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3 True clusters

A severe case of conceptual headache

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Cluster *n*. A group of the same or similar elements gathered or occurring closely together; a bunch.

(*The American Heritage Dictionary of the English Language*, third edition. Boston & New York: Houghton Mifflin Company, 1992)

Clusters are geographic concentrations of interconnected companies, specialised suppliers, service producers, firms in related industries, and associated institutions (for example, universities, standard agencies, and trade associations) in particular fields that compete but also cooperate. Critical masses of unusual competitive success in particular business areas, clusters are a striking feature of virtually every national, state, and even metropolitan economy, especially those of more economically advanced nations.

(Porter 1998a, 197f)

Cluster headache *n*. A severe recurring headache . . . characterized by sudden sharp pain, watering of the eye, and runny nose on one side of the head.

(*The American Heritage Dictionary of the English Language*, third edition. Boston & New York: Houghton Mifflin Company, 1992)

Introduction

The cluster approach has, since its appearance in academic and policy scenes in the early 1990s, had an enormous impact. As an analytical approach it is undoubtedly persuasive and has contributed to substantial progress in the analysis of several of the classical issues dealt with by economic geographers. At the same time it is an elusive, and at times confusing, concept open to multiple interpretations and understandings. So whilst it has been a powerful rallying call and focus point for debate on issues of regional competitiveness and adjustment, the cluster approach has equally caused 'recurring headaches' for many of us active in the field of cluster research – and cluster-based industrial, regional or innovation policy formulation.

The aim of this chapter is to analyse why this is the case and, it is hoped, to contribute to a somewhat clearer idea of what the cluster concept can and can not do for us.[1] Our point of departure is ambivalent. On the one hand, we believe that the cluster movement has in recent years meant a lot to the revitalization of research in economic geography (broadly defined) and to progressive reformulation of agendas in regional and industrial policy. On the other hand, one must wonder if something has not gone seriously wrong along the way. The cluster concept and the associated approaches or models it has given rise to have arguably come to embrace and stand for too much: such that now it has become increasingly unclear what they represent and what they can help us achieve.

We start the chapter with a discussion of what we see as the main contributions of the cluster approach. Following this we suggest that despite the important contributions the concept has made it has also been dogged by considerable conceptual confusion. We discuss the origins and dimensions of this conceptual confusion and go on to suggest that the core problem is that the concept has been elevated to the status of an ideal type: a persuasive theoretical construct but one ill-suited to empirical investigation and policy formulation. This development has, we argue, helped to side-track empirical research and has led to the domination of a series of implicit assumptions that seem to guide empirical research. These assumptions are hard to verify from the empirical work available and we suggest research needs to rethink the hypotheses it is working from. We conclude by arguing for greater degrees of conceptual flexibility and suggest that if the cluster debate is to move forward we need to sidestep cluster puritanism and concentrate our efforts on understanding why clusters have a role in knowledge and innovation.

The contribution of the cluster approach

Some basic points of departure first. In a knowledge-based economy, the ability to innovate is more important than cost efficiency in determining the long-term ability of firms – and regions – to prosper. Innovations, defined broadly, occur predominantly as a result of interactions between various actors, rather than resulting from the creative act of a single individual or firm (Håkansson 1987; Hippel 1988; Lundvall 1992). From this, follows that the level of analysis for understanding the processes of industrial innovation and change should involve some notion of an industrial system or of a network of actors interacting while carrying out similar and related economic activity.

There are a number of reasons why interactive learning and innovation processes are not aspatial or universal, but on the contrary unfold in such ways that geographical space plays an active role. Territorially delimited institutional and cultural traits impact upon the direction and speed of innovation processes. Spatial proximity carries with it, among other things, the potential for intensified face-to-face interaction, short cognitive distance, common language, trustful relations between various actors, easy observation, and immediate comparison (Malmberg and Maskell 2002; Storper and Venables 2002). In short, spatial

proximity seems to enhance processes of interactive learning and innovation, and therefore industrial systems should be assumed to have a distinctly localized component.

