
The elusive concept of localization economies: towards a knowledge-based theory of spatial clustering

Anders Malmberg

Department of Social and Economic Geography, Uppsala University, PO Box 513, S-751 20 Uppsala, Sweden; e-mail: Anders.Malmberg@kultgeog.uu.se

Peter Maskell

Danish Research Unit for Industrial Dynamics (DRUID), Department of Industrial Economics and Strategy (IVS), Copenhagen Business School (CBS), Howitzvej 60, DK-2000 Frederiksberg C, Denmark and Centre for Economic and Business Research (CEBR), Langelinie Allé 17, DK-2100 Copenhagen, Denmark; e-mail: maskell@cbs.dk

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Abstract. A number of possible advantages of industry agglomeration—or spatial clustering—have been identified in the research literature, notably those related to shared costs for infrastructure, the build-up of a skilled labour force, transaction efficiency, and knowledge spillovers leading to firm learning and innovation. We identify two shortcomings of existing research on the clustering phenomenon. First, the abundance of theoretical concepts and explanations stands in sharp contrast with the general lack of work aimed at validating these mechanisms empirically and the contradictory evidence found in recent empirical work in the field. Second, there is still a lack of a unified theoretical framework for analyzing spatial clustering. In an attempt to remedy the latter shortcoming, this paper investigates the nature of the cluster from a knowledge-creation or learning perspective. We argue for the need to establish a specific theory of the cluster where learning occupies centre stage. The basic requirements for such a theory of the cluster are discussed. Two main components of such a theory are identified: it must explain the existence of the cluster on the one hand and its internal organization on the other.

Introduction: economic geography in a knowledge-based economy

The process of globalization is often associated with the ‘unbundling’ of the previous relationship between sovereignty, territoriality, and state power and, as a consequence, with steadily weakening nation-states (Ruggie, 1993). Yet it is arguably the gradual shift in the basis of industrial competitiveness from static price competition towards dynamic improvement that has contributed most in making globalization the favourite business buzzword at the recent turn of the century. The shift has favoured firms that are better able to innovate and create knowledge than their competitors and has thus moved the competitive edge of an increasing number of firms from cost reduction to the generation of entrepreneurial rents (Spender, 1994).

The creation of knowledge is usually seen as a process requiring dedicated investment. At the level of the individual firm, knowledge-creating investments are often associated with research and development activities and with the adoption of leading-edge technology. Equally important, however, is the investment in ‘low-tech’ learning and innovation (Maskell, 1998), which takes place when firms, in fairly traditional industries, learn and innovate while handling and developing mundane day-to-day operations such as resource management, logistics, production organization, marketing, sales, distribution, and industrial relations (Malerba, 1992).

It may well be that spatial clustering always contributed to economic growth by enhancing learning processes, but the shift towards a knowledge-based economy has certainly amplified our interest in understanding the nature of this proposition. This had led some scholars to propose that the localized cluster is *the* territorial configuration most likely to enhance learning processes. Today Silicon Valley and Hollywood

are probably the most celebrated examples of successful clusters, but even small nations are also sometimes looked upon in this light (Porter, 1990).

In the context of economic geography, the concept of agglomeration has to do with the spatial concentration of people or economic activity. For a long time this phenomenon has attracted research interest. Throughout the 20th century, a literature proliferated which, taken together, contributed to our understanding of why industry agglomerations emerge, and in what ways a location close to similar or related firms contributes to the competitiveness of an individual firm.⁽¹⁾

The concept of agglomeration may have two different meanings in this context (Estall and Buchanan, 1961). One is related to the phenomenon that people and economic activity in general tend to concentrate in cities or industrial core regions. The advantages gained by such behaviour are often referred to as urbanization economies (compare Hoover, 1937; Dicken and Lloyd, 1990). The other is related to the phenomenon that firms within the same or closely related industries tend to gather at certain places. Those mechanisms leading to such behaviour are correspondingly referred to as localization economies. It is the latter aspect of agglomeration which makes up the main focus of the rest of the paper. Industry agglomeration, localization, and spatial clustering are used more or less synonymously in the literature, to denote the phenomenon that similar or related firms and industries tend to assemble (concentrate, agglomerate, collocate, cluster) in particular places. Here, we mainly use the concepts of localized clusters and spatial clustering to denote the phenomenon of agglomeration of similar and related industries.

After a period of relative neglect during the 1970s and 1980s, the 1990s saw something of a boom in research efforts devoted to analyzing and explaining spatial clustering (for example, Sabel, 1989; Storper, 1993; Amin and Thrift, 1994; Porter, 1998; Scott, 1998).⁽²⁾ Key ingredients in this resurgence include the widespread interest in the industrial districts phenomenon which followed in the wake of the intense 'post-Fordism debate' in the 1980s, and the renewed interest in cluster dynamics following Porter's interventions in the field since the early 1990s (Porter, 1990; 1994; 1998). Today we find scholarly interest in this phenomenon across a wide range of academic disciplines and traditions. Of course, individual scholars and disciplines pursue different discourses and analyze the role of geographical space in the economic process as part of disparate wider agendas. Some frame their analysis in the context of specifying the role of local knowledge in a globalizing world economy, others relate such discussions to a broader transformation of capitalism, while yet others approach the role of localized clusters from the point of view of general business strategy, or attempt to bring economic geography into the core of mainstream economics.

There are several reasons to take the issue of spatial clusters seriously. One is that spatial clustering is at the very core of what research in economic geography is all about. Analysis of spatial clustering brings to the fore concepts such as proximity, place, and milieu—all focal points for research in economic geography. There is a lot to learn about the role of proximity and place in economic processes by trying to pinpoint the driving forces that make for the agglomeration in space of similar and related economic activities.

