland's share of UK GDP has fallen from 9.2% to 8.5%. Similarly, the share of employment has fallen from 9.6% to 8.7% and population from 10.0 to 8.5%. Total employment is now marginally lower than in 1955.

rely on relatively low wage costs and government grants to attract inward investment. New sources of competitive advantage are urgently required if Scotland is to create and sustain a high-income economy.

## **CLUSTERS AND COMPETITIVE ADVANTAGE**

### ***The Concept***

Porter argues that competitive advantage and strong industrial clusters are inter-related and that successful clusters drive economic development. He defines a cluster as 'a group of inter-related industries whose linkages mutually reinforce and enhance their competitive advantage'. Economic development depends upon competitive companies which serve international markets. However, such companies are more likely to emerge and prosper if they are part of a geographically concentrated industry. An industry consists of a number of firms producing essentially the same product (i.e. industries are defined by specific products such as personal computers rather than generic sectors or technologies such as electronics). In turn, competitive industries are more likely to develop in regions where the industry is part of a cluster.

To illustrate the concept, consider the industries which make up the Scottish food cluster<sup>1</sup>. The cluster contains industries ranging from the primary sector (e.g. agriculture, fishing and breeders) through a variety of manufacturing industries (e.g. feed mills, the basic processing of meat, further processing such as ready-made meals and the manufacture of equipment and packaging) into the service sector (e.g. transport, business and financial services, retailing, food services such as fast food chains, universities and research institutes). Within the cluster, each industry may be very different with varying sources of competitive advantage. However, their performance is actually or potentially interdependent. Innovative and efficient food processors generate demand and a route to market for the agricultural and fishing industries. In turn, the competitiveness of processors depends upon, for example, the cost and quality of raw materials coming from the primary industries, the efficiency or otherwise of auction marts and abattoirs along with access to, and the nature of, retailers and food service companies. Competitive advantage (or disadvantage) may arise from anywhere within the

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<sup>1</sup> *The comments on the Scottish and Danish food clusters are to illustrate the practical meaning of the concepts. They are not a definitive or comprehensive analysis of these clusters. The comments are based on preliminary findings of research undertaken for the food cluster strategy.*

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cluster including, for example, the presence or absence of internationally competitive equipment manufacturers, packaging companies or retailers. As a means of linking manufacturers to retailers, food brokers and category management companies (both poorly represented in Scotland) are becoming an increasingly important source of competitive advantage.

Successful clusters are more than simply geographic concentrations of related industries. The nature and effectiveness of the linkages are crucial. These are of two types. First are customer-supplier linkages which can affect the performance of the entire production chain. While local purchasing provides potential benefits, this does not imply everything should be purchased locally. Many inputs need to be sourced globally. In competitive, robust clusters many industries (at different stages of the production chain) serve export markets. Often more important is the second type of linkage which may spread throughout the cluster. These include complementary or shared skills, knowledge, know-how, distribution channels, marketing image and infrastructure.

