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## 2 The contribution of clustering to innovation: from Porter I agglomeration to Porter II export base theories

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### 1 Introduction

Innovation is a crucial driving force behind productivity and competitiveness. Ever since the seminal work of Joseph Schumpeter, evolutionary economists have made great strides in 'unpacking' the nature and causes of innovation and understanding the continual 'gales of creative destruction' that beset national and regional economies. More recently notions of competitiveness have also received increasing attention. Much of this has been inspired by the works of Michael Porter. In these he has argued that there are close links between competitiveness, productivity and innovation. His main contribution to our understanding of what these links might be is his specialized concept of clusters. He has identified in particular the processes that link or network the elements of clusters as being especially significant in the overall achievement of national economic competitiveness.

Over the last decade or more Porter has produced a stream of work on the relationships between clustering and competitiveness. During this period his conceptualization of clustering has shifted so much that it is possible to identify two different Porters. In Porter I he defined clusters as 'Geographic concentrations of interconnected companies, specialised suppliers, service providers, firms in related industries, and associated institutions (for example universities, standards agencies, and trade associations) in particular fields that compete but also co-operate' (Porter, 1998, p. 197). This was a relatively localized and supply-side concept of clusters.

In his more recent work, Porter II (2003) now argues that it is primarily export-oriented clusters that drive regional prosperity. Exporting clusters tend to pay higher wages than those serving purely local markets do and so they help to pull up other wages in the regional economy. Export clusters are, however, much more likely to have national and international linkages than to be based on purely local connections. This is therefore a relatively internationalized and demand-side notion of clusters.

These major shifts in Porter's conceptualization of clusters through time mean that each must be analysed separately in order to understand the possible contributions of the processes of clustering, particularly with respect to the interlinkages and networking among firms and other organizations and institutions concerned with innovation.

Accordingly, apart from this introduction and conclusions, this chapter is divided into three main parts. The second section first provides a brief introduction to Porter's analysis of the connections between competitiveness, productivity and innovation. This sets the scene and explains why innovation is such an important driver of national and regional competitiveness.

The third section summarizes and evaluates the Porter I analysis of localized supply-side clusters. Here it is argued that there are many similarities between traditional localization

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and urbanization agglomeration economies and clustering. It is difficult to identify significant additional contributions of the Porter I analysis of clusters to these previous theories.

Section 4 examines Porter II and its relationships to export base theory. Here it is argued that exports are indeed a key indicator of the competitiveness of national and regional economies, but it is hard to think of the international linkages that express demands for new goods and services as clustered in any acceptable definition of that term.

In the conclusions it is argued that, although economic actors are increasingly linked by networks, this does not necessarily rely on clustering in any meaningful sense of that term. Firms in particular localities can usually be shown to have local linkages, but these are often no more than temporary and serving their economic interests of the moment on a 'pick and mix' basis. Conversely, many competitive firms can also be shown to have national and international linkages that they rate as more important for them than their local networks. These are often crucial vehicles for the transfer of international leading-edge knowledge and so make significant contributions to the local learning and innovation systems that are so important for economic success in the modern economy. Overall combinations of local and international knowledge and learning processes make more significant contributions to innovation than either Porter I or II clustering processes on their own.

### **2 Porter: competitiveness, productivity, innovation**

The notion of competitiveness only really entered economics in the 1980s, as a buzzword from management studies. Michael Porter's books on competitive advantage played a key role. By the 1990s, the term had become highly fashionable, again aided by Porter's further two important books (*The Competitive Advantage of Nations*, 1990; *On Competition*, 1998). The concept soon drew opposition, from both left and right. Reich (1990) and Krugman (1996) were dismissive of the concept.

Part of the problem stems from using the term at different levels of economic aggregation. Thus, within the economics literature, the notion of competitiveness has been used at both ends of the spectrum, applied to the individual firm (the microeconomic level) and to the national economy (macroeconomic level). Clusters represent a third meso level located somewhere between these two. Defining precisely what is meant by competitiveness beyond the organizational boundaries of individual firms has proved problematic.

Increasingly, the term has been defined in terms of productivity. The principal goal of a nation is to produce a high and rising standard of living for its citizens. The ability to do so depends, according to Porter, not on the difficult notion of 'competitiveness' but on the productivity with which a nation's resources are employed. A rising standard of living depends on the capacity of a nation's firms to achieve high levels of productivity and to increase productivity over time. Sustained productivity growth requires that an economy continually upgrade itself.