⁽¹⁾ Among the 'classics' in this field of research can be mentioned Marshall (1890), Weber (1909/1929), Hoover (1937; 1948), Myrdal (1957), Hirschman (1958), Ullman (1958), Chinitz (1961), Jacobs (1961), Pred (1966; 1977), and Greenhut (1970). More recent contributions have been signed by geographers such as Scott (1983; 1988; 1998), Amin and Thrift (1992; 1994), and Storper (1997) alongside business strategists and economists such as Porter (1990; 1994; 1998), Krugman (1991a; 1991b; 1991c), and Enright (1998).

⁽²⁾ Accounts of this literature are found in Harrison (1992), Norton (1992), Storper (1995), Malmberg (1996), Baptista (1998), Bianchi (1998), Yeung (2000), and Hanson (2000).

Second, this task has obvious policy relevance today. Throughout the OECD world (and beyond, as a matter of fact) cluster-based policies have in recent years increasingly been seen as *the* main option in the field of industrial and regional policy. As an important element of these policies we find a doctrine saying that regions should specialize industrially and promote the dynamics of spatial clustering in order to gain or sustain competitiveness and prosperity.

Taken together, this means that spatial clustering is important enough to justify an attempt to track its conceptual underpinnings and empirical status, even if it means that sometimes different and perhaps not always compatible accounts are ‘lumped together’ in an eclectic way into something defined as ‘spatial clustering research’. We maintain, however, that there is some justification in doing so. The point of departure of this paper, therefore, is that the individual additions to this literature can still be read as contributions to a common research agenda: that of understanding the role of space and place in industrial development in general, and the phenomenon of spatial clustering in particular.

The aim of the following two main sections is fairly modest: to review and summarize the most important arguments making up what could be labeled ‘spatial clustering theory’, and subsequently to direct our attention to the somewhat discomfiting fact that the theoretical mechanisms identified so far by and large evade successful empirical validation. Even though the phenomenon of spatial clustering is indeed one of the main ‘classical issues’ of economic geography, and despite the fact that considerable research efforts have been made over the last decade, we have to acknowledge that its causes and effects remain elusive.

Furthermore, and perhaps more discomfiting, we believe that research in economic geography and related disciplines has so far failed to come up with something close to a satisfactory theory of the localized cluster. Remedying this latter shortcoming is precisely what we are aiming at in the final major section of the paper. Here we propose a way of structuring our understanding of how the cluster partakes in knowledge creation. In dealing with this issue, we raise a set of questions about the way in which economic performance is related to space in general, and to the role of localized learning in particular.

A review of earlier research on spatial clustering

Existing literature provides two types of knowledge on spatial clustering. One source of knowledge is to be found in ideographic, historical work on the origin and development of various types of localized clusters. Every so often one finds that localized clusters of similar and related activities have deep historical roots. One way to analyze the emergence of a localized cluster is thus simply to try to trace its roots backwards in history. Such historical accounts will often show that the emergence of spatial clusters of similar and related economic activities is related to three factors: they often originate in a series of events leading to the start of a new firm at the place of residence of the founder; they develop through spin-offs and imitation within the local milieu; and they are sustained by various forms of inertia, meaning that firms rarely relocate once they have been reproduced in a place. The further development of the cluster will typically include a deepening division of labour between local firms, the creation of a local culture, supporting infrastructures and institutions adapted to the proliferating industry, the establishment of the place as a brand of the industry and subsequent attraction of resources (people, capital, firms) from outside. Such a story also includes phases of consolidation—at some stage some firms tend to take on leading roles. This means that they take over other firms in the cluster so that an initially small-firm-based agglomeration often ends up by being dominated by a limited number of

larger firms. Finally, history tells us that most localized clusters, sooner or later, run into problems. Elements of petrification are often revealed at points in history when technological or other developments call for rapid restructuring. This may mean that what was once a leading centre of dynamism within a given line of business ends up as an 'old industrial region', facing great problems of renewal and finding itself out-competed by firms located elsewhere. Then again, there are also examples of crisis-ridden clusters managing to 'reinvent' themselves, so that they can actually retrieve some of their former greatness. In the following, we will disregard this empirically rich but often less theoretically sophisticated literature. Instead we will focus on some theoretical contributions that try to identify the mechanisms which give economic and other advantages to the individual firm located in a cluster.

Traditional approaches based on cost reduction

The more theoretically oriented part of the literature of agglomeration usually does not focus on the origin and subsequent historical development of localized clusters. Rather it aims at explaining the existence of spatial clustering by identifying and analyzing those permanent advantages that may accrue to firms located close to other similar and related firms, rather than being located in isolation. Thus, the concept of localization economies refers to these advantages. Three different mechanisms have traditionally been identified in this context.

First, there are benefits to be gained from the possibility for agglomerated firms to share the cost of certain collective resources among several firms. This applies in particular to the cost of establishing the required infrastructure. When an agglomeration of similar or related firms is established, there is also a potential to adjust the local infrastructure, the educational system, and other types of collective goods after the needs of this particular industry. The first mechanism can thus be labeled *reduced costs for producing and maintaining a dedicated infrastructure and other collective resources*.

Second, agglomeration makes for the development of a local labour market for specialized skills. The establishment of a local pool of skilled labour has been proposed as a major element of localization economies ever since Alfred Marshall more than a century ago wrote so elegantly about the advantages of being located in an industrial district:

"Again, in all but the earliest stages of economic development a localized industry gains a great advantage from the fact that it offers a constant market for skill. Employers are apt to resort to any place where they are likely to find a good choice of workers with the special skill which they require; while men seeking employment naturally go places where there are many employers who need such skill as theirs and where therefore it is likely to find a good market" (Marshall, 1920, page 270; first published 1890).

Marshall also pointed out that, especially when the infrastructure (and thus commuting possibilities) were badly developed, risk considerations would naturally attract workers to clusters of similar firms thereby creating an "obstacle to the success of any business in which special skills are needed, but which is not in the neighbourhood of others like it".