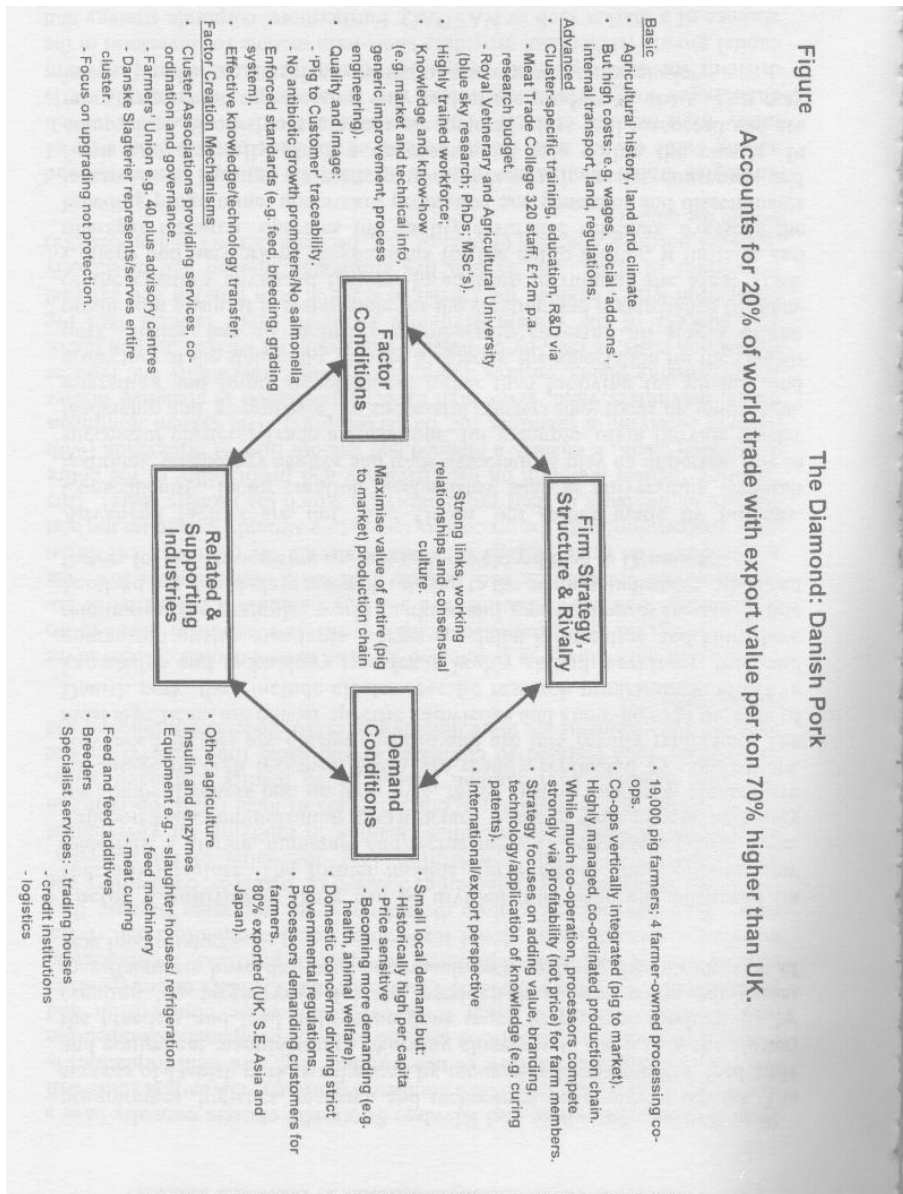
#### ***The Diamond***

A framework for analysing competitive advantage is provided by Porter's diamond. To illustrate its application, the Figure presents the diamond for the highly successful Danish pork cluster. While competitiveness is determined by the entire system, the role of each element of the diamond is briefly described.

**Demand:** It is the nature rather than size of local demand which is important. Successful clusters need to serve global markets. Nevertheless, advantage derives from 'leading edge' or sophisticated local customers who work with suppliers to promote innovation. Ideally local demand should anticipate or lead world demand. Hence, an ability to meet local demand creates the ability to serve global markets. Demanding customers can include both final consumers and intermediate demand (i.e. other companies in the production chain). In the case of Danish pork, the growing concern amongst Danish consumers for health, quality and animal welfare (now reflected in strict government regulations) initially adds cost but is enabling the industry to adapt quickly (and ahead of the competition) to changing consumer tastes in some of the world's richest markets.

**Supporting and Related Industries:** As illustrated by the Scottish food cluster map, these can be industries within the production chain (i.e. customers and suppliers) or those with shared locational requirements. Local, but world class, suppliers provide potential advantages (such as cheaper and easier access to inputs) while the geographic concentration of industries with

shared requirements enables an area to achieve the critical mass necessary to support cluster-specific factor conditions such as specialist skills, training



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programmes, logistics, research and technology development centres. The success of Danish pork is enhanced by innovative local breeders, feed mills and equipment manufacturers. Working closely with the rest of the cluster, the breeders and feed mills have done much to increase productivity by creating 'on target' pigs for the production system while equipment manufacturers have designed new machinery enabling the introduction of new food products.