Similarly, Krugman also argues that, if competitiveness has any meaning, then it is simply another way of saying 'productivity' (Krugman, 1990, p. 9). As a result, throughout the industrialized world, the main focus of the competitiveness debate is on productivity (for example, for the USA, see The Council on Competitiveness (2001); for the UK, see Brown (2001), DTI (1998, 2003) and H.M. Treasury (2000); and for Europe, see European Commission (2003) and O'Mahony and Van Ark (2003). For many

the notion of productivity is preferred to, or considered interchangeable with, that of competitiveness.

This is reflected in the work of Porter. In his seminal work on 'The Competitive Advantage of Nations', Porter (1990) sought to explain the competitive advantages of national economies. This focus on competitiveness led him to analyse the underlying causes of observed differences in economies. He argued that the first of these is productivity. Thus he says, 'A region's or nation's standard of living (wealth) is determined by the productivity with which it uses its human, capital and natural resources. The appropriate definition of competitiveness is productivity' (Porter, 2002).

Productivity, however, is not a characteristic that can be developed in a vacuum. In its turn it is also highly dependent on innovation. Porter argues that innovative capacity is the key to productivity and competitiveness can be equated with productivity. In the context of the increasing internationalization of the world economy, first world economies need to concentrate on high value-added products and services and to be innovative in doing so (Porter, 2003). In these economies it is 'Productivity and innovation – not low wages, low taxes, or a devalued currency – [that] are the definition of competitiveness' (Porter, 2000, p. 30). So the key link for Porter between innovation and competitiveness is that innovation is a significant driver of productivity.

Much of the work on innovation has been inspired by the writings of Joseph Schumpeter. His main legacy is that he has inspired serious consideration of four main ideas in economic theory. These are, first, that innovation is the main source of dynamism in capitalist economic development. Second, is the importance of the historical (evolutionary) perspective in understanding long-term economic change. Third, that it is essential to distinguish conceptually between invention, innovation and diffusion of innovations. Fourth, is the importance of the links between organizational, managerial, social and technical innovations (Schumpeter, 1939, 1942). His ideas were taken up and developed in particular by Nelson and Winter (1982) and Dosi, Freeman, Nelson, Silverberg, and Soete (1988). Their work represents the basis of modern innovation and evolutionary economic theory.

Porter has defined innovation as an attempt 'to create competitive advantage by perceiving or discovering new and better ways of competing in an industry and bringing them to market' (Porter, 1990, p. 45). More broadly the concept can be defined as the introduction of a new or changed product, process, service or new form of organization into the marketplace. In short, innovation is the commercialization of new ideas. These can include new manufactured products, new ways of producing products or, more frequently, but much more difficult to measure, new or improved services. In addition it should also be noted that innovation is not just a technological and economic process. It is also a complex social and geographic process. It is highly dependent on new knowledge and the ways in which individuals and groups exchange that knowledge.

Interest in innovation has increased enormously since the recessions of the early and late 1980s. It is seen as a main economic objective of the developed economies as they are confronted by international competition from the newly industrializing (NICs) and less developed countries' (LDCs) economies based on price and low labour costs.

There is plenty of evidence to show that innovation does play an important role in driving competitiveness and hence economic growth. The OECD, for example, estimates that, between 1970 and 1995, about half of the total growth in output of the developed world resulted from innovation (OECD, 2000) and the proportion is increasing, as the

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economy becomes more knowledge-intensive. They go on to argue that between 25 and 50 per cent of economic growth comes from technological progress (OECD, 2000). The Enterprise Directorate of the European Commission also estimated that, in 2002, 40 per cent of the variation in per capita income between the regions of Europe can be explained by differences in innovative performance (European Commission Enterprise, D-G, 2002, p. 12).

The links between innovation and productivity and thence to competitiveness are complex and not particularly well understood. In principle, it seems fairly plausible that process innovations can lead to more efficient forms of production and therefore productivity gains. Product and service innovations can also lead to higher sales, increasing returns to scale and therefore to productivity gains. Beyond this there is still much to 'unpack' in these relationships.

Up to this point in the argument it is possible to agree with Porter that innovation can drive productivity in various ways that lead to new processes or sales. It also contributes to competitiveness, both through its contributions to productivity and in its own right. Innovative new products and services are exportable and therefore push up competitiveness as measured by conventional standards. The key question for this chapter is therefore 'Do the kinds of clustering processes identified by Porter contribute to innovation?'