Thus, it can be argued that local labour markets function better, from the point of view both of firms and of employees, if there are several similar and related firms around (compare Krugman, 1991a). *Well-functioning markets for specialized skills* can thus be added to the list of localization economies.

Third, firms in agglomerations can reduce their costs as interfirm transactions and shipments are simplified when the distance between firms is negligible. The customer firm which can place an order with a supplier located down the street will gain an

advantage in relation to a competitor which has to travel long distances to discuss a deal with its supplier. *Reduced interaction costs for collocated trading partners* may be a shorthand for this mechanism (Scott, 1983), with is described by Porter (1998) in the following way:

“the proximity of companies and institutions in one location—and the repeated exchanges among them—fosters better coordination and trust. Thus clusters mitigate the problems inherent in arm’s-length relationships without imposing the inflexibilities of vertical integration or the management challenges of creating and maintaining formal linkages such as networks, alliances, and partnerships” (page 80).

A more recent approach: knowledge spillovers

Towards the recent turn of the century, a different kind of account came to occupy centre stage in the discourse of the cluster, occasioning a number of new research propositions. Here, a fourth major factor is introduced: localized clusters of similar and related firms form the basis of a local milieu that may facilitate *knowledge spillovers* and stimulate various forms of adaptation, learning, and innovation. This is the aspect of spatial clustering that has attracted the bulk of research interest during the 1990s (Porter, 1990; Malmberg et al, 1996; Maskell et al, 1998; Maskell and Malmberg, 1999a; 1999b). The insight that proximity between related firms leads to the development of relations that in different ways may stimulate various exchanges of information and knowledge is, however, far from new: it can be found in Marshall (1890) and in a number of subsequent studies and occasionally also in economic geography. Estall and Buchanan thus emphasize that:

“a close relationship, almost a partnership, grows up among related firms in a given geographical area. The ability, for example, of members of the group to *meet without inconvenience* to discuss common problems and matters of mutual interest is a not inconsiderable advantage of close geographical association” (1961, page 109, emphasis added).

The general argument is that a local industrial structure with many firms competing in the same industry or collaborating across related industries tends to trigger processes which create not only dynamism and flexibility in general, but also learning and innovation. In such an environment, chances are greater that an individual firm will get in touch with actors that have developed or been early adopters of new technology. The flow of industry-related information and knowledge is generally more abundant, to the advantage of all firms involved. A local culture with specific norms, values, and institutions (formal and informal) makes it possible to transfer tacit forms of knowledge from one actor to another.

Precisely when it comes to the impact of spatial clustering on the learning and innovation ability of firms, economic geography has in recent years in a very fruitful way begun to interact with other economic and social science disciplines studying firm competitiveness, learning, and innovation. Analyses of how different nations exhibit distinct innovation systems (Lundvall, 1992) have been adopted by geographers who have tried to show that, within individual countries, there exist regional innovation systems built around agglomerations of related firms, industries, and institutions (Florida, 1995; Cooke, 1998; Morgan, 1997).

Porter’s model of how long-term national industrial competitiveness is created has been used in a similar way. Porter (1990) argues that the characteristics of a local milieu which determine the innovative ability of firms are captured by four interrelated driving forces: factor conditions; demand conditions; related and supporting industries; and firms’ structure, strategy, and rivalry. Porter’s model was originally

developed in an attempt to analyze national differences in industrial competitiveness, but it has subsequently been used as a model for explaining the innovative power of localized clusters (Porter, 1990; 1994; 1998; Malmberg et al, 1996; Enright, 1998; Larsson, 1998).

In the context of research on, for example, innovative milieux, industrial districts, innovation systems, or the economics of proximity, something of 'a modern approach' to the analysis of spatial clustering has gradually proliferated. This is not to deny that in several important respects, the GREMI approach to innovative milieux (Maillat, 1998; Camagni, 1995; Ratti et al, 1997), is different from, for instance, Marshallian analyses of the Italian industrial districts (Brusco, 1982; Bellandi, 1989; 1996; Becattini, 1990; Dei Ottati, 1994; Gottardi, 1996), the French 'proximité' tradition (Blanc and Sierra, 1999; Kirat and Lung, 1999), or econometric cluster analyses (Swann et al, 1998), just as they do not conform to the 'systemic' analysis of innovations whether national (Lundvall, 1992) or regional (Markusen et al, 1986; Saxenian, 1994), nor to the managerial approach applied by Porter (1990).

Allowing ourselves a certain amount of simplification, however, we argue that these different schools of thought have a shared point of departure in seeing the long-term competitiveness of a firm as determined by its ability to innovate and engage in processes of continuous learning. Cultural, institutional, and infrastructural factors in the local milieu affect the general climate within which firms develop. Spatial proximity between actors does in various ways make easier those knowledge spillovers and interactions which form the basis for innovation and learning, and it is in this context that spatial clustering becomes a key focus of analysis. Most, if not all, of these approaches, have knowledge spillovers as a major research focus. Still, we would argue, to the extent that the individual studies within these divergent approaches contain a specific theoretical account of the cluster it is, again, based on reductions in *the costs of interaction*.

The cluster exists, it is implied, because the collocation of firms cuts the expenses of identifying, accessing, and transferring knowledge. Some studies have emphasized how firms will cut the costs of interacting if located in a cluster characterized by trust and other features of social capital (Maskell, 2000) that help reduce malfeasance, induce reliable information to be volunteered, cause agreements to be honoured, enable employees to share tacit information, and place negotiators on the same wavelength. Other studies have, however, noted how collocation might create advantages of knowledge spillovers even if trust levels are insignificant, as, for instance, in Silicon Valley where "nobody knows anybody else's mother", and where no deep history or complex family ties exist (Cohen and Fields, 1999, page 2).