**Factor Conditions:** These can be divided into basic and advanced (or specialist) factors. The former include, for example, land, climate, raw materials, a literate, numerate and increasingly IT competent labour force, transport and communication infrastructure. Some of these may be necessary for competitiveness but, on their own, rarely sustain long-term competitive advantage or high incomes. Many are readily replicated by competitors. Advanced factors are cluster-specific and are less readily replicated. The most significant are cluster-specific knowledge and know-how. In the case of Danish pork, they include cluster-specific research programmes, effective knowledge and technology transfer, a highly skilled workforce, high and guaranteed quality standards, image, specialist information and know-how relating to, for example, world markets and genetic improvements. While Scotland has world class research relating to the primary industries, advanced factors for food processing are less well developed than in Denmark.

Advanced factors are not 'God Given' but rather made by humans. Consequently, 'factor creation mechanisms' such as universities, research institutes, technology centres and trade associations play an important role in successful clusters. Trade associations, for example, often provide cluster leadership and 'governance'. In successful clusters they focus on innovation, upgrading and future development rather than lobbying for subsidy and protection of the status quo. Danske Slagterier, the association for the Danish pork cluster, has an inclusive membership covering all stages of the production chain. It is responsible for the creation and maintenance of many of the cluster's advanced factors. In addition to running the Meat Trade College and networking mechanisms for the entire cluster, it initiates and manages research, operates the quality assurance schemes, oversees the breeding programme, undertakes promotion and generates and disseminates information. Through its participative processes, it creates consensus and focus and generally plays a developmental role within the cluster. In comparison, Scottish associations are generally less well resourced and are more fragmented representing only part of the production chain. This may intensify rather than resolve conflicts of interests within the cluster.

**Firm Strategy Structure and Rivalry:** Successful clusters normally have a number of local companies which compete vigorously. Given that some will lose out in this process, a flow of new entrants (e.g. new firm formation) is essential to maintain competition and the stock of companies. Competition may be more effective when it involves non-price competition and personalised rivalry between local Chief Executive Officers or entrepreneurs relating to, for example, reputation for quality products, technological excellence, innovation or global leadership. Local competitors and rivals, rather than internationally more distant ones, are important because they encourage innovation and upgrading. Success of 'overseas' competitors can be discounted as 'unfair competition' (e.g. the value of the currency, government protection or subsidies) leading to lobbying for government support rather than a positive response. Success of local rivals, operating in the same business environment, cannot be so readily explained away. Companies must respond to compete. At the same time innovation and business improvements are more quickly perceived, understood, imitated and further improved.

The Danish pork cluster is dominated by four farmer-owned co-operatives which integrate the production chain from raw material through to distribution. Company structure and strategy combine the benefits of co-operation and competition and, despite high basic costs, ensures low cost production. The price of pigs is administratively set (avoiding cut-throat price competition) with the processors competing strongly to sign-up the best farmers on the basis of their profitability (in which the farmers share). This structure focuses attention on the efficiency and profitability of the entire production chain. It enables a planned and smooth flow of production (with farmers receiving a premium for 'on target' pigs). The system minimises waste, maximises yield, gives high capacity utilisation in slaughter houses and processing plants, ensures quality and product traceability and reduces transaction costs, in part, by by-passing intermediaries such as auction marts. The success of the system gradually attracted more farmers into pig production which enabled the cluster to achieve both internal and external economies of scale. The system has eliminated disease and effectively manages potential conflicts of interest (e.g. between farmers and processors) within the cluster.

