INNOVATION CLUSTERS: KEY CONCEPTS

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1. The Nature and Significance of Innovation

Innovation is important both as an activity in its own right and as a spur to economic development – and competitiveness – generally, but it can be argued there is, at the very least, a lack of agreement in the academic literature about what innovation is; about why, where, and how it takes place; and about what precise forms it assumes at the local level (Aydalot, 1986; Sternberg, 1996; Castells and Hall, 1994; Ivarsson, 1999).

These differences matter both in terms of achieving a basic understanding of the phenomena of innovation, but also in terms of devising policy measures to actively promote the process of innovation at the local level, which many cities, regions and countries are currently actively attempting to do in the UK, across Europe, and around the world. There are therefore potentially important applied policy implications of the social science studies for whether, and how, innovation can be systematically fostered (Atkinson, 1994; Department of Trade and Industry, 1998; European Commission, 1994, 1995).

But, as we have just noted, innovation is easier to describe than it is to systematically analyse, and easier to analyse than it is to effectively promote. Part of the problem, of course, is the imprecise way in which the activity of innovation itself is conceptualised. To achieve more precision, the logic of analysis suggests that innovation should be should be systematically analysed and then divided into rough categories to produce a working taxonomy based on a number of key dimensions. A major part of the purpose of this paper is to develop such a working taxonomy.

It should be stressed from the outset however that innovation is not an isolated event – it is dependent both on its corporate, temporal and its spatial context for expression. If fact it could be argued that the study of the innovative context has gone through a series of stages. Initially, it was seen largely as an activity carried out by individual innovators - in effect, commercially successful inventions and inventors - such as Goodyear's vulcanisation of rubber; or Bendix's development of the air brake; or Shockley's creation of the transistor. Further, these innovators often worked within single firms – alone, or in small groups. The basic unit of analysis at this stage was the innovator, or the innovator-within-the-firm.

More recently however, it has become increasingly accepted that as commerce and technology have become more complicated, so the process of innovation has, itself, become more complicated – and more spatially extensive – and the analysis of the innovative process entered a new phase. Currently, the process of innovation is now normally seen as a collaborative rather than as an individualistic activity and this innovative collaboration often has a significant multi-team, and, indeed, a multi-firm dimension. As a consequence of this collaborative style of working it is increasingly recognised that there are important spatial aspects to the process of innovation – ranging from the production arrangements of Small and Medium-sized Enterprises (SMEs) within local innovative areas, to the global trading activities of the very large Trans-National Corporations (TNCs).

One currently prevailing view is that the basic unit of assessment of innovation is a **cluster of inter-acting firms operating, often in a particular industry, within a fairly small spatial compass and the firms are 'embedded' in their local area in terms of production linkages including their workforce and communication flows**. For example, over the past two decades, agglomerative clusters of innovative firms have been identified in a number of different countries, and the firms within them are engaged in a wide variety of economic sectors ranging from high-technology, such as pharmaceuticals, computers, scientific instruments and cellular phones, to much more traditional forms of manufacturing such as automobiles, clothing and shoes. In many, if not most, cases the firms interact with each other in terms of labour supply, access to common (tacit) knowledge, producer-supplier linkages, access, venture capital provision, or some combination all of these factors (Scott, 1990; Sternberg, 1996; Keeble and Wilkinson, 1999).

And yet there is increasing evidence that not all innovative firms work in this way. It is becoming increasingly evident that there are substantial variations in the internal structure of these agglomerative clusters – some are highly integrated in production terms; others are not; some undertake joint marketing and some do not. On closer examination apparently homogeneous clusters do, in practice, exhibit a good deal of heterogeneity in terms of their organisational arrangements (Rabellotti and Schmitz, 1999).