Yet, studies across the different approaches have run into difficulties when attempting to identify empirically and specify theoretically the localization economies that should account for the existence of the cluster. Without being unfair, we believe, one can argue that they do not contain any theory specifying how the territorial configuration of many colocalized firms in related industries would be able to create knowledge in ways not equally available, for example, to a single but larger firm, or to well-functioning (trust-based) networks of interacting firms, each placed at a different location. A common practice is to reverse the chain of causality. Analyses of innovative clusters, for instance, seldom start, as one would expect, by identifying how knowledge is shared and technology transferred in a way that enhances the competitiveness of firms, followed by showing how the cluster emerged as a *consequence* of these benefits. Instead, the existing performance of firms already located in the cluster is assumed to be shaped by hypothetical local spillovers. In much of the literature there is, thus, an obvious risk of ending up with models

of circular causation: when the cluster-generating economic mechanisms cannot be observed, their existence is 'proven' with reference to the actual existence of the cluster (compare Krugman, 1995).

Shortcomings and challenges in existing research on spatial clustering

Another major problem is empirical validation. There is an obvious lack of systematic attempts to assess empirically the precise mechanisms behind and the magnitude of localization economies (compare Sabel 1989, Malmberg, 1997; Larsson 1998; Markusen, 1999). Whereas economic geographers and others have devoted considerable efforts in documenting the existence of spatial clustering and to assess the level of interfirm transactions in such settings, not many—and with few exceptions also less successful—attempts have been made in terms of showing differences in firm performance between those located inside and outside localized clusters (Appold, 1995; Swann et al, 1998).

There are different explanations for this situation. First, this is after all a relatively new, or at least relatively newly rediscovered, line of research. A second explanation is presumably that rigorous empirical testing presupposes a certain amount of simplification (some would say 'vulgarization') of a relatively complex theoretical argument, something that in itself is regarded as dubious by many.

Several problems can be identified in this context. First, most empirical information on industry agglomeration is based on case-study material. This problem is aggravated by the fact that the selection of cases seems to be quite biased, with an analytical emphasis on high-tech industries and regional success stories (Wiig and Wood, 1995). In contrast, there is a lack of systematic empirical work on what Lundquist and Olander (1998) refer to as the 'grey mass' of more mundane, not so spectacular firms, industries, and regions. A second problem is that many analyses are marked by a static research design. They portray interfirm relations and patterns of interaction at one point in time, which means that every so often attempts are made to draw conclusions about dynamic processes on the basis of cross-sectional data (Staber, 1997). The most serious problem, however, is that existing empirical results often do not give clear-cut support for the theoretical argument: localization economies indeed remain elusive.

There are at least three sets of empirical questions that seems to be of crucial importance here: How common is spatial clustering across industries and nations? In what way and at what magnitude do firms in localized clusters interact? Which characteristics of a local milieu are particularly important for the competitiveness of firms, and are firms in localized clusters more competitive than other firms? Below, some examples will be given of relatively recent attempts to answer these questions.

How common is the agglomeration phenomenon?

Much of our knowledge on industry agglomeration is anecdotal in the sense that it builds on more or less detailed accounts of individual regions or particular industries. Not least there is an abundance of analyses of what has been referred to as 'the holy trinity' of economic geography—Silicon Valley, the Third Italy, and Baden-Württemberg—three regional success stories which during the late 1980s and early 1990s came to be regarded as archetypal or 'paradigmatic' in various respects. Even though the list of examples has been extended well beyond those three regions (see Porter, 1998), the fact that so much research on the agglomeration phenomenon is based on 'stories rather than statistics' has been a source of criticism (Head et al, 1995).

There are, however, studies which, based on aggregate industrial statistics are showing high, and rising, levels of agglomeration across a broad range of industries. Krugman (1991a) analyzes the distribution of 106 industries across US federal states and finds that many industries are indeed strongly agglomerated at this level. Enright (1993) presents a statistical analysis of the forces making this pattern (see also Ellison and Glaeser, 1994). Malmberg and Maskell (1997) show that a majority of industries (ISIC four-digit level) in four Nordic countries (Sweden, Finland, Norway, and Denmark) have become more agglomerated over a twenty-year period, despite the fact that manufacturing industry taken as a whole has become more dispersed over the same period. By defining a regional industry agglomeration as a local labour-market area where the location quotient is larger than 3 (that is, there are three times more jobs in a particular industry than there would have been if the region had had a proportional share of national employment in the sector), Isaksen (1996) identifies 143 agglomerations in Norway and these agglomerations account for a fifth of national employment in total manufacturing industry. Head et al (1995) study the location decisions of 751 Japanese plants in the USA since 1980 and find that agglomeration economies at the level of the industries play a major role in explaining the location pattern. All in all, there is support for maintaining the thesis that spatial clusters at the industry level is a widespread enough phenomenon to justify further study.

Proximity matters, but to what degree is interfirm innovation local?

Localization economies are, as has already been stated, usually seen to arise because firms taking part in local interexchange will benefit from lower costs. Presence in an agglomeration is held to improve the profitability of firms by reducing their costs of exchange of goods, services, and information (Appold, 1995). According to Scott (1983; 1988) the economies of agglomeration are particularly manifest when linkages between firms tend to be small-scale, varying, and unpredictable, and thus where the interaction costs rise rapidly with increasing distance. In other words, the greater the product and production flexibility, the more important are the localization economies.

This emphasis on the efficiency and intensity of local transaction is paradoxical, given that extensive local transactions have simply not been found in the empirical analyses that have tried to measure this. Thus, most firms have very limited buyer–supplier relations with other firms in their region, even in cases where there are many related firms in the same region (McCann, 1995). Larsson and Lundmark (1991) analyze patterns of interaction between firms in the Kista area in northern Stockholm, and find that firms in this telecommunications and information technology cluster report few business transactions with other firms in the area. Angel and Engstrom's (1995) analysis of the US personal computer industry finds no support for the proposition that computer producers and their suppliers increasingly agglomerate in the same places. Larsson (1998) shows, on the basis of a survey of more than 300 Swedish machinery producers, that the local market (defined as a 100-km radius) is of marginal importance for the sales and purchases of these firms.