The cluster concept, and associated models and lines of argument, offers a neat response to all the above assertions: the cluster promises to produce innovation and competitiveness via a series of interactive processes within systems of actors assembled in a milieu defined through some form of spatial proximity. Phrased in such a way it is perhaps little surprise that the approach as presented by Porter (1990) and subsequently developed by himself, his associates and others (Porter 1994, 1998a, 2000, Enright 1998, Malmberg et al. 1996, Malmberg and Maskell 2002) has caught the imagination of social scientists and brought some genuine contributions to the analysis of key issues of economic geography.

The cluster approach provides a way to describe the systemic nature of an economy: i.e. how various types of industrial activity are related. Beginning with the firms in the industry where we find the main producers of the primary goods, the cluster also embraces supplier firms and industries providing various types of specialized inputs, technology, machinery and associated services, as well as certain important customers and more indirectly related industries. There is much to be said in favour of this way of approaching the systemic nature of economic activity. It opens up a scope for analysing interactions and interdependencies between firms and industries across a wide spectrum of economic activity. In addition it contributes to the bridging of a number of more or less artificial and chaotic conceptual divides that characterize so much work in economic geography and related disciplines. These include, for example, manufacturing versus services, high-tech versus low-tech, large companies versus SMEs, public versus private activities, etc. A single cluster, defined as a functional industrial system, may embrace firms, actors and activities on both sides of these divides (see also Dicken and Malmberg 2001).

Furthermore, Porter's model of the determinants of competitiveness in clusters, the 'diamond model', identifies a number of mechanisms proposed to foster industrial dynamism, innovations and long-term growth. Essentially, the model is built around four sets of intertwined forces related to (1) factor conditions; (2) demand conditions; (3) related and supporting industries; (4) and firm structure, strategy and rivalry. The treatment of these factors includes several points that are indeed novel.

First, in relation to factor conditions the emphasis on the role of specialized factors and factor-upgrading redirects our focus from the very general classical notions of the availability and cost of capital, labour and land towards a much more nuanced understanding that stresses the type of specialized factor conditions – smart money, specialized skills, dedicated and advanced infrastructures – which are developed historically to fit the needs of a particular economic activity. These are important location factors since they are difficult to move and difficult to imitate in other regions (cf. Maskell et al. 1998). Another, perhaps more original, idea is that of the roles of selective factor disadvantages in promoting dynamism and long-term growth: a regional economist's version

of the old idea that 'necessity is the mother of invention'. Arguably, no previous account in economic geography and related fields has so explicitly made the point that shortcomings in factor conditions (such as labour shortages and high wages, scarce natural resources, expensive electricity, strict public regulations, etc.) can actually trigger technological and institutional innovations that will in the longer term be much more important contributors to the competitive success of firms in specific places.

Second, the treatment of the demand side as a primarily qualitative factor is original. Most previous models have emphasized access to a large market as an important locational advantage. Porter's account, in contrast, alerts us to the fact that it is the sophistication of demand that matters if we are interested in innovation and long-term competitiveness. According to this view, the locationally advantaged firm is the one that is in a position to receive and react to signals from sophisticated demand, rather than simply the one that is blessed with 'many customers' in the local market. This idea is also present in other recent approaches to the dynamics of industrial systems; for instance, in Eliasson's (2000) notion of the competence bloc the 'competent customer' plays a key role (Malmberg and Power 2005a).

Third, the importance of local rivalry is made much more explicit than in previous models of spatial agglomeration. That a firm may gain advantages from being located close to other firms in the same industry is, of course, a key insight in classical agglomeration theory. Rarely, though, has this advantage been attributed to the fact that spatial proximity between rivals will trigger dynamism and growth. The idea here is that local rivalry adds an intensity and emotional dimension to competition that can be harder for actors to perceive in dispersed global markets. The firm down the road is often seen as the 'prime enemy', a bit like the rivalry between neighbouring football clubs. Firms in a local milieu tend to develop relations of rivalry, where benchmarking in relation to the neighbours is more direct, partly for reasons of local prestige, and partly, presumably, simply because direct comparison is simplified (it is much easier to see if your neighbour has a better car than you). One could speculate that there are several reasons for the latter. It is easier to monitor the performance of a neighbouring firm than a competitor far away. In addition, if one firm displays superior performance, it is obvious to everyone that this cannot be 'blamed' on different external conditions, since these are, in principle, identical for all firms in the local milieu (cf. Malmberg and Maskell 2002). Furthermore, as numerous sociologists and social psychology from Thorstein Veblen to today have pointed out, self-esteem, personal comparisons, competitiveness and locally accrued social status are powerful human emotions and motivators.