In the past few years it has been suggested that there are different **types** of innovative clusters and that some of these clusters, at least, contain firms which although they are located relatively close together in spatial terms have no, or very limited - linkages of any type with other local innovative firms – or with the areas they are located within. They are not so much embedded in their local areas as weakly attached to them, or simply located within them. Further, some of these firms are extremely small and in these micro-firms the importance of the individual innovator and the innovator-within-the-firm has begun to re-assert itself (Hart and Simmie, 1997).

We will examine these different types of innovative cluster later in this paper, but first we need analyse more closely what innovation itself means. Briefly, innovation has been described as, 'the commercialisation of creativity' (Simmie and Hart, 1999, p. 447). But a more extensive definition is required for our purposes in this paper. In our previous, published UK Economic and Social Research Council (ESRC)-sponsored papers on this topic, our starting point has been the definition of innovation which has been adopted by the European Community (EC), and which has been widely accepted by others. According to the EC, innovation is,

> *The commercially successful exploitation of new technologies, ideas or methods through the introduction of new products or processes, or through the improvement of existing ones. Innovation is a result of an interactive learning process that involves often several actors from inside and outside the companies* (EC DG XIII 1996, p.54).

Four explicit, and one implicit, aspects of the definition of innovation are important to us. In terms of the **explicit** dimensions:

- Firstly, innovation is a *commercial* concept not simply a technological, or even an intellectual property one. However novel an innovation is, unless firms are able to successfully exploit their innovation in commercial terms it is not relevant for our present purposes.

- Secondly, there are *degrees* of innovation. The innovative process can involve the creation of completely new products or services or, more commonly, simply the improvement of existing products and services. Innovation can thus be radical or incremental in character.

- Thirdly, *whatever* the degree of innovation it normally arises because individuals working in groups have learned from each other how new or improved goods and services can be created and commercially exploited.

- Fourthly, the basic unit of innovative process is not necessarily an individual, or even an individual firm working in isolation, it is a **network** of individuals, or firms, working together to produce the innovation.

Finally and in some ways most importantly, the **implicit** dimension of the EC definition is that while the definition is a generally a useful one for research purposes it says nothing about how innovation – or more properly the innovative process - is arrayed in spatial terms. The statement, 'Innovation is a result of an interactive learning process that involves often several actors from inside and outside the companies', says nothing about **the spatial location** of these individuals – they may be next door, literally or metaphorically, or they may be a world away given modern production mechanisms. These mechanisms range from local systems such as Just-in-Time Delivery (JIT) and Flexible Specialisation (Flex Spec), to simultaneous global production by TNCs at a dozen different sites – or even some combination of these different local/global mechanisms (McCann and Fingleton, 1996; Piore and Sable, 1984; Amin and Thrift, 1994).

The spatial dimension is important because we know that certain areas are more innovation-rich than are others, but it does not therefore logically follow that all of these clusters are highly integrated, or even interactive, in terms of either traded, or un-traded components of innovation. Just as there are different degrees of innovation – ranging from radical to incremental - it is possible to hypothesis that there are different types, and, indeed, degrees of the spatial arrangement of innovation. In short, our central hypothesis is that there are several different types of innovative clusters; that they need to need be more systematically analysed; and that the spatial dimension is highly significant in this context in determining how these clusters operate. Our concern in this paper is to examine, based on theoretical contributions and case studies, what might be called the *Areal Distribution of Innovation* or, *ADI*, and to attempt to produce a rough taxonomy of the different kinds of the identified *ADI* clusters to determine more clearly in what ways they are the similar, and what ways they differ from each other, using a number of different operating criteria.

2. *ADI*: Spatial Strategies for Dealing with the Process of Innovation

The whole subject area relating to agglomerative clusters of innovation is complex and is becoming more so as the number of individual case studies of the topic continues to grow. In some cases in the literature, the same terms are used to mean different things, or different terms are used to mean the same thing. Clarity is required if we are to learn more about this important area both for academic and for policy-making purposes. As we suggested at the outset, innovation is important in its own right but the *ADI* is also closely related to another current, major economic concern - the whole issue of competitiveness. Most developed countries are seeking to increase the competitiveness of their economies and the process of promoting innovation is viewed by both governments and by academics observers as central to the task of fostering it (Porter 1990; Atkinson 1991; European Commission 1994, 1995; Camagni 1991; UK Department of Trade and Industry 1998).