How important is the local milieu for the innovative ability and overall competitiveness of firms?

As we have already noted, the 1990s has required a reorientation in the study of spatial clustering, such that the previously dominant focus of interfirm transactions has generally given way to an increased emphasis on knowledge spillovers and localized interactions leading to processes of learning and innovation [see Storper (1995) or Malmberg (1997) for more elaborate views, and Hudson (1999) for a

critique of this ‘learning turn’]. To a degree, this turn can be interpreted as a reaction to the failure to capture in empirical analyses the local transactions previously held to explain agglomeration phenomena. When empirical research showed that firms in a localized cluster did not conduct much business together (or in Storper’s terminology: when the traded interdependencies between firms in agglomeration proved to be of modest magnitude), an alternative which was close to hand was to look for other types of (untraded) interdependencies. For various reasons, knowledge spillovers stood out as a promising hypothesis.

It has not, however, been easy to document, in empirical analyses, the existence of localized learning patterns beyond the level of case studies of individual regions. Thus, Harrison et al (1996), who collected data on a large number of firms in the US metal industry, found insignificant support for the existence of localization economies in the spatial pattern of innovation and industrial competitiveness. Larsson’s (1998) study of Swedish producers of machinery, showed that these firms did indeed report rather strong localization in the field of technological relations (as compared with the very much globalized flows of supplies and finished goods), but the correlation between localized technology relations and innovative ability, turned out to contradict the arguments put forward in agglomeration theory (Larsson, 1998; Larsson and Malmberg, 1999). Contrary to what was expected, it was the firms that reported the most spatially extended patterns of technological collaboration which seemed the most innovative. Malmberg et al (2000) showed that the presence of other exporting firms in the same industry in the local milieu had an almost negligible effect on the export performance of Swedish exporting manufacturing firms. Internal economies of scale (that is, the size of the export firm) and urbanization economies (that is, the presence of other firms—regardless of industry—in the local milieu) had a much larger effect.

Lundquist’s (1996) study of how the local milieu affects the international competitiveness of Swedish firms does not in a direct way try to test the impact of localization economies, but what it does show is that firms’ dependence on their local milieu varies considerably, even for highly competitive firms. Fuellhart (1999) shows that firms in the carpet industry, a highly clustered industry in the USA, report little use and availability of common sources of information compared with firms in other industries and regions. Staber (1996), found no support for the proposition that interfirm relations are embedded in the social structure of the local milieu or that firms in any important sense utilize local institutional arrangements which can support collaboration and innovation. Given that this study is made in one of the regions of ‘the holy trinity’, the conclusion is noteworthy: “it seems impossible to claim that Baden-Württemberg represents an example of an industrial district” (page 313). Herrigel (1996), who also studies Baden-Württemberg, argues that the industrial crisis of the region in the 1990s had to do with rigidities in the German productive system which can be traced back to the very same institutional arrangements which were previously regarded as the main source of competitiveness of the firms of the region. Taken together, these results put distinct question marks over several recent theoretical propositions advanced in the literature on spatial clustering.

Later, in the concluding section of the paper, we will return to some methodological problems that might cause this predicament in empirical research on spatial clustering. We believe, however, that the causes are not just related to problems of appropriate research designs and sufficiently good data. The revealed lack of empirical evidence is also related to some conceptual problems, to which we turn in the following section.

A knowledge-based approach to the theory of spatial clustering

As we see it, a satisfactory theory of spatial clustering must be able to perform several functions.⁽³⁾ It must include an explanation for *the existence of the cluster*. This means that it must specify the process or processes that impel similar and related firms to cluster at one place and by doing so thrive. More specifically, the theory must provide an explanation for the advantages that *many* related firms might accrue when colocated but which are not available to a hypothetical *single* firm carrying out precisely the same activities, even at the same location, using the same suppliers, customers, and workforce. Furthermore, a theory of the cluster should address *the internal organization of the cluster*. This implies that it should provide a framework for understanding the division of labour taking place between and among firms within the cluster. The theory must, finally, be dynamic in the sense that it can encompass the possibility of and reasons for the decline of formerly successful clusters.

The existence of the cluster: the advantage of being in the same place

A main shortcoming in existing accounts of spatial agglomeration seems to be a superficial understanding of the nature of the explanatory problem. In particular it is not always realized that, although colocation might help diminish the costs of interaction, a superior way to reduce such costs would presumably consist of joining the different activities and placing them under one common ownership, thus eliminating most costs of interaction. No theory explaining the existence of the cluster can, therefore, be based on (interaction) cost reductions alone. In consequence, a new point of departure must involve rephrasing the basic research question.

Most analyses aim to transcend the traditional way of grouping firms into industries, by introducing the *vertical dimension* of the cluster, where division of labour and complementarity are the most important dimensions of relatedness. Firms specializing in different stages of a production process carried out along the vertical dimension of the cluster require some kind of coordination, as the output of one firm may be the input of another. The vertical dimension of the cluster thus consists of firms linked through input–output relations while possessing knowledge, experience, and skills useful for undertaking dissimilar but complementary activities. As we have seen, this type of transactional link makes up the core of much analysis of localization economies despite the fact that few empirical studies have been able to show that such linkages are indeed predominantly local.