Strategies which continually improve productivity through innovation and adding value (rather than simply cutting costs) underpin the prosperity of many high-income clusters. This requires a local environment which encourages long-term commitment and investment. For example, it is difficult for new high tech companies to reinvest income for long-term capital growth (rather than providing short-term income for investors) in the absence of a market such as NASDAQ. Furthermore, corporate strategy and the

environment are interdependent. Individual Scottish food companies cannot adopt the integrated production chain management of the Danish pork cluster. Some form of shared vision and 'collective' decision (a form of governance) to move towards such a system would be necessary.

**Government.** Rather than being concerned simply with the business environment, policies are required for cluster-specific environments. Government's role is to prod and challenge the cluster to innovate and upgrade and not, by responding to short-term demands, to make life easy. In innovation-driven and high-income clusters, governments often support R&D, training, education and infrastructure relevant to the cluster. Policies should deal with the entire cluster and all elements of the diamond and an integrated rather than departmental or functional approach is beneficial. In Denmark, for example, the Department of Food, Agriculture and Fishing incorporates the entire production chain with government support mainly in the form of R&D with strict standards and regulations driving continuous improvement and innovation. Since clusters are geographically concentrated, a regional (or small country) level of implementation is often appropriate.

### **THE DIAMOND: A DYNAMIC SYSTEM**

Successful clusters are more than simply geographic concentrations of apparently related industries. Competitiveness derives from the cohesion of the cluster and how it operates. Strengths throughout the diamond are helpful. Strong local demand, for example, is unlikely to generate competitiveness in the absence of high quality advanced factors or dynamic, competing local companies. However, there is nothing deterministic about the model. Competitiveness is possible with some limited disadvantages. Indeed, some basic factor disadvantages such as high wages or land costs can spur innovation which becomes a source of competitive advantage. The nature and effectiveness of networks within the cluster are also crucial. For example, local demanding customers will not generate competitiveness if they are not well connected with local suppliers.

The factors driving a cluster vary over time and from place to place. In the early life of a cluster, basic factors (e.g. raw materials, low labour costs) can be important. As income rises, capital investment becomes more important. However, capital is now internationally mobile and available to more and more regions. Consequently, high-income clusters depend upon innovation and the exploitation of knowledge. The fundamental significance of the diamond is how it drives innovation and cluster upgrading. Many of the mechanisms have already been described including the role of local rivalry,

new firm formation, customer-supplier links, the research base and technology transfer. The innovation process varies from cluster to cluster (e.g. it is very different in a food compared to an IT cluster) and depends upon the overall system and not simply individual companies.

## **THE LOCAL DIMENSION**

It is perhaps surprising that as trade barriers and communication costs fall, the local environment becomes a more important influence on competitive advantage. It can be argued that as the world becomes more integrated, the effects of national boundaries (e.g. currency values, regulations and trade barriers) become less and local agglomeration economies become more important. In the European context, this could result in increased regional specialisation and stronger regional clusters. (Krugman 1991). In this more competitive environment, firms in strong clusters are more likely to survive and prosper.

While many inputs and products will (and must) be sourced globally, local but globally competitive suppliers still provide advantages. Furthermore, the innovation process remains highly localised. For example, building on existing resources and know-how, multi-media, for example, is emerging in a limited number of tightly defined geographic areas in the US including Silicon Valley, Los Angeles/Hollywood and New York. The local matters because innovation depends upon face-to-face contact, close working relationships, tacit knowledge, know-how and specialist labour markets. All are subject to significant distance decay effects.