But the attempt to foster competitiveness through innovation has a paradoxical character. The process of innovation, by definition, involves firms engaging in activities involving risk and uncertainty, and yet it is well known that firms normally seek to avoid precisely this type of behaviour because of the difficulties, and possibly even dangers, to the firm which it entails. As Schumpeter suggested, innovation, 'strikes not at the means of the profits and outputs of the existing firms, but at their foundations and their very lives' (Schumpeter, 1943; quoted in, Simmie, Wood, Hart and Sennett, forthcoming, 1999).

But firms seek certainty in their operating environments for profit and planning purposes (Cyert and March, 1963). Therefore, at the heart of competitiveness there are dynamic tensions which turn on the nature of the innovative process itself. On the one hand, because firms compete with each other and because this competition increasingly involves **introducing** technological innovation – *i.e.* developing new products or services with a technological content - uncertainty in the marketplace about the future is increased. Innovation is fundamentally de-stabilising and the more radical the innovation the more de-stabilising it is. On the other hand, companies are continuously **responding** to innovations – either their own, or those introduced by other firms – but they must also seek to achieve some form of stability so that they can continue to pursue their short-term and long-term profit and production targets. We will contend in the remainder of this paper that space, as well as organisation structure have a role to play in seeking to balance these conflicting elements.

The *Areal Distribution of Innovation* is, of course, heavily influenced by this balancing paradox. ADI is not a new issue but it will be contended in this paper that its organisational shape has changed over time and that it currently assumes a number of quite different forms at the local level, partly as a result of seeking to deal with the paradox of innovation. However, the basic significance of innovation *per se* in fostering economic growth is unquestioned – and has been for some time. Sixty years ago Schumpeter, in a memorable phrase, called innovation, 'creative destruction' (Schumpeter 1939). Freeman has also commented on the crucial importance of fostering commercial change. He stated simply, 'not to innovate is to die' (quoted in Wever and Stam 1999, p.391). Innovation is central to competitiveness, and innovative products, and services, can change whole production chains, working methods, and consumer life-styles, often in ways not foreseen when the innovation

first reached the market. The growth of entertainment and commercial activities centring on the world-wide web provides a case in point.

In theory, there are a number of different strategies available for managing the process of innovation and most of these strategies have a spatial/locational component. One approach is to promote commercial creativity internally – but also to seek to anticipate the cumulative consequences of innovation by other firms and organisation which impact on the individual firm's operating context, including it's spatial context by some form of forward planning to seek to create certainty can be achieved. Clearly one of the key issues for firms is how to manage not simply individual innovations but the process of innovation itself.

These strategies have usually had a spatial dimension and it is possible to identify a number of different *ADI* configurations. For example there is a strategy which might be term 'Macro-Globalisation'. This means, simply that very-large firms in particular countries such as America or Japan extended their activities throughout the world. These large firms grew larger and created Trans-National Corporations in the 19th and for a large part of the 20th centuries. These TNCs sought to increase both the total amount of their market quantity and their market share by mergers and by globalising their activities – and by globally promoting their own innovations (Porter 1990; Amin and Thrift 1994). This globalisation allowed the firms to partly internalise the market on a very broad spatial scale and thus reduce both uncertainty and costs. In some cases there was also a policy on the part of some of these firms, to pursue **vertical integration** within their economic sector to give the firms greater control of their raw materials, and ultimately of their customers by purchasing their suppliers and their distributors and thus controlling the production process from beginning to end.