On these points, at least, it should be acknowledged that the cluster approach has contributed to genuine progress: the role of specialized production factors and selective factor disadvantages, sophisticated customer demand, and local rivalry are novel and innovative proposals that have enriched our understanding of why conditions in a local milieu, in general, and agglomerations of similar and related firms, in particular, might promote superior firm performance.

Porter's contribution to conceptual confusion

Arguments regarding the persuasiveness and competitiveness of clusters have become widely circulated in academic as well as in policy circles since the early 1990s. In a recent paper, Martin and Sunley (2003) scrutinize the cluster concept and the broader 'cluster trend' in economic geography and related disciplines and advance a number of more or less justified points of critique. Indeed there is a growing concern that there is a good deal of fuzziness surrounding the cluster concept (Markusen 1999; Martin and Sunley 2003).

In our view, the really disturbing lack of clarity is at the most basic level: what is meant by the terms 'cluster' and 'clustering'? This seemingly trivial question is causing continuing and increasing problems. We are not thinking here of subtle definitional issues relating to the scales, boundaries and criteria for the identification of clusters. Rather, we think that the main confusion is related to whether clusters and clustering should be seen to be primarily functional or spatial phenomena. On this particular issue, Porter himself has contributed to the conceptual mess by presenting quite different basic definitions in various texts since 1990. Compare, for example, the following quotations.

In the original cluster account, Porter writes:

> The competitive industries in a nation will not be evenly distributed across the economy . . . A nation's successful *industries* are usually *linked* through *vertical* (buyer/supplier) or *horizontal* (common customers, technology, channels, etc.) *relationships* . . . The reasons for *clustering* grow directly out of the determinants of national advantage and are a *manifestation* of their *systemic character. One competitive industry helps to create another in a mutually reinforcing process*.
>
> (Porter 1990, pp. 148–9, emphasis added)

It is only after saying that clusters are sets of *functionally* interrelated industries (within the spatial context of a nation) that Porter goes on to discuss spatial aspects:

> Geographic concentration of firms in internationally successful industries often occurs because the influence of the individual *determinants* in the 'diamond' and their mutual reinforcement are *heightened by close geographic proximity* within a nation.
>
> (Porter 1990, pp. 156–7, emphasis added)

Thus in the 1990 book, it is obvious that Porter regarded *clusters as functionally related industries*, while at the same time observing that such functional clusters 'often' seemed to be prone to 'geographic concentration' since spatial proximity amplifies the mechanisms that make clusters of industries dynamic and innovative. Then, throughout the 1990s, Porter adopted a view according to which geographic concentration gradually became an integral part of the definition of the cluster. Thus, in a recent paper, Porter (2000) writes:

> *A cluster is a geographically proximate group of interconnected companies* and associated institutions in a particular field, linked by commonalities and complementarities.
>
> (Porter 2000, p. 254, emphasis added)

Now it seems *clusters are defined by geographical proximity*; even though the precise scale of this geographic concentration is left to the imagination. This gradual slide in the definition of the cluster concept is unfortunate and, we think, a main source of confusion.

Indeed it would be practical if we could collectively strive to establish a terminology that is as free as possible from basic confusion. It is deeply unsatisfactory to develop a scholarly conversation around a core concept the meaning of which various participants in the conversation have different opinions about; not just differences over details but differences at the level of basic definitions. We certainly need one concept that brings out the idea of functionally linked economic activities. 'Industrial system' would seem to be an appropriate generic term, but since the 'C-word' is presumably going to be around for a while, 'industry cluster' could be a useful alternative. When, on the other hand, we face geographical concentrations of similar or related economic activity, we could preferably use the traditional term 'agglomeration', or possibly 'spatial (or localised) cluster', in order to avoid some of the confusion.