### **3 Porter I: local supply-side clusters and agglomeration economies**

Although Porter's work on clusters was derived primarily from business studies it can also be seen as conceptually related to previous scholarship on agglomeration and industrial districts. Alfred Marshall coined the phrase 'industrial district' in 1890 (Marshall, 1919). The idea was taken up and reinvigorated by Becattini (1990). Studies originally inspired by the idea of flexible specialization in fast-growing industries such as textiles, footwear, and ceramic tiles in the Third Italy claimed to have rediscovered industrial districts in the areas specializing in these industries. It has also been argued that some high-tech industrial complexes in California operate as industrial districts (Saxenian, 1991; Scott, 1993).

One common thread exemplifying the practical activities of these different systems is the promotion and development of intensive networks. In most of the original examples these link local congeries of small firms, each highly specialized in a particular process or phase of production (Bianchi, 1986; Bellini, 1987). In later examples they are said to connect large firms and suppliers in regions and enable the introduction of flexible specialization by facilitating subcontracting. In this way the networks reduce the manufacturing depth of larger companies. Such networks are said to foster smooth diffusion of innovation throughout the whole urban economy (Grabher, 1991).

The explanation offered in this work for innovation being spatially concentrated is that companies adapt to change and the new pressures of demand by deverticalizing into smaller but locally networked firms concentrated in specialized industrial districts. They need the advantages of local proximity in order to minimize the costs of their constant innovation and change. These advantages are similar to those identified as localization economies within industries by Hoover (1937, 1948).

This conceptual framework is reflected in Porter I. In this earlier work he argues that supply-side 'localized' microeconomic dynamics and environments drive competitiveness and the complex of forces underlying it. It is these dynamics that he refers to as 'clusters'. Initially he defines clusters as 'Geographic concentrations of interconnected companies,

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specialised suppliers, service providers, firms in related industries, and associated institutions (for example universities, standards agencies, and trade associations) in particular fields that compete but also co-operate (Porter, 1998, p. 197).<sup>7</sup> Porter I clusters must therefore have two key characteristics.

The first is that they must be geographically concentrated. The second is that firms in the cluster must be linked or networked in some way. Clusters are constituted by interconnected companies and associated institutions linked by commonalities and complementarities. The links are both vertical (buying and selling chains) and horizontal (complementary products and services, the use of similar specialized inputs, technologies or institutions, and other linkages). Most of these linkages involve social relationships or networks that produce benefits for the firms involved.

These building blocks and relationships are shown diagrammatically in his famous diamond. Thus, in Porter 1, there are four main interlinked driving forces underlying the competitiveness of local clusters. These are firm rivalry and strategy, demand conditions, related and supporting industries and factor input conditions. The main reason why clustering is said to take place is essentially that geographic proximity facilitates networking between these key drivers and reduces the transactions costs imposed by distance.

It can be shown empirically that innovative firms do indeed show strong tendencies to concentrate geographically. In the United States, Audretsch and Feldman (1996) used a 1982 Small Business Administration census of innovation citations taken from over 100 scientific and trade journals to identify the geography of US innovations. The census included a total of 4200 new product announcements that contained information on the location of the enterprise that introduced the innovation.

Their first finding was that the spatial concentration of innovative activity in particular industries was much greater than for all manufacturing. For example, 41.7 per cent of all recorded innovations in the computer industry were in California. A further 12 per cent were listed in Massachusetts. As a result, these two states alone account for more than half of all the innovations in the computer industry. Altogether, the most innovative sectors provide 80 per cent of all innovations.

Beyond this, 11 states account for 81 per cent of all innovations. California is the state in which the greatest numbers of innovations were listed. New York, New Jersey and Massachusetts followed. Audretsch and Feldman (1996) comment that 'A particularly striking feature . . . is that the bulk of innovative activity in the United States occurs on the coasts, and especially California and New England.'

In Europe, a study by Hilpert (1992) of the location of scientific funding from the European Community, national governments and the regions found that up to three-quarters was concentrated in ten 'Islands of Innovation'. These were identified according to the following criteria:

- Islands which are specialized in more than one of the three studied techno-scientific fields.
- Islands which are covering more than 20 per cent of public R&D expenditures in the country.
- Strong presence in the islands of both research institutions and enterprises.
- Islands which are European 'knots' in the web of cooperation links (Hilpert, 1992, p. iv).