But is has become apparent over the past two decades at least that there are other quite different *ADI* approaches at work as well by TNC firms across the globe. Large firms have been engaging in a process of 'down-sizing' or, more euphemistically, 'right-sizing', and reducing the number of their work force and concentrating on their core business while contracting out peripheral functions. This **vertical disintegration** approach by global firms has taken place throughout the 1980s and '90s and is seen as a means of cutting costs and promoting efficiency (Amin and Smith 1991; Sadler 1999).

But there has also been another completely different way of seeking to increase efficiency; deal with uncertainty; and promote innovation at the local level which has been in existence for some time – but which has become particularly important in the social science literature over the last decade or so - and which might be described as **horizontal integration**. Horizontal integration refers to local clusters of firms which work closely together in a number of economic, social and knowledge-based ways in the innovative process. The description of these clusters use words and phrases which are often borrowed from other disciplines including economics, business studies and most importantly, geography (Gordon and McCann, forthcoming 2000).

But in the case of many of these areas the terms employed relate more to what might be called the **geology of innovation** rather than the geography of innovation. For example, geological terms commonly employed in the literature include: *clusters* of interacting firms which are *embedded* in their local areas in terms of their workforce

and their use of indigenous information sources, and as a result, create *agglomeration* economies. These borrowed geology terms are important because they reveal a particular way of conceptualising clusters. While it is undoubtedly true that such integrated clusters exist it would be wrong to assume that they exhaust the universe of discourse on this topic. In the next section we will begin to analyse the different shapes that innovative clusters can assume.

3. Types of Local Innovative Clusters and Their Internal and External Relationships

By building on our own earlier research work on this topic (Hart and Simmie, 1997); and the work of others (Sternberg, 1996; Gordon and McCann, forthcoming, 2000); it is at least conceptually possible to begin to construct a taxonomy of clusters by beginning to identify key types of innovative local areas based on a number of performance characteristics, or dimensions.

The most basic, common characteristic of all of these areas is that particular types of firms are located in a *relatively* close physical proximity to each other, i.e. they form agglomerative economic clusters, or spatial concentrations. But once one has said this one has not said a good deal - there are different types of agglomerative clusters. In some cases – but not all – these clusters are innovative in terms of producing goods or services, or both. The generic title for these areas are *agglomeration economies* based on the observations of Weber, Marshall and Schumpeter who suggested that firms locate together to reduce transaction costs, to increase flexibility and to achieve maximum information flow (Weber 1909; Marshall, 1925; Schumpeter, 1934; Krugman, 1991). Another way of describing these areas are that there are flexible local production systems which employ different forms of social capital, including information and communication linkages, to create highly-articulated producer and supplier market networks. The Webberian 'ideal type' of the model has been described as the Local Production Network Paradigm (LPNP) (Simmie and Hart 1999).

But it is becoming increasing apparent as the number of case studies continue to grow that this overall ideal type needs more careful analysis. One way of approaching this analysis and building a taxonomy is by using basic Set Theory. Within the overall agglomeration economy, or LPNP, main set, it is possible to theoretically identify at least three sub-sets which have been widely discussed in the literature. They are:

- **Type A – Cohesive Clusters**
- **Type B – New Industrial Districts**
- **Type C – *Innovative Milieu***

The Set Theory notation for this is: Types A, B, C $\supset$(are contained within) the Agglomeration Economies/Local Production Network Paradigm Set – that is, the three sub-sets share common elements of the main set. We will briefly review the operating characteristics of each of these sub-set types and give examples of industries and areas where they operate for illustrative purposes.

Type A – Cohesive Clusters

The analysis of clusters relates, unsurprisingly, to the period of time when they were identified and the type of industries which were prevalent at the time. What might be termed Cohesive Clusters are the oldest types of areas under examination here. The operational characteristics of these agglomerative economies were mentioned by Weber (1909), and Marshall (1925). Cohesive clusters are groups of firms which initially located together to reduce costs. Weber's logic was that entrepreneurs would locate in areas of least cost with regard to factors such as transport and labour and therefore benefit from economies of scale. He assumed that transport costs are a function of weight and distance. The concern was to keep the costs of movement associated with material assembly, and subsequent distribution to the market, to a minimum.