## **WHY A CLUSTER APPROACH?**

### ***Economic Development Benefits***

The basic argument is that successful clusters enhance the performance of individual companies and drive economic development. They provide the conditions for greater new firm formation, innovation and the emergence of successful global companies<sup>1</sup>. Strong clusters also attract inward investment. At least in part because of its IT industries, Scotland continues to attract a large share of Europe's electronics inward investment. In other industries such

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<sup>1</sup> For example, 70% of all US new semiconductor companies are set up in Silicon Valley and, on average, they perform better than semiconductor companies set up elsewhere in the US.

as automotive with little established Scottish presence, it is much less competitive<sup>1</sup>. Strong clusters also attract higher quality inward investment. For example, in the IT industries, RD&D projects generally locate in areas with IT-specific advanced factors including highly skilled and experienced labour (e.g. software engineers), high quality academic research, technology development centres, effective technology transfer mechanisms demanding sophisticated customers, indigenous IT companies and a 'high tech IT' image. All these are only available in an IT cluster. The existence of the IT industries in Scotland was a necessary condition enabling it to compete for, and win, the Cadence project which is planned as a global leader in the design of system-on-chip products employing up to 1,700 highly qualified staff (Scottish Enterprise 1998).

In turn, high quality inward investment has potentially greater spin-offs to the indigenous IT sector. For example, Cadence may attract its customers to Scotland, stimulate greater local sourcing (it is during the design stage that much high value sourcing is determined), employ and train the type of people who subsequently set up their own companies and, as system-on-chip knowledge develops in Scotland, attract its competitors to Scotland. Building the environment necessary to attract such projects and build indigenous companies requires focus. Scotland cannot build the critical mass and support the specialist infrastructure necessary for a wide range of unrelated industries. The environment required by different industries varies. Consequently, as Porter argues, no region (or country) is, or can be, competitive in all clusters. A degree of specialisation is inevitable and desirable.

This raises the danger of over-specialisation. However, focusing on specific clusters does not mean more of the same. Rather a cluster approach helps to diversify the economy in two ways. First, it may target (for example, for inward investment) a range of industries in the cluster including critical gaps such as supply industries or customers. Through its focus on innovation and upgrading, it helps generate new or tomorrow's industries. It is not simply about more PCs or chip producers but about the next generation of products such as multi-media, flat panel displays and industries related to system-on-

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<sup>1</sup> A study for Scottish Enterprise of US and Japanese greenfield manufacturing inward investments into six European countries (Belgium, France, Germany, Republic of Ireland, Netherlands and the UK) found that Scotland obtained 26% of all electronics projects (70% of all those locating in the UK). For other manufacturing industries, it got just 8% of the projects (21% of the UK's projects) and in the car industry it obtained under 2% of projects (and these produce electronic components for the car industry).

chip technology. Second, it offers the opportunity to diversify away from assembly and manufacturing into a wider range of functions such as RD&D.

### ***Policy Delivery***

Compared with a business development or sector approach, clusters offer a more comprehensive competitiveness agenda, the potential for better-targeted interventions and more effective policy delivery. Through assistance to individual companies (such as advice, consultancy and investment), business development deals with issues internal to the company. While these will remain important, business development leaves untouched the many wider issues which affect competitiveness and company performance. No amount of assistance to a food processor will be effective if the real source of competitive disadvantage arises from poor links to suppliers or customers and ineffective management of the production chain. While a sector or industry approach deals with the wider business environment, it considers only the specific sector or industry. A cluster approach is more inclusive dealing with issues wherever they are found in the cluster which enables better-targeted intervention. For example, policies which provide infrastructure for food processors are unlikely to be effective if the main source of competitive disadvantage lies within agriculture or the fishing industry. Given its wider competitiveness agenda, the cluster approach avoids potentially misleading and inappropriate distinctions between the primary, secondary and tertiary sectors.

Finally, it offers the possibility of greater cost effectiveness through the creation and exploitation of synergy between policy instruments. An integrated approach generates greater spillovers and indirect policy impacts. For example, targeting IT RD&D inward investment is more likely to be successful if simultaneously the necessary infrastructure (e.g. specific skills, research, technology centres, customers etc.) is being developed. Similarly, investment in cluster-related academic research is more likely to produce spillovers and economic benefits than research not linked to Scotland's actual or potential clusters. To realise potential synergy, cross-cluster policies, for example, innovation, entrepreneurship, exploitation of the science base, training and inward investment need a specific cluster dimension.