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The ten major European islands identified in this way are Greater London, Rotterdam/Amsterdam, Ile-de-France, the Ruhr area, Frankfurt, Munchen, Lyon, Grenoble, Turino and Milano. See Simmie (2001) for a study of five of these city regions.

Thus, although the mechanisms through which innovations are conceived and brought to market are increasingly international, they are all conceived in particular localities and so subnational 'hot-spots' are formed in particular fields (Metcalf et al., 2002). These 'hot-spots' are often concentrated in city regions giving rise, for example, to the distinctive urban European geography of innovation as shown by Hilpert (1992), Simmie (2001), Huggins (2001) and IAURIF (2002).

Thus there is strong evidence to show that innovation is concentrated in a limited number of city regions. This provides a descriptive case for clustering making an important contribution to innovation. This, however, tells us little about what the processes could be within such clusters that could lead to their high rates of innovation. For an explanation we must look to the second main characteristic of Porter I clusters, which is that firms in the cluster must be locally linked or networked and that this must make significant contributions to local innovation.

The notion of networks is not a new idea. Perroux (1950) developed it in his analysis of growth poles. He examined the use of supply links as part of the multiplier effects of dynamic sectors. Scott and Storper (1987) also argue that increases in demand generate possibilities for increased economies of scale that can be realized either by internal vertical integration or by external linkages with other firms through flexible, networked production complexes. Thus there are questions that need to be raised both about the 'newness' of networked systems of production and their relative importance as compared with continuing market and hierarchical systems.

Despite these caveats, there is a strong line of reasoning which currently suggests that restructuring in manufacturing industries in the advanced economies is generally moving in the direction of networked forms of production. This line of reasoning is so pervasive as to be labelled the new 'network paradigm' (Cooke and Morgan, 1993; Storper and Harrison, 1991; Amin and Thrift, 1992; Yeung, 1994).

In Porter I clusters, networks and close linkages with buyers and suppliers and other institutions are important, not only for efficiency, but also for the rate of improvement and innovation. Location affects competitive advantage through its influence on productivity and especially on productivity growth (Porter, 2000, p. 19). In this respect the key to successful competition is based first on the ability to produce continuous streams of innovation and, secondly, to position a company strategically in the marketplace in such a way as to produce products that are both different from and superior to those of rivals.

Porter claims that there are a number of advantages to be gained with respect to the key activity of innovation by operating in a local cluster. These advantages include the ability to perceive and react to new buyer needs more quickly thanks to the proximity of demanding and sophisticated customers. In addition, firms can see the evolution of new technologies and understand their implications and possibilities more quickly. Local relationships, including those with universities, are said to facilitate this process (Porter, 2000, p. 23).

From this perspective the cluster concept has become increasingly associated with the 'new' or 'knowledge' economy. The argument here is that the processes that drive the

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development of new economic knowledge and its application and commercialization in innovation are facilitated by localization (Martin and Sunley, 2003). Norton (2001), who argues that the success of the US in the 'new' economy derives directly from the growth of large and dynamic clusters of innovation and entrepreneurialism, supports this idea. Baptista (1996) has also argued that 'geographical concentration is of foremost importance for organisational improvement and technological innovation' (Baptista, 1996, p. 60).

In summary, Porter argues that localized clusters deliver innovation because of the following:

- They allow rapid perception of new buyer needs.
- They concentrate knowledge and information.
- They allow the rapid assimilation of new technological possibilities.
- They provide richer insights into new management practices.
- They facilitate ongoing relationships with other institutions, including universities.
- The knowledge-based economy is most successful when knowledge resources are localized.

But convincing evidence on the importance of purely local networking to innovation is hard to find. Simmie et al. (2002) interviewed 160 innovative firms in five major European city regions. The firms were asked to rate on a scale of 1 to 5 the importance to them of a list of reasons for locating in their particular cities. Principal component analysis was then used to group their replies into a series of related sets of reasons. The highest ratings were given to fairly traditional factors associated with agglomeration economies. These included professional and skilled labour and business services, and transport and communications. The two most significant reasons for firm location were good access to a major airport (mean score 3.39) and the availability of professional and technical labour (mean score 3.86). In contrast, the types of reason that might be expected to indicate the significance of clustering, such as production and consumption linkages and networks, as well as social networks, tended to score lower than agglomeration advantages. Proximity of collaborators (mean score 2.85), followed by proximity of suppliers at 2.58 were the top rated cluster linkage type of reasons for innovative firms to be located where they were.

