Entrepreneurship and Development: The Role of Clusters

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ABSTRACT. Defining entrepreneurship as the creation of new organisations, this paper explores, from a literature review standpoint, the moderating effect of clusters on the impact of entrepreneurship on development. To identify potential causes of this moderating effect, the paper focuses on three different impacts: entrepreneurship on development, clusters on development, and clusters on entrepreneurship. The findings of the paper are threefold. First, entrepreneurship is positively associated with economic growth. Given the importance of entrepreneurship in changing the economic and social structure of the economy, more research on the impact of entrepreneurship on development – i.e. focus on capabilities rather than on output – is needed. Second, it is difficult to reach empirical generalisations on the impact of clusters on development and entrepreneurship given conceptual and methodological constraints. Both positive results and caveats are found at different levels of analysis and at different stages of development of a cluster. Finally, given the previous finding, it is difficult to generalise on the impact of clusters on the association between entrepreneurship and development. Consensus on and validity between conceptual and operational definitions of clusters; consideration of context as well as process and, therefore, quantitative and qualitative methods; and differentiation between levels of analysis controlling for cluster stage and strength are the main criteria for future studies to consider to disentangle the impact of clusters on entrepreneurship, development and the association between entrepreneurship and development.

1. Introduction

Does clustered entrepreneurial activity contribute to development more than non-clustered? Defining entrepreneurship as "the creation of new organisations" (Gartner, 1989, p. 62) and cluster as a geographically proximate group of firms and associated institutions in related industries, linked by economic and social interdependences (adapted from Porter, 1998), this *research question* arises for several *reasons*.[1] *Firstly*, it targets one of the most important challenges and contributions of the entrepreneurship field, i.e. the role of new enterprises in furthering economic progress (Low and MacMillan, 1988). *Secondly*, both clusters and entrepreneurship face high visibility among academics and policymakers, given their common historical resurgence and potential to retain and increase employment after the drastic changes in