On the other hand, most well-known examples of industry agglomerations are obviously based on the *horizontal dimension* of the cluster, because they are made up of several firms operating in the same industry. Industries are normally defined on the basis of similarity in the final output: that is, firms producing the same type of goods or services are defined as belonging to the same industry. Firms producing similar output—in principle—compete on the same market. Whereas the firms in the vertical dimension of the cluster are business partners and collaborators, the horizontal dimension consists mainly of rivals and competitors. The dynamic effects of local competition are, however, relatively neglected in most theoretical accounts of agglomeration, with Porter's (1990) concept of domestic rivalry a notable exception.

However, Marshall (1890) long ago drew attention to the possible advantages of *variation* that are caused by the localized and parallel performance of similar tasks carried out by independent firms. In order to remain manageable some kind of shared vision and coherence are required within any single (multidivisional) firm that will

⁽³⁾ The line of thinking presented in this section was originally developed by Maskell (2001a).

seriously limit the magnitude and breadth of simultaneous experimentation that may take place at any one time. No such restriction exists for a number of independent firms doing similar things in the cluster; the process of parallel experimentation and testing of a variety of approaches is fuelled by the differences between independent firms (that is, their owners, managers, and employees) in terms of perceptive powers, insights, attitudes, and assessments of the information at hand.

Colocated firms undertaking similar activities find themselves in a situation where every difference in the solutions chosen, however small, can be observed and compared. First, with regard to *observability*, spatial proximity brings with it the special feature of spontaneous automatic observation. Just as people in a residential area simply cannot help noticing what their next-door neighbours do (regrettably, many would say), business firms often have remarkably good knowledge of the undertakings of nearby firms even if they do not make any dedicated efforts at systematic monitoring. If those neighbouring firms are in a similar business, it is more likely that the observing firm will understand, and learn from, what it observes.

The second element is *comparability*. While it might be easy for firms to blame an inadequate local factor market when confronted with the superior performance of competitors located far away, it is less easy when the premium producer lies down the street. The sharing of common conditions, opportunities, and threats make the strengths and weaknesses of each individual firm apparent to the management, the owners, the employees, and everyone else who cares to take an interest. Each firm in the horizontal dimension of the cluster is provided with information about the possibilities to improve and the incentives to do so. This is also the essence of the domestic/local rivalry component of Porter's diamond model (Porter, 1990).

Successful experiments can easily be distinguished from the less successful by knowledgeable local observers. Promising avenues identified by one firm will soon be available to others. Firms with similar capabilities in the horizontal dimension of the cluster constantly imitate the proven or foreseeable success of others while adding some ideas of their own. If the firms of the cluster were to be spread throughout a large city among many unrelated businesses their ability to learn from each other's mistakes and successes would be severely restricted.

It might be worthwhile to emphasize an essentially Darwinian feature of variation: it does not presuppose any trust whatsoever among the firms as a prerequisite for learning. It does not require any close contact or even an arm's-length interaction between the firms. This might partly explain the disappointing results of many empirical studies trying to document the abundance of interfirm collaboration in localized clusters.

Whereas suppliers and customers in a vertically organized production chain *need* to interact with each other in order to do business, competitors do not. Most *manifest* relations in the cluster will therefore be along the vertical dimension, and this creates inherent difficulties for any empirical investigation of the horizontal benefits of clustering when relying on what is easily observable.

The proposition put forward here simply suggests that the cluster exists because of localization economies *that are independent of the degree of internal interaction at least in principle*. The only requirement is that *many firms undertaking similar activities* are placed in circumstances where they can monitor each other constantly, closely, and almost without effort or cost. Variation emanates naturally when firms possessing somewhat similar bodies of knowledge must act on incomplete and uncertain information. Colocation helps firms identify and imitate superior solutions while combining them with ideas of their own.

The cluster exists, we thus propose, primarily because of the benefits of enhanced knowledge creation that occur when many colocated firms undertake similar activities. These benefits are enhanced by the ease of interaction across different bodies of knowledge when the same local circumstances are shared. We shall now turn our attention to the important, but secondary, types of knowledge creation stemming from the vertical dimension of the cluster, once its existence has been secured.

The internal differentiation of the cluster

Specialized suppliers and sophisticated customers become attracted to the cluster, once established, by the particular opportunities available. The vertical dimension of the cluster might, however, also be developed by task partitioning as firms become more specialized. Very specialized firms often find solutions and notice peculiarities otherwise overlooked, even when specializing in performing some particularly trivial tasks. The perception of minor anomalies, previously unnoticed, leads in turn to new insights and ways of improvement and, as a result, to a general acceleration of the growth of knowledge.

By creating an appropriate vertical differentiation, the cluster can therefore develop knowledge far beyond the reach of any of its members. With the internal growth of knowledge, new economic activities become possible, the economy of the cluster progresses, and the resulting extension of the internal market makes the process self-reinforcing (Young, 1928).

It follows from the concept of variation dealt with above that, if all firms specialize so much that they all become part of the vertical dimension, then the specific learning through variation and monitoring must necessarily cease. Only by a steady increase in the number of firms in the cluster would it be possible to create knowledge simultaneously by variation and by the division of labour, and this restriction should be kept in mind when studying empirically the internal structure and the growth of the clusters.

The benefits and returns of the division of labour must also be balanced against the obstacles and costs of reassembling and coordinating separate bodies of knowledge (Loasby, 1999). Dispersed knowledge must be reassembled in order to be useful. Interfirm learning⁽⁴⁾ is subject both to thresholds, before the knowledge bases of divided firms have grown sufficiently apart for interaction to imply learning, and to ceilings, after which the cognitive distance becomes too great for firms to bridge, and where learning will cease. Even when situated between the two extremes it can be very difficult, and sometimes even impossible, to transfer and reuse knowledge even if it is openly available, but it is often less difficult when the transfer takes place within a community that shares the same language, beliefs, judgments, and values. When firms collocate, a spatially defined community is usually formed that makes it easier for them to bridge communication gaps resulting from heterogeneous knowledge endowments. The innovative capabilities of firms are enhanced because collocation can provide them with an arsenal of instruments to obtain and understand even the most subtle, elusive, and complex information of possible relevance developed because they were *separate firms* pursuing their individual agendas. Hence, the process of clustering tilts the balance between advantages of specialization and costs of coordination so that a higher level of knowledge creation can be obtained. The ability to decode and utilize knowledge residing elsewhere is not a phenomenon to be captured by input–output analyses of trade flows or accounts of business contact patterns.