At the geographic level of city regions, therefore, the characteristics of traditional agglomeration economies can easily be mistaken for evidence that local firms value highly local linkages and networks. In reality, as in the pure model of agglomeration, there may be no form of collaboration between actors beyond what is in their individual interests in an atomized and competitive environment. The key variable is the size of the agglomeration. Greater size increases the chances of profitable local interactions through chance, the law of large numbers and natural selection of the businesses that can benefit from the multiple opportunities on offer.

Porter himself has been very weak in demonstrating in any detail the nature and types of networking and collaboration in the clusters he identifies. It is argued here, therefore, that the processes involved in Porter I clustering have not been shown to be much more than the kinds of relatively temporary linkages associated with the pure model of agglomeration.

#### **4 Porter II type clustering: demand-side export base theories**

In Porter I, despite the fact that globalized economic interactions are increasing in importance, Porter argued that such linkages mitigate disadvantages rather than create advantages. He said, 'Distant sourcing is a second-best solution compared to accessing a competitive local cluster in terms of productivity and innovation' (Porter, 2000, p. 32). As a result he emphasized the significance of microeconomic conditions and the ability to improve them in order to improve the competitiveness of the macro economy in general.

Nevertheless, globalization appears to reduce the incentives for firms to invest time and resources in purely local clusters. Instead, they clearly need to be competitive in international markets. This requires capabilities for fast-changing business strategies, flexibility, and constant recombinations of specialized suppliers and other business partners. Globalization and changing products have also reduced the importance of traditional localized factors of production. All these factors seem to emphasize the importance of 'weak ties' (Granovetter, 1973) which are multiple, open ended, changing and link both national producers and international customers.

More recently Porter (2003) has taken these arguments on board. He now argues that it is primarily export-oriented clusters that drive regional prosperity. Exporting clusters tend to pay higher wages than those serving purely local markets do, and so they help to pull up other wages in the regional economy. Export clusters are, however, much more likely to have national and international linkages than to be based on purely local connections. The critical importance of these extended linkages in the context of a globalized international economy calls into question the relative significance of the kinds of limited and local connections so often stressed by local policy makers supposedly following Porter's analysis.

While the earlier version of the cluster hypothesis had much in common with traditional agglomeration economy theory, this latest version of the cluster hypothesis has much in common with traditional export base theory. Export base models were founded on the theory that demand for a region's exports drives growth. They were developed originally by Ohlin (1933), North (1955), Tiebout (1956) and Richardson (1969), who argued that a region's growth is determined by the exploitation of natural advantages and the growth of the regional export base, which are in turn largely influenced by the level of external demand from other regions and countries. The demand for a region's exports is determined by their competitiveness that results, in part, from regions specializing in goods and services where they have a comparative advantage.

Further development of export-based models also emphasized the impacts of cumulative causation and agglomeration. Kaldor (1970) and Dixon and Thirwall (1975) developed the idea that regions are able to exploit the benefits of economies of scale and specialization. This improves their export performance and in turn raises output growth. Later developments incorporated the effects of external economies of scale. Here it is argued that geographical concentrations of economic activity improve productivity and thereby raise output.

This theoretical approach has seen something of a revival over the past decade. One leading economist, Paul Krugman, has labelled this the 'new economic geography'. Among other things, this revival now recognizes the key importance of cities and regions in shaping a nation's competitive performance (Krugman, 1991; Fujita, Krugman and Venables, 1999). At the heart of this recognition is the argument that the competitiveness

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of a nation's industries in the global marketplace is shaped in large part by the extent to which those industries are able to benefit from the increasing returns that flow from localized specialized agglomeration.

One of the more recent expositions of this theory was propounded in the Kalecki Memorial Lecture, by Rowthorn who argued that 'The prosperity of a region is determined primarily by the strength of its export base' (Rowthorn, 1999, p. 23). In this case the export base is defined as 'all those activities which bring income into the region by providing a good or service to the outside world, or provide locals with a good or a service which they would otherwise have to import. The alternative term "tradables" is also used to denote such activities' (Rowthorn, 1999, p. 22).