This is more than a question of terminology for it seems to us that there needs to be some flexibility built into the way we use, define, delimit and debate the cluster concept in spatial settings (i.e. when we look to the real world). Perhaps a key issue here, to which we will return later in the chapter, rests on the observation that it seems obvious that (functional) industry clusters will not normally be confined to, or contained within, any narrowly defined and spatially bounded scale (Malmberg and Power 2005a). On the contrary, most industry clusters will have widespread global connections and, if we were able to identify their boundaries in spatial terms, the spatial scale would in most cases certainly not be just an urban region. For instance, dynamic and innovative high-tech firms (for instance the pharmaceuticals giants) will most likely look to find the best technological and scientific partners irrespective of where they are located. By making spatial configuration (i.e. the degree of agglomeration) an attribute of an industrial cluster, rather than part of its definition, one could establish a platform for more fruitful analyses of how 'geography' comes into play in the overall process of industrial competitiveness, growth and transformation.

In other words, rather than trying to squeeze 'cluster charts' into narrowly defined regions (where they rarely will fit in), we should research hypotheses such as those found in the diamond model regarding the role of proximity and local milieu on the proposed mechanisms leading to competitiveness. When it comes to spatial agglomerations of similar and related economic activities, i.e. localized clusters in the terminology proposed here, there are also reasons to believe that firms in such settings are less interrelated than Porter and others have led us to believe (Malmberg and Power 2005b).

Clusters: strictly defined ideal types?

What we have just described leads on to a more general set of problems and questions. Should the cluster concept be very strictly defined, and in consequence be applied very selectively to deal with a limited number of exclusive real-world cases? Or should we adopt a more flexible stance where the precise definition of the cluster concept is left more fluid, such that the concept can used to research – and act upon – a much larger number of real world cases (cases where only one or a few 'cluster characteristics' are in evidence)?

The way the cluster concept tends to be used today indicates that there are at least four different dimensions or defining criteria that should be present for a true, fully fledged, cluster to be said to exist. The first two were discussed in the previous section: those of spatial proximity and functional inter-linkage.

Thus, according to the spatial agglomeration criterion, a cluster is defined as a geographical concentration of similar and related economic activity. This criterion brings two major problems. The first is, as we have seen, that extreme flexibility prevails when it comes to determining what is meant by geographical concentration: are we talking about an industrial estate, a city, a region or even a nation? In principle, we are left free to make our own judgements about the balance between space and systems, where we draw the lines and what we include.[2]

The second criterion of the cluster concept in action is, again, the idea of the cluster as a functionally defined industrial system. The point here is that a cluster is not limited to an individual industry but embraces all the actors, resources and activities that come together to develop, produce and market various types of goods and services. One problem with this is that there are no theoretical reasons to argue that such system should be defined or delimited in either a narrower or a broader sense. The context of the analysis or the policy action determines whether it is more appropriate to focus on a broader automotive cluster or instead to choose more narrowly defined clusters that make, for instance, only trucks, buses, private cars or even particular components. Another problem relates to how much spatially agglomerated activities should compete and/or collaborate with each other in order to be conceptualized as related. In practice most of what we think of as functional regions (daily urban regions, local labour market regions, etc.) are much smaller than the spatial extension of most functional systems.

As the cluster approach has become increasingly popular as a policy tool and found itself being adapted to practical purposes a third criterion of what a cluster is has become prominent in both policy initiatives and academic research. This criterion is based on the existence and links between identity, self-awareness and policy action. According to some observers, the institutionalization of some common idea or purpose is a necessary ingredient of a true cluster. For a cluster to be said to exist, some actor (often employed by a public institution rather than a private company) has to identify it as a cluster, whether existing or 'dormant' (or 'potential', or 'emerging'), give it a name (preferably one that refers

to a low lying area surrounded by hills: 'XXXX-Valley'), and start acting in order to consciously develop it (Lundequist and Power 2002, Rosenfeld 1997, Raines 2001). Thus, in policy circles clusters have become more or less synonymous with the existence of a policy programme and a number of more or less concerted policy actions. This could be seen as a discursive definition of the cluster concept where a cluster has come to refer to a specific policy initiative. Such clusters might or might not have a resemblance with the functional and geographical dimensions already discussed. In our view, cluster-based policy programmes could preferably be referred to simply as cluster initiatives; as indeed more policy-oriented work is already doing (see for instance Sölvell et al. 2004).

A fourth criterion of the cluster concept is one in which the cluster idea becomes synonymous with competitive success. This is the idea that the cluster is not just a system or a geographical concentration but one that is also dynamic, innovative and competitive – doing things that 'distant rivals cannot match' (Porter 1998b). In this view the cluster is always a success story and in essence an end-state. It is a concept that describes and elevates particular states of achievement. As such it is a concept that is not entirely applicable to those who wish to describe or apply generalized developmental trajectories or processes.