In the latter part of the 19th century and the beginning of the 20th, manufactured goods were often heavy – *i.e.* there was a low value-to bulk ratio - and therefore transport costs were an important factor in overall production costs and the major markets were usually domestic and often associated with urban areas. At the same time Weber, and later Marshall, argued that as goods became more sophisticated labour costs would form a higher proportion of the overall value of the product and therefore access to a pool of trained labour would become another key priority for entrepreneurs. If the point was reached where the labour costs outweighed the transport costs then the rational entrepreneur would base his locational decision on labour cost reduction. The situation was dynamic and over time as production changes continued to occur important factors relating to economies of scale developed. These were: the creation of internal production linkages; bulk buying and selling to reduce the levels of stock held by individual firms; increases in information flow between firms and infrastructural advantages.

Thus the concept of the Cohesive Cluster grew and developed over time. In the case of most of the companies involved were there was a high degree of inter-dependence in terms of production linkages but without any overall direction by any single firm because most of the firms were small and medium sized (SME) enterprises. Their method of operation in the cluster was rather like Adam's Smith's concept of the 'hidden hand' where each individual seeking to maximise their own self-interest has the inadvertent, but beneficial effect, of economically advantaging everyone. In their ideal type form they are a working model in miniature of the principles of neo-classical economics with many buyer and sellers, none of whom is large enough to control price, and free flows of information which is feed into the production process.

Cohesive Clusters were often located in urban, including inner city, locations, such as the Jewellery Quarter in Birmingham, or the Hackney area in London. Their method of dealing with the threats posed by innovation were too be extremely flexible in terms of rapidly responding to change in the production of new products and they drew on the abilities of a highly-skilled local labour force. They tended to specialise in industries such as fashion items, reproduction furniture, and printing – all of which required the capacity for quick change production. The Clusters were inter-active in terms of their internal trading relations but they also very open in terms of the membership of firms within them. There was both easy entrance and easy exit to the production cluster. The main *economic* advantage has traditionally been described as

the reduction of 'transaction costs' particularly transport costs. But there is another reason forming this type of cluster as well which relates to the risks and uncertainty associated with the innovative process itself. By working together in a flexibly inter-active way firms in this cluster could reduce risk by spreading it between and among them – in effect, by syndicating it.

Type B – New Industrial Districts

New Industrial Districts are the second type of cluster under consideration here. They differ from the previous example in several ways but they share the fact that their description relates to the period of time when they were identified and the type of industries which were prevalent at the time within them. New Industrial Districts tend be knowledge-based – that is they often have a high proportion of companies in high-tech sectors such as computing, Information Technology (IT) and micro-electronics. They rely extensively on R&D for the creation of new products. They tend to be located on the fringe of urban areas or even at some distance from them - examples include Silicon Valley in California and the M4 Motorway Corridor in Britain (Hall, Breheny, McQuaid, Hart, 1987; Scott, 1990; Storper, 1993).

In contrast with Type A clusters, New Industrial Districts produce goods with are relatively small and light in weight and therefore have a high value-to-bulk ratio and, as consequence, transport costs are not a major concern for entrepreneurs in locational decision terms. Transports *costs* are not a major concern but transport *speed* – and reliability of delivery - are. The type of goods produced in these clusters are urgently required throughout the world by customers and they need to be rapidly produced and shipped – often by air to global markets. Speed, in general, is an important concern in the New Industrial Districts and there is constant concern about being overtaken by innovations produced by competitors so the pace of fostering innovation is brisk. The employees in these firms are not simply highly-skilled, a substantial proportion are highly-educated scientifically and technologically. Thus in terms of transaction costs information and dependable high-speed transport links are key elements.