The export base of a city region is important not just for its local supply-side characteristics but also because of its international demand-side linkages. From this perspective exports and trade bring external knowledge into the innovation processes of cities. While some export-based growth models were designed, in the first instance, to explain the development of NICs and LDCs, innovation and trade are vehicles for technological knowledge spillovers in numerous directions. They can provide the knowledge and experience needed for these less advanced economies to catch up with the more advanced. There is also an empirical relationship between accumulated R&D expenditures and total factor productivity. The benefits of R&D can spill across both the less and more advanced countries through trade. This effect is larger the more open an economy is to foreign trade.

Some evidence of the significance of international trading linkages for innovative firms can be gleaned from the third Community Innovation Survey (CIS 3). This is the most comprehensive Europe-wide survey of innovation. Local agents for each of the member states conduct it on a four-yearly cycle. The methodology is based on the recommendations of the Oslo manual (OECD/Eurostat, 1997). In the UK, the Office of National Statistics (ONS) conducted the survey in 2001 for the Department of Trade and Industry (DTI). It involved a two-stage sample of all firms in the UK. In the first stage, 13 315 firms were sent a postal questionnaire, in April 2001. A top-up survey of 6287 was conducted in November of the same year. This produced a total sample of 8172 firms. The results were weighted to represent all firms in the production and construction industries, wholesale trade (excluding motor vehicles), financial intermediation and business services. The weighted results constitute the largest sample and best estimates of the innovation activities of firms across the entire UK for the period 1998–2000.

Table 2.1 shows an analysis taken from CIS 3 of the locations of collaborators for innovative and non-innovative firms. It may be seen that, in general, innovative firms tend to have higher rates of collaboration and therefore linkages than non-innovative firms do. This could suggest some contribution to innovation by clustering. On the other hand, the highest rates of collaboration are recorded with national rather than local firms and institutions. Furthermore, higher rates of collaboration with suppliers, customers and competitors are recorded for Europe and the US than with their local equivalents.

These data indicate the complex nature of the kinds of linkages that contribute to innovation within firms. They show that local agglomeration economies are still important and suggest that city size plays a more significant role in providing the kinds of assets required by innovating firms than does any form of clustering. They also show that, while linkages at numerous geographical scales are important, purely local linkages of the kinds associated in some of the literature with clusters are often less significant than national

Table 2.1 Locations of collaborators by type of collaborator

	Non-innovators <i>Local</i> %	Leading innovators %	Non-innovators <i>National</i> %	Leading innovators %	Non-innovators <i>European</i> %	Leading innovators %	Non-innovators <i>United States</i> %	Leading innovators %
<i>Internal</i>								
Other enterprises within group	0.5	5.1	0.7	5.9	0.4	5.2	0.5	5.0
<i>Market</i>								
Suppliers of equipment, materials, comps. Software	0.5	3.8	1.2	13.4	0.4	7.1	0.2	3.2
Clients or customers	0.6	4.5	0.9	14.0	0.3	7.3	0.2	4.8
Competitors	0.3	1.1	0.3	4.0	0.1	2.5	0.0	1.5
Consultants	0.5	2.6	0.6	7.6	0.1	1.2	0.1	1.4
Commercial laboratories or R&D enterprises	0.1	1.3	0.4	4.0	0.1	1.3	0.1	1.1
<i>Institutional</i>								
Universities or other higher education institutes	0.4	4.5	0.5	7.7	0.1	3.1	0.1	0.5
Government research Organizations	0.3	0.7	0.3	3.1	0.1	0.6	0.1	0.3
<i>Specialized</i>								
Private research institutes	0.1	0.7	0.3	3.0	0.0	0.8	0.1	0.4
Total N=100%	3776	3154	3776	3154	3776	3154	3776	3154

Source: CIS 3.

Table 2.2 Growth in key indicators of competitiveness of non-innovators and leading innovators, 1998–2000

	Non-innovators	Mean scores %	Leading innovators
Growth			
Turnover	6.4		19.5
Exports	29.1		100.2
Capital expenditure	29.5		46.3
Employees	7.2		9.8

Source: CIS 3.

and even international connections and collaborations. This supports the view of innovation as a set of internationally distributed systems located in city regional 'hot spots' in the more advanced national economies.