How then should we regard this situation where there are obviously (at least) four sets of meanings attached to the cluster notion? One refers to functional system and interaction, another to spatial agglomeration, one to self-identity and policy action, and another to already successful examples. Porter himself, as we saw, seems to believe that the first two more or less coincide and could thus be treated as one. In relation to the third, in his view the issue of self-awareness and policy action is subordinate. He states that government agencies that significantly influence a cluster can be considered part of it, but it is obvious that, at least in his earlier writings, there could well be dynamic clusters without such agencies. In the case of the fourth criterion he also seems very open to thinking that proven success is an essential dimension of a true cluster.

If one takes cluster theory seriously, then a strict definition of a true cluster is based on the criterion that:

- There should be a spatial agglomeration of similar and related economic activity.
- These activities should be interlinked by relations and interactions of local collaboration and competition.
- There should be some form of self awareness among the cluster participants and some joint policy action ('we are a cluster and we are determined to develop together').
- The cluster should be, in one way or another, successful (innovative, competitive).

As we mentioned above, it is often hard to tell in the existing literature whether the use of the cluster concept refers to any of the above four criteria or indeed

some imagined 'ideal type' where all, or at least the first three, coincide. As we understand the debate to date, what has emerged is a series of implicit assumptions and models that have in essence lifted the idea of the cluster to the level of an 'ideal type'. Max Weber (1947, 1949) suggested that the ideal type was a part of researchers' attempts to wrestle with the problem of the ambiguities presented to us by the empirical world: an attempt which always involves the imposition of order, the emphasizing and perhaps exaggeration, and even elimination, of certain elements of the reality presented to us. The construction of an ideal type is an attempt to arrive at a unified definition but for those interested in direct empirical description it is inherently problematic since it is essentially the construction of a gross stylization (Aron 1970). Indeed Weber himself viewed the ideal type as a heuristic device, a mental concept, that whilst conceptually pure 'cannot be found empirically anywhere in reality' (Weber 1949; Weber 1947: 110). It appears to us that cluster thinking has become preoccupied with the development of pure ideal types.

The problem introduced above is that the more strictly we define clusters, the smaller the number of real world cases that conform to the definition. In a strict, or puritan, view of clusters then we should find a mixture of certain degrees of all four criteria contained in the ideal type, and definitely all of the first three, before a cluster can be said to exist. Indeed despite a current abundance of clusters and cluster initiatives there are few places in the world (at whatever spatial scale one looks) where we can find such 'true' or 'real' clusters. Porter's often cited claim that 'clusters are a striking feature of virtually every national, state, and even metropolitan economy, especially those of more economically advanced nations' (1998a: 198) becomes increasingly doubtful when stricter definitions of a cluster are applied.

The introduction of the success criterion as part of the definition is problematic for another reason. In much cluster research, there is an implicit model that looks something like:

Competitive Success = f(Interaction, Agglomeration, Policy institutions)

This too carries problems with it. The first, again, is that of exclusiveness. How, for instance, do we deal with cases where everything seems to be in place – an agglomeration, an interactive system and a policy framework – but there is still no innovativeness or the core product is simply no longer competitive? Is this a cluster? Alternatively how do we deal with a case where there are the beginnings of an agglomeration, the initial bubbling of a creative milieu and a well organized, high-profile cluster organization but as yet nothing much more than lots of investment in a promise and a dream? Is this a cluster? But the more serious problem is that the model, when combined with the ideal type definition, leads to circular reasoning: clustering is claimed to lead to competitiveness, while at the same time clusters are partly defined on the basis of their competitive success.

Researching clustering and knowledge creation?

The above has implications for how economic geographers and others should approach the clustering issue. A preoccupation with ideal type reasoning on the cluster concept has contributed to sidetracking empirical research on clustering. The introduction of the cluster concept could have triggered lots of research on the fruitful issue of how industrial transformation occurs as a result of interactions within and across industrial systems (i.e. clusters defined in the functional sense) and the role of spatial proximity (concentration or agglomeration, i.e. clustering in the spatial sense) in such processes. Instead, we would argue, there has been far too much focus on interaction between firms within geographically defined spaces and numerous rather pointless attempts at trying to assess to what degree there is actual interaction going on locally and thus whether a specific region can indeed be said to contain a 'fully fledged' or 'true' cluster or not (Martin and Sunley 2003).