Again in contrast with Type A clusters, Type B clusters are composed of a range of different size firms, from Trans-Nationals to SMEs. The large firms form, often, long-standing relations with their smaller suppliers and they work jointly on projects – in some cases with time horizons of decades. These relatively stable supply chains allow firms to deal with the threats posed to them by the innovation process by seeking to control change through established long-term planning and production arrangements in what might be described as a 'closed club'. Finally, although they are called 'new' industrial districts many have been in existence for 30 years and more and are now better described as mature rather than recent.

Type C – *Innovative Milieux*

The description of the third type of cluster is largely based on the work of the group of researchers called *GREMI* (*Groupe de recherché europeen sur les milieux innovateurs*) which emphasised the importance of social capital in promoting innovation (Aydalot, 1986; Camagni, 1991; Maillat, 1995). In the *innovative milieux*

social networks were established between individuals within firms and between individuals in different firms. These networks were based on experience of working together in the past and therefore trust bonds within the network were created. This type of cluster tends to be located in urban areas where established relations between firms and individuals have existed for some time. As Capello has noted, 'Cumulative and collective learning processes enhance local creativity and innovative output, through the informal exchange of information and specialised knowledge' (Capello, 1999, p.9). Learning takes place in a variety of ways with individuals in different firms exchanging information or individuals moving from one firm to another. Examples of *innovative milieux* clusters include Emilia-Romagna and parts of Northeast Milan. Firms in this type of cluster are willing to jointly pursue common goals on innovative projects which may involve risk.

There are many parallels between the *innovative milieux* cluster and the Cohesive Cluster which was mentioned earlier. Both are largely based on small and medium sized firms within urban areas who rely heavily on the skills and knowledge of a common workforce which, in turn, means the firms are deeply 'embedded' in their locale. There are also importance differences as well. The Type C Clusters actively seek to promote innovation rather than simply rapidly responding to it and actively work together to promote common, medium and long-term innovative goals. The firms in the Type C cluster respond to the threats posed by the innovative process, once again, by seeking to spread the risk through active and continuing syndication of their production arrangements.

Table 1 on page below summarises the main characteristics of the three types of clusters which we have just briefly described but it also introduces a fourth type of innovative area which displays characteristics which are different from the previous clusters. This type of cluster is the most recently described in the literature and its characteristics raises questions both about conventional agglomeration economics, *per se*, and about current national and European Union policies for promoting innovation. We will call it for the purposes of this paper, : Type D – Proximity Clusters – and we will briefly describe it below.

Type D – Proximity Clusters

In each of the three types of cluster mentioned earlier considerable emphasis has been placed on internal linkages of various types between and among the firms and individuals involved in the innovative process. These linkages include both traded and un-traded relations and relate to social capital (a skilled and knowledgeable workforce); physical capital (effective transport and communication systems); and financial capital (funding through the firm's own resources, venture capital or public grants and loans). The firms are acting as a Local Production Network (LPN). There are also close linkages between the workforce of the producer firms and their local area, to the extent that they the firms are described as 'embedded' within it.

Proximity Clusters, on the other hand, work in a completely different way. They exhibit a great degree of internal heterogeneity in terms of their production organisational arrangements, rather than cohesiveness (Hart and Simmie, 1997;

Rabellotti and Schmitz, 1999; Capello, 1999). On the basis of a number of growing number of publications, it has been discovered that within overall innovative areas