The significance of innovation to competitiveness in general and to exports in particular is shown in Table 2.2. This shows a comparison between innovative and non-innovative firms in the UK taken from the CIS 3. It may be seen that, between 1998 and 2000, the mean growth in turnover among leading innovators was around three times that for non-innovating firms. The same applied to exports, with the mean growth in exports among leading innovators being more than three times that for non-innovators. There is therefore a strong correlation between innovation and export growth. In so far as exports are a good indicator of competitiveness, it may be argued that innovation is a key driver of competitiveness.

Thus it is possible to agree with Porter that exports are one of the keys to economic growth in particular localities. This is primarily because they bring in new capital, revenues and ideas to city regions. The recognition of the significance of exports to the economic growth of localities is not new and represents the rediscovery of traditional export base theory. It is also clear that innovation is one of the key drivers of exports. The development of market leading goods, processes and services provides the firms that accomplish this with comparative advantages over their rivals and sometimes early mover monopoly profits in the early years of an innovation's product life cycle. What is not at all clear is what distinctively Porterian-type clustering processes contribute to innovation.

## 5 Conclusions

It has been argued that there are two rather different conceptions of clustering in the work of Porter. In the first of them clustering is seen as a highly localized set of processes in which firms interact with competitors, suppliers and customers in such a way as to drive up competitiveness. While there is clear evidence of the concentration of innovative firms in a limited number of key places, there is little evidence to show that the linkages they use are much different from those of traditional agglomeration economies. In this respect they tend to be temporary and only maintained for as long as it is in a firm's atomistic interests to do so.

In the second concept of clustering, Porter recognizes the huge significance of the growing internationalization of the world economy. As a result he then argues that it is only those clusters that are able to export into the international economy that may be

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considered as truly competitive. This brings to the fore the importance of international linkages as opposed to the mainly local forms of collaboration that he emphasized in his first model. The problem with this shift in emphasis is that this later view accords very much with traditional export base theory. It also calls into question the significance of the whole geography of clusters if the most significant networks that firms use are international rather than local.

Despite the major conceptual differences between Porter 1 and 2 clusters the key elements of the 'diamond' remain common to both of them. Thus in both cases the inter-linked driving forces underlying the competitiveness of clusters are firm rivalry and strategy, demand conditions, related and supporting industries and factor input conditions. It is not clear, however, exactly whether or why these driving forces need to be located in geographic proximity to each other in Porter 2 export-based clusters. Thus, for example, the demand conditions for exports can be located in almost any part of the global economy. Supply chains can be international rather than local. Knowledge is becoming an increasingly important factor input to the production of goods and services and can be derived from global sources. Many studies have shown the significance of national and international networking as compared with local linkages.

Thus, on the one hand, Porter 2 has correctly recognized the importance of the development of the international economy, while at the same time undermining the conceptual basis of the localized geography of networks and linkages in Porter 1. In the former there does not appear to be any particular reason why the main elements of his diamond need to be exclusively or even mainly concentrated in one main locality. Despite this, it is still possible to identify local concentrations of industrial sectors in cities and regions. It is interesting, therefore, to speculate on what role such local concentrations play in the context of the globalized economy.

In this context it is first clear that production has to take place somewhere so agglomerations of economic activity are found in all national economies. Within these agglomerations there are varying levels of linkages and networks between different companies, sectors and other local economic actors. None of these agglomerations are independent economic islands and so they also have varying degrees of linkages with other actors in different locations in the global economy. Thus, on the one hand, localized concentrations benefit from traditional agglomeration economies and, increasingly, those associated with knowledge spillovers. On the other hand, those economic nodes that develop local networking skills also seem to be better at extending the reach of that tacit knowledge across national and the international economy.

This is a highly selective process. In general, city regions higher in national urban hierarchies are the most interlinked with other cities in their national and the international economy. Consequently they form the key trading nodes in the globalized economy. They may very well be driven by one or more of Porter's cluster attributes, but the chances of all four being geographically confined to one urban or regional locality are remote.

In practice, there would appear to be very few truly local clusters exporting into the global economy. In most cases, what may be seen in localities is elements of export-based clusters with other parts of their value chains located in other localities. Airbus is a good example of this type of cluster. Various parts of its final product are manufactured in different countries in Europe. None of these locations can individually be regarded as an aircraft-making cluster by themselves, but, when added together across national borders,

they constitute the European civil aircraft manufacturing export-based cluster with similar characteristics to those identified in Porter 2.

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