We are at the stage then when there is a lot of confusion about what the concept actually involves, with the effect that research (and policy) has become far too based on a number of ideal types and criteria that may not offer us the most solid conceptual basis for scholarly conversations and real-world interventions. One possible solution to the resulting conceptual and empirical patchwork may be to go back to the underlying theoretical assumptions upon which the various cluster approaches seem to rest.

After having spent recent years immersed in cluster literature, conferences and case studies, it seems to us that the cluster concept is essentially a concept attempting to reconcile the fact that most economic activities (and workers) occur in localized clumps with the reality that the products and services they produce (whether they are new or rather old offerings) have to find a market within a globalized knowledge economy. In our view, the cluster approaches' popularity rests on a deeper understanding of a more macro-economic nature: that the leading-edge competitive forces dominant in the Fordist and pre-Fordist periods – mass production, cost cutting, price competition, and product standardization – have given way, at least in the rich countries, to a stress on how added-value can be created through harnessing the knowledge, flexibility, adaptability and innovativeness of our firms and populations. If we are right in thinking this way, then the cluster approach is less about maintaining competitiveness through collective control of resources and agglomeration economies and rather more about findings ways in which knowledge and innovation can be given a supportive environment.

Going back to basics means trying to understand the cluster movement less as a tool for developing regional competitiveness and rather more as a conceptual framework for analysing the fundamental dynamics of knowledge creation and innovation in industrial settings (which we all roughly agree is the ground upon which competitiveness grows). In the rest of this chapter we will attempt to work with this understanding of clusters and clustering and suggest that to get at the core of the cluster approach we could do a lot worse than to look at how clusters have been said to create knowledge and learning at a 'local' level.

Clusters, localization and knowledge creation: three received hypotheses

Drawing on extensive literature reviews we have undertaken (the results of which also appear in Power and Malmberg 2005b), we suggest here that it is possible to identify certain broad areas of agreement in the literature – about how knowledge is created in clusters – that could be seen as basic underlying hypotheses driving current research. The following three hypothetical propositions are, we argue, those that underpin the majority of cluster research we are aware of:

(1a) *Knowledge in clusters is created through various forms of local inter-organizational collaborative interaction*. This hypothesis is grounded in the proposal that firms that collaborate more on technology with firms and other actors (e.g. universities) in the local milieu will innovate more, and in the idea that firms that meet sophisticated demand from demanding customers in the local milieu will be forced to innovate at a higher pace than other firms.

(2a) *Knowledge in clusters is created through increased competition and intensified rivalry*. The claim here is that rivalry between similar firms in a local milieu will be more intense, almost emotional, and this will create a pressure to innovate in order to outsmart the local rival. In part, this is related to the fact that firms in a localized cluster are more visible to each other, and thus that observation, monitoring and benchmarking thereby is easier and more efficient. Therefore, firms with nearby rivals will be more innovative than firms that have their main competitors located elsewhere.

(3a) *Knowledge in clusters is created through spill-over effects following from the local mobility and sociability of individuals*. This hypothesis is based on the idea that knowledge diffusion will be more rapid among local firms than among globally dispersed firms, owing to the intensity of informal interaction in the local milieu as well as through flows of people in the local labour market. Here the cluster is seen to rely on underlying localised factor conditions. In particular, there have recently been a number of studies that propose a version of the cluster concept that stresses the centrality of local labour market processes to the innovative capacity, competitiveness and indeed existence of clusters. It is the dynamism of the local labour market that is held to account for the associated clusters' dynamism.

These, we would argue, are all interesting and researchable hypotheses that could be deduced from the cluster literature, based on the underlying argument that the forces that enhance the dynamism of an industry cluster are strengthened by geographical proximity, via a series of mechanisms.