Table 1: Key Characteristics of the Innovation Clusters

Type of Innovative Cluster	Type of Linkages	Cluster Characteristics	Examples of Industries/Locations
Type A – Cohesive Clusters	• Local pool of production, sector specialised, labour • Non-traded externalities • Maximum information flow • High degree of internal production linkages	• Mostly small firms • Located In-Town, often in Inner City • Rapid-response to change • Flexible • Easy entrance and exit - 'Openness'	• Jewellery quarter, Birmingham • Reproduction furniture, Hackney, London
Type B – New Industrial Districts	• Traded and non-traded externalities • Established trading linkages – including transport/information linkages between firms • Stable production – relations between firms	• Mixture of large and SMEs • Located Out-of-Town • Macro-global trading • Attempts to influence change through producer/supplier pre-planning • Enduring relationships - 'Closed Club'	• Silicon Valley, California • M4 Motorway Corridor, Britain
Type of Innovative Cluster	**Type of Linkages**	**Cluster Characteristics**	**Examples of Industries/Locations**
Type C – *Innovative Milieux*	• Relations based on trust between individuals • High-risk projects employing common, agreed goals • High-degree of both traded, and untraded linkages between firms	• Mostly SMEs • Located out of urban areas • Importance of social capital • High degree of 'embeddedness'	• Emilia-Romagna • Northeast Milan
Type D – Proximity Clusters	• Relatively close spatial bunching • Knowledge-based innovators • Stronger external than internal linkages • Customer-specified, batch production	• SMEs and micro-firms • Located out-of-town • Micro-global trading • Local area is a location rather than part of a production system – 'unembedded'	• Hertfordshire

such as the county of Hertfordshire immediately to the north of Greater London, there are innovative clusters which are not agglomerations in the way the term is used conventionally. That is, innovative clusters have been identified and examined empirically which have extremely limited linkages of any type **within** the cluster area but often have extensively linkages outside of it. These proximity clusters are so-called because they are located in a relatively close spatial relationships with each other but do not form the kind of Local Production Network which the previous three clusters exhibited in different ways. They are not so much embedded in an area but weakly attached to it.

As we have already noted, the concept of agglomeration in the economic literature is borrowed from geology and means that the various elements – in this case firms – interact and are inter-linked - with each other. They are effectively fused together in terms of their production operations. But in the case of Proximity Clusters perhaps a better geological analogy would be a conglomeration – a set of identifiably distinct elements contained within a larger body – rather than an agglomeration. In the former case, the individual innovative firms are near each other but usually do not have continuing and systematic linkages between them. It is rather like the distinction in logic between correlation and causation - because events occur together it does not necessarily follow that activity A **causes** activity B, they might simply happen at the same time and the two events are coincidental rather than effectively co-ordinated.

Proximity clusters typically occur outside major conurbations and at least in the Hertfordshire example contain a number of very small 'micro-firms'. In these micro-firms the importance of the individual innovator has begun to re-assert itself as it did in the 19th century. The firms are highly innovative and develop specialist products which they sell all over the world. Often it is the continuing client of the firm – in many cases intermediate buyers such as heath services, or defence organisations - who seek to promote innovation rather than simply the firm on its own. In this case the innovative process is more influenced by 'demand-pull' rather than 'technology-push'. In terms of set theory there is a dis-juncture between the agglomeration economies/local production network set and sub-set Type D – it belongs in a different set.

4. **Conclusion**

What we have attempted to do in this paper is widen the analysis of agglomeration and innovation and to suggest that however significant and interesting New Industrial Districts, and *Innovative Milieux* are they do not exhaust the universe of discourse under consideration with regard to innovative cluster areas.

In considering the relationship between agglomeration and innovation in this paper we have suggested that it is logically possible to have: agglomeration without innovation**;** to have quite different types of innovative agglomerative clusters; and to have innovation without agglomeration at all.

This line of reasoning also leads to an important final point. The clear-cut taxonomical categories presented in Table 1 are purely for analytically illustrative purposes. In practice it is likely that the various categories would overlap and even be super-imposed on each other in different areas, at different points in time. Nevertheless, the Table, at its most basic demonstrates that there are important differences between the four different types of cluster identified. It is also logically to assume that different types of cluster requires different types of policy to promote innovation – and competitiveness – policies which are appropriate to the type of cluster under consideration and its operating context - if they are to have their desired effect in fostering the innovative process.

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