## **THE SCOTTISH ENTERPRISE APPROACH**

### ***Which Clusters?***

The four pilot clusters are being used to test the model and explore how cluster strategies can be most effectively developed. Reflecting this

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experience, the approach is now embedded in Scottish Enterprise's strategy (Scottish Enterprise 1999) and over the next few years it plans to implement the four 'pilot' strategies and develop further cluster strategies. The obvious question is 'which clusters?'

Highly successful clusters are self-evident and pick themselves. Currently Scotland has no strong innovation-driven clusters. There is little evidence that such clusters can be 'wished into existence' or created from scratch. Rather they emerge from existing industries, resources, and assets. The basic idea is to strengthen embryonic and potential clusters. Monitor's analysis of the Scottish economy suggested the opportunities include:

Biotechnology	Information Industries, including
Chemicals: Bulk	Semiconductors
Speciality	Computing
Drink	Communication Equipment
Food	Software
Financial Services	Multi/Creative Media
Educational Services	Energy/Oil and Gas
Forest Products	Power Generation Equipment
Engineering	Textiles
	Tourism

Given that none of these is sufficiently large to support the Scottish economy and to avoid the dangers of 'picking winners' and over-specialisation, the intention is to encourage all embryonic and potential clusters. However, not everything can be done simultaneously. Consequently, some prioritisation is necessary. Within this inclusive but staged approach, prioritisation criteria include the importance of the cluster to the Scottish economy (e.g. employment, value added, exports, R&D), long-term growth potential, the ability of the cluster to compete internationally, the urgency of any required action (e.g. immediate threats or opportunities) and the willingness and desire of cluster players to participate and collaborate. The latter is a core criteria since most successful clusters are based on active private sector participation and strong public-private partnerships.

### *And in Practice*

Working with partners, the aims of cluster strategies are to establish a shared vision and understanding of what needs to be done (and what can be done), to increase the cluster's innovation, competitive advantage and capacity to generate sustainable employment and to produce an agreed and widely supported action plan. The process includes analysis of global trends, key cluster drivers, competitor regions (benchmarking as illustrated by the Danish pork diamond) and the identification of 'gaps' and missing or weak but critical links in the cluster map. The creation of the cluster map, along with other techniques such as scenario planning, have proved very useful in the four 'pilots' as a means of generating a shared understanding and vision of what needs to be done. A critical stage follows the initial analysis when a decision needs to be taken on whether or not to continue. Rigorous discussion is required to establish the extent to which participants feel initiatives can be delivered which will make a significant difference and their willingness to collaborate and participate in the strategy's implementation.

The required actions are cluster specific. There are already many projects in Scotland which illustrate the types of initiative which are coming out of the process. For example, the Aberdeen Offshore Technology Park has attracted a group of firms and institutions around the International Drilling Centre while the Industrial Power Association provides a mechanism for collaborative bids for large overseas contracts. The Scottish Electronics Forum operates as a pan-Scottish industry body dealing with the barriers to further development of electronics in Scotland. The difference is that the cluster strategies and action plans are based on a more comprehensive, focused and integrated approach with greater emphasis on creating and lubricating networks and 'cluster governance'. This involves enabling and facilitating dialogue and generating an understanding of the benefits from participation and collaboration. One test of a robust cluster is the extent to which prospective actions are adopted and taken forward by a broad range of partners.