⁽⁴⁾ The product innovation literature has firmly established that firms learn from each other when interacting. See, for instance, Rosenberg (1972), Freeman (1982; 1991), Kline and Rosenberg (1986), Håkansson (1987), Hagedoorn and Schakenraad (1992), OECD (1992), DeBresson (1989).

Clusters and the wider local milieu: the institutional fit

The learning processes identified so far are rooted in the day-to-day operations of the firms in the cluster, but influenced by institutions such as social capital. It is reasonable to assume that the cluster's particular set of institutions has emerged as a response to the special requirements of the activities performed by the firms making up the cluster, as recent research has shown the existence of such a correlation at the national level between patterns of specialization in production and trade, on the one hand, and the knowledge base on the other (Archibugi and Pianta, 1992).

Once a dominating institutional pattern has been established it will attract those firms most compatible with it. A favourable institutional pattern will also attract entrepreneurs with ambitions to set up firms in the particular industry. This is also why many of the most talented 'wannabes' within the film industry tend to end up in Hollywood and many of world's best specialists in information and communication technology are attracted to Silicon Valley.

There is thus a fundamental *interdependence* between the economic structure and the institutions of the cluster. Just as the set of firms undertaking similar and complementary activities differ among clusters, so do institutions. It is the particular set of activities in the localized cluster that affects what is done within and among the firms and therefore *what is learnt*, but the institutions in the cluster define how things are done and consequently *how learning takes place* (Lundvall and Maskell, 2000). Different modes of learning create different outcomes which might be more or less suited to the challenges and opportunities presented by the world outside the cluster.

Precisely because the institutions developed within the cluster become specific, they will differ from one cluster to the next (Maskell and Törnqvist, 1999). The very mechanisms that reduce cognitive distance *within* the cluster tend to increase the cognitive distance *between* clusters. This is not to be avoided nor regretted, because the cluster-specific institutions are often a major prerequisite for making the firms of the cluster attractive for outsiders to interact with.

However, there is a downside that becomes apparent when a successful fit creates routines of extraordinary durability: they are retained and sometimes even aggressively defended long after changes within or outside the cluster have made them redundant (Demsetz, 1988). It is difficult to *unlearn* successful habits of the past, even in cases where it is obvious to everyone concerned that they hinder future knowledge creation and success (Hedberg, 1981; Imai et al, 1986).

In the cluster, as elsewhere in the economy, an inability to unlearn might go hand in hand with an increasing resistance towards new ideas, a growing bureaucratic inertia, and a general organizational degeneration, especially when the firms are operating in generous markets (Eliasson, 1996). The experience of success results in a flatter forgetting curve, and accepted best practices assume a life of their own (Hamel and Prahalad, 1994). It is an established fact of life that it is a lot easier to challenge the orthodoxy of others compared with one's own, and firms—sometimes the whole cluster—are sometimes led by their former success into trajectory-specific lock-ins (David, 1985; Arthur, 1989). Or in the words of Boisot:

“experiences work their way into the collective memory and expectations of a culture and remain embodied in institutional arrangements long after they have ceased to serve. They may then obstruct rather than assist the process of social adoption much as early childhood traumas become the source of phobias and pathologies in later adult life” (Boisot et al, 1983, page 160).

Institutions are linked to social history and they might be slow to adapt to the change in the related industries of the cluster. Therefore no one-to-one correlation between industrial structure and institutional endowment should automatically be expected,

and empirical studies continuously add to our understanding of why a complete match is seldom found and how different degrees of mismatches affect the performance of the cluster. As we see it, the ‘institutional fit’ is not in itself part of the explanation of the existence of the cluster. Rather, it contributes to the explanation of the successful path-dependent development trajectories of clusters—and to the lock-in situations in which clusters sometimes end up.

The main elements of the theory presented here are summarized in table 1. The different mechanisms suggested as playing a role in the different dimensions of the localized cluster may show up in different ways in empirical assessments, and their relative impacts may vary over time. One would perhaps expect that variation, observation, and comparison would be key features in the early development of cluster, while specialization and interaction—alongside institutional adjustment—would play an increasingly important role as time goes by.

Table 1. Cluster dimensions and learning dynamics.

Dimensions	Dynamics		
	capabilities of local firms	institutional precondition	knowledge-enhancing mechanism
Horizontal	similar	cognitive proximity	variation observation comparison selection rivalry
Certical	complementary	trust (social capital)	specialization interaction exchange coordination collaboration

Conclusion: where do we go from here?

The research problem attached to the agglomeration phenomenon may seem trivial. We have a phenomenon that can be observed in reality. Firms in the same or related industries often—although far from always—tend to locate in the same place, and this should reasonably indicate that there should be some advantages connected to such a location pattern: localized clusters do exist and this may legitimately make us assume that such a spatial structure is in some sense efficient or rational. This point of departure is common to many scholars, not only in economic geography but also in economics and business studies:

“A cluster of independent and informally linked companies and institutions represents a robust organizational form that offers advantages in efficiency, effectiveness, and flexibility” (Porter, 1998, page 80).

At the same time, it has turned out to be extremely difficult to identify empirically the mechanisms that are supposed to account for its existence.