Clusters, localization and knowledge creation: empirical evaluation

However, the empirical validation of the propositions advanced in the cluster literature leaves a lot to be desired. This is partly due to the fact that there has been a general reluctance to spell out the theoretical propositions made in a form that would make it possible to subject them to systematic empirical

validation. After a systematic review of the empirical literature on clusters and clustering we found that the empirical basis for the above three hypotheses is such that the three could be recast as follows:

(1b) *Knowledge in clusters is seldom created through local inter-organizational collaborative interaction*. A distinctly mixed picture emerges from the literature on inter-firm transactions (such as buyer–supplier relations, etc.) and inter-firm collaboration (such as joint product development, etc.). It appears that intense collaborative interaction with similar and related firms in the localized cluster does not come out as a major knowledge creating mechanism (Angel and Engstrom 1995; Hendry et al. 2000). In addition, though examples do exist, they are few, and there tend to be modest commercial relations between firms within spatial clusters. Furthermore in a localized cluster the majority of firms tend to have most of their important suppliers and customers somewhere else (Larsson and Lundmark 1991; Angel and Engstrom 1995; Larsson 1998; Markgren 2001) and innovation and knowledge creation tend to follow value chains that are most often global (Fuellhart 1999; Zeller 2001; Owen-Smith and Powell 2002; MacKinnon et al. 2003). University–industry collaborative links do exist in some places (Jaffe 1989; Jaffe et al. 1993; Anselin et al. 1997; Narin et al. 1997; Zucker et al. 1998; Howells 2002; Rodríguez-Pose and Refolo 2003) but they tend to be more appropriate to some industries than others and are in general much more global than local. Finally whilst other, more informal, types of collaboration are more common locally and temporally (Keeble et al. 1999; Wallsten 2001; De Propris 2002; Isaksen 2003) it appears that such relations also normally extend far beyond the confines of narrowly defined regions.

(2b) *Knowledge in clusters may well be created through increased competition and intensified rivalry, though we are not sure yet*. If Porter is correct in thinking that local rivalry is crucial to motivating and driving knowledge creation and innovation (Porter 1990, 1998a, 2001) then it is surprising that the extent to which local rivalry occurs and the effect it has have not been well studied empirically. Some evidence does exist (Sakakibara and Porter 2001, Power and Hallencreutz 2002, Boari et al. 2003, King et al. 2003) but the extent to which local rivalry effects knowledge creation in this limited evidence varies. Furthermore there seem to be many firms and sectors that see themselves as relatively isolated from competitors, in that they have very few and these are often located very far away (Glaeser et al. 1992; Audretsch and Feldman 1996; Baptista and Swann 1996, 1998; Malmberg et al. 2000). While it is too early to dismiss this hypothesis, we would not at this stage propose that rivalry is a more important booster of knowledge creation than various forms of collaboration.

(3b) *The creation of knowledge in clusters is probably helped by spill over effects following from the sociability of individuals and almost certainly by labour mobility*. What we found in the studies we reviewed is that informal knowledge exchanges do seem to occur across groups of professionals and specialized individuals in clusters (Thrift and Leyshon 1994, Coe 2000, Bennett et al. 2001, Lissoni 2001, Grabher 2002 Benner 2003, Welz 2003). There is also mounting evidence that local

labour mobility plays an important role in rates of innovation and that localized clusters that are relatively successful tend to have higher rates of labour mobility into the cluster, within the cluster and within the cluster firms (Angel 1991, Almeida and Kogut 1999, Gilson 1999, Breschi and Lissoni 2001, Cooper 2001, Fosfuri et al. 2001, Dahl 2002, Dahl and Pedersen 2003, Lewis and Yao 2003, Madsen et al. 2003, Rosenkopf and Almeida 2003, Song et al. 2003, Power and Lundmark 2004). Of course what is good for the cluster's overall knowledge creation and spreading might not be good for all firms, and there is evidence suggesting that firms in clusters with high labour mobility view such 'dynamism' as a considerable cost (Almeida and Kogut 1999; Lawson 1999; Dahl 2002) and even a potential threat to the trade secrets they hope to commercialize (Ronde 2001, Fosfuri and Ronde 2004).

To summarize very broadly, the available evidence suggests to us that, if we are interested in knowledge creation and knowledge-based innovation, localized clusters seldom appear to be the localized systems of interrelated firms bound together by tightly knit organized inter-firm transactions and collaborations that many academics and policy-makers seem to want them to be. Perhaps the image of cosy collaborations and friendly groups of scientists developing wonderful products after a short drive from home is fatally flawed. The evidence suggests that, for instance, these scientists might be better off driving to the nearest airport than the local business park (cf. Bathelt et al., 2004), and that if they are staying home they are more likely to be innovative if they are enviously keeping watch on their competitors' achievements than if they are collaborating with them. On the basis of the evidence it seems that localized clusters are perhaps best understood as sites of informal social interaction and as arenas for flexible and well-functioning markets for specialized and skilled labour. In short, there seems little evidence that organized inter-firm transactions and co-operation characterizes successful firms. At the same time, there is growing evidence that labour market dynamics and social interaction at the level of the individual can play important roles in firms' and clusters' knowledge creation processes.

Conclusion and implications

In this chapter we have suggested that the state of play in cluster research is currently rather unsatisfying. We have a situation where considerable conceptual confusion reigns and that this confusion presents academics and practitioners with real 'cluster headaches'. In particular, we have pointed to the idea that the cluster literature has become far too concerned with conceptual puritanism that aims to identify certain attributes and qualities that earmark a set of industrial activities as a 'cluster'. Indeed we have suggested that an implicit set of ideal types and an implicit model of cluster competitiveness have emerged to dominate many aspects of the cluster debate. However, for those of us concerned with using what is in essence a very interesting and positive concept to help us better understand the economic world and understand how policies can help it, the current situation presents us with a real set of problems.

Not least of these problems is that we in academia have developed a conceptual discourse that is increasingly poorly attuned to understanding the objects of study – actual 'clusters' – and to helping policy interventions that are rapidly shaping it into a patchwork of clusters. By concentrating on conceptual purity and modelling ideal types we are faced with the fact that very few *true* clusters exist. This presents us with some problems: what do we do with the rest? What do we do with those clusters that do not fully conform to the ideal type but seem to be there anyway? What do we do if we see something dynamic in a certain place but find out that it is not a system, an agglomeration or institutionalized?

We argue here that there seems to be an expedient value in being less categorical and in realizing that there is a gap between the realities of competitiveness on the ground and the models of competitiveness that the regional development and economics literature put forward. We should then be realistic and study competitiveness everywhere it occurs and not get too stuck on the definitional and categorical details. Getting stuck in the modelling and categorizations usually, in our limited experience, involves recourse to policy that simply points out what is lacking from the 'cluster' and tries to work out where that could be inserted; rather than building on competitive strengths or thinking about whether the dynamics of the case in question are best served by less severe cluster bandages. We might also argue that another possible solution to the problems arising from the existence of few true localized clusters is that we begin to be less focused on the role of the local in competitiveness and innovation studies and instead focus more energy on the links between the extra-local and the local in competitiveness and innovation: which after all usually involves being competitive or innovative in markets that are not in the same place as the 'cluster'. Thus we should be careful not to fetishize ideal types and the local in our attempts to understand and support regional development.

Finally, whilst we have suggested there is a need for more conceptual flexibility and that the debate has become somewhat stilted, we do believe that, by refocusing on certain essential elements, rigorous and analytically challenging debate and progress are possible. We argue that a sensible way forward is to take a step back from the cluster puritans' attempts to delimit the concept strictly and instead go back to basics and start asking questions that are based on the underlying reason why cluster approaches have in fact become popular. We think that this involves taking seriously the idea that what we are really interested in is how knowledge (and innovation and learning) are created in localized clusters. However, if we review available empirical studies of clusters we find that certain assumptions have driven much research and that the evidence for these findings is often somewhat mixed and limited. This suggests to us that it is high time that cluster research rethinks its underlying assumptions and tries to move forward on the basis of new questions and hypotheses; albeit ones that are based on the same fundamental search for answers to questions about knowledge creation that gave the cluster approach its attractiveness in the first place.

Notes

1 This chapter builds upon and develops arguments presented in a series of papers, co-written by the authors in various constellations, over the last few years, notably Dicken and Malmberg 2001, Malmberg 2003, Malmberg and Maskell 2002, Malmberg and Power 2005a, 2005b, and Lundequist and Power 2002.

2 In practice, there are of course conventions according to which we normally tend to adopt some notion of a functionally defined ('daily urban') region as the basis for defining the spatial boundries of localized cluster.

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