The actions can relate to any part of the cluster map or diamond. Inputs will be required from all the standard policy instruments including inward investment, training, small firm support, property and other significant policies such as the promotion of entrepreneurship (Scottish Enterprise 1993) and the commercialisation of the Scottish science base (Scottish Enterprise and Royal Society of Edinburgh 1996). Actions may involve not only individual companies but also universities, specialist R&D centres and further education colleges. This raises the question of who is, or should be, involved? This follows from the analysis of the cluster map and a full understanding of

its dynamics. However, it should include all those with links and connections within the cluster and, in particular, all players with a significant influence on actual or potential competitive advantage (and especially innovation). In the case of the food cluster, farmers and processors are inextricably linked, both are connected to transport and logistics and all potentially benefit from the education and research institutes. It involves a wider range of players than in the traditional sector approach. Nor are clusters mutually exclusive but rather they overlap. Companies, institutions and individuals can be in several clusters. Smart regions will be ones which encourage and exploit such relationships. For example, software companies (e.g. related to e-commerce) could be in several clusters while there are obvious interactions between the food and biotechnology clusters. The approach brings together a wide range of actors who, at the present time, have few structured opportunities for dialogue and collaboration.

## **CONCLUSIONS**

A number of misconceptions about the cluster approach can lead to unnecessary misunderstanding. This paper has sought to dispel some of the myths. Amongst the more important ones are:

- ◀ Clusters are irrelevant in a world of low-cost communication and reduced trade barriers. On the contrary, it has been argued that they become more beneficial as the world becomes more integrated. Innovation, in particular, remains highly geographically concentrated.
- ◀ Clusters are only about 'high tech'. While the 'high tech' clusters of Silicon Valley and Route 128 (Massachusetts) are amongst the world's best known, traditional industries, as illustrated by the Danish pork case study, also benefit from clustering. Other well-known examples are 'Third Italy's' consumer industry clusters which are internationally competitive, driven by innovation and support high incomes. Furthermore, to be successful, traditional industries need to apply science and technology (i.e. they need to be 'high tech').
- ◀ Clusters are about a few and encourage over-specialisation. However, it has been shown that a cluster approach incorporates much of the economy, includes more companies and institutions than alternative approaches and helps to diversify the economy while retaining the benefits of specialisation.

- ◀ Clusters are inward looking and parochial. While the local environment is a fundamental influence on competitive advantage, successful clusters are outward looking and serve global markets.
- ◀ It's about government planning. Indeed, in many successful clusters (even in the US) government plays an active role. However, it does not involve subsidising individual companies, picking winners or propping up failing companies. Rather, the government's role is to encourage and facilitate innovation and change. Indeed, the private sector must be involved in both setting the agenda and implementation.
- ◀ It means creating clusters from scratch. However, there is no notion of this. Clusters emerge from, and build on, existing industrial, commercial and research strengths.

Once developed, successful clusters benefit individual companies and other cluster players through a wide variety of spillovers, externalities, and agglomeration economies. In this context, government policies which convert embryonic, potential or weak clusters into successful, innovation-driven clusters can be seen as the creation of a public or collective good. Successful clusters, even in the US, are not simply the product of market forces: see the article by Botham in this issue of **Scottish Affairs**. There is an essential role for governance which includes government. Experience from elsewhere shows that political support (but not control) contributes to success. Government may need to mobilise and certainly support private sector participation. Success requires the active involvement of all relevant government departments and agencies working to a shared cluster agenda. However, not everything can or should be delivered through cluster strategies. While having a cluster dimension, generic policies promoting, for example, entrepreneurship, innovation, the exploitation of science and technology and small firms are still necessary. Industrial strategy requires joined up thinking and a combination of cluster and cross-cluster strategies.

Nor should clusters be seen as an everlasting panacea. Even strong, successful clusters get 'locked into' old ideas and technology, atrophy and decline. Vigilance, innovation and continuous improvement are essential. Nevertheless the paper has argued that a cluster approach offers advantages compared to traditional business development and sectoral policies, increases policy impact through exploiting synergies and, most fundamentally, can create new sources of competitive advantage which are not readily replicated by competitor regions. They offer a route to a successful high income, high output economy. Given that clusters are essentially a local, regional or small

country phenomena, devolution offers Scotland the opportunity of economic success through a cluster approach to economic development.

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