One problem relates to the issue of spatial scale. The notions of *local* and *regional*, which are often central in analyses of spatial clustering, are extremely elastic. First, the two notions are often used more or less synonymously in the literature. Furthermore, they may denote a number of geographical scales, extending from the local neighbourhood (a street or block in a city, or a small town) through to entire nations or even groups of nations. Similar mechanisms or forces are held

to explain both why advertising agencies flock together in a particular street (Madison Avenue) in New York, and why the 'European banana' developed as a core area of heavy industrialization during the 19th century, an area which extended across several countries in the heartland of what is now the European Union. It does not, however, seem possible to define, once and for all, a specific geographical scale at which one could argue that spatial cluster economies exert a particularly strong influence. Rather, it seems reasonable to allow the scale to vary according to what type of phenomenon is emphasized in the analysis.

Thus, if we focus primarily on the role of formal institutions (such as the legal system) or cultural and linguistic aspects, the nation-state may often work as a good proxy for 'the local milieu'. To the degree that the agglomeration economies work in a dichotomous way, such that they render advantages in the exchange between insiders in a milieu ('us') and in a corresponding way complicate the exchange (of goods, services, and/or information) with outsiders ('them'), nation-states are often the relevant scale. If, however, we primarily focus on business transactions between related firms, the geographical scale will be more of a continuum. In principle, one may assume that the costs of interaction will generally increase with increasing distance so that the agglomeration economies are maximally forceful in the case of the immediate juxtaposition of two trading partners, but will gradually decrease as distance grows. When, on the other hand, the primary focus of the analysis is the mundane, everyday, often informal, exchange of information and ideas, associated with frequent face-to-face contacts and more or less unplanned meetings which are seen to push forward the creation of new ideas and innovation, the relevant spatial resolution will turn out to be a fine one. Normally, we will then focus on small places or on limited parts of larger functional regions (urban neighbourhoods, city blocks).

At present it does not seem reasonable to attach the use of the concept of localization economies to one particular spatial scale, even though the theoretical approach proposed in this paper would tilt our focus towards the smaller scale. Nevertheless, the conceptual elasticity indicated above, and the fact that individual theoretical accounts often lack explicit discussion of the issue of spatial scale and the interaction between various levels, are somewhat troublesome.

Another, and perhaps more significant issue is the problems of *measurability*. Although it is relatively uncomplicated to assess empirically to what degree firms in a particular industry are agglomerated, it is much more difficult to investigate the degree of agglomeration across groups of firms which are related along some other dimension (through business transaction, shared technology, etc). As soon as one leaves the industry classification of official industrial statistics, the possibility of using existing data diminishes rapidly:

"Clusters rarely conform to standard industrial classification systems, which fail to capture many important actors and relationships in competition. Thus significant clusters may be obscured or even go unrecognized" (Porter, 1998, page 79).⁽⁵⁾

⁽⁵⁾ It should be noted that in reality, even to assess what is an agglomerated location pattern in a properly defined group of firms (for example, belonging to an industry according to standard classifications like ISIC) is not that simple. Florence (1948) was among the first to emphasize how agglomerations may be produced by pure chance. Ellison and Glaeser (1994) illustrate this point by showing that one only needs to throw six darts at a map of the USA before it is likely that two will hit the same state. Thus, when concluding that a certain spatial distribution, according to some statistical measure, indicates that we are faced with agglomeration, we should be sure that we are actually observing 'more than random' agglomeration.

It is also comparatively easier to map patterns of interfirm linkages in terms of flows of commodities or money between firms, than it is to capture flows of information and knowledge resulting from effortless observation of neighbouring firms (Törnqvist, 1970; Metcalfe, 1988; Jaffe et al, 1993). Finally, when it comes to the institutional, social, and cultural milieux, some characteristics are indeed possible to map [see Putnam (1993) for an interesting if controversial attempt to measure the degree of 'civicness' in Italian regions], but it is evidently extremely difficult to study in a way that allows for systematic comparison across regions, phenomena which are stated to be 'in the air', the phrase Marshall (1890) used.

Furthermore, there is an urgent need to increase our knowledge of some other possible trade-offs that are often, explicitly or implicitly, advanced in existing accounts. Thus, it seems obvious that firms need a supporting structure of trustful and collaborative actors in order to perform well. At the same time, however, there is a need for competition and rivalry to drive the innovation process, defined in a broad sense. In most existing accounts of the spatial clustering phenomenon, the collaborative element is emphasized at the expense of rivalry. In the present paper a different approach is suggested, emphasizing the possible learning effects along the horizontal dimension of the cluster.

We suspect that the reason for the relatively meagre results coming out of studies attempting to study empirically the magnitude and intensity of local interfirm collaboration may be that it is on the horizontal dimension of interfirm observation, comparison, and rivalry that the effects of agglomeration are most important. Thus, a 'nice' and collaborative atmosphere might not at all characterize most relations between firms in a spatial agglomeration. Firms may dislike each other and refuse to talk but can still, indirectly, contribute to each other's competitive success in the global market. To the degree that this is the case, there are reasons to be cautious about some of the policy initiatives which, with theoretical inspiration from some of the literature discussed here, are exclusively geared towards promoting the establishment of local networking and interfirm collaboration (compare Maskell, 2001b).

At the start of the paper we argued that research on spatial clustering is at the core of economic geography, highlighting as it does the impact of proximity and distance, institutions, and local milieux on economic processes. We have subsequently argued that a theory of spatial clustering should play down the role of cost efficiencies in favour of focusing on the way clustering enhances knowledge creation. In that context we have argued that spatial clustering induces variation, observability, and comparability, while at the same time allowing increased differentiation without discouraging knowledge exchange by imposing too large a cognitive distance. We suggest that, rather than using the costs induced by 'friction of distance' as the starting point, the spatial attributes of interactive learning and innovation processes would perhaps be a fruitful point of departure not only when analyzing spatial agglomerations, but also when it comes to reinigorating research in economic geography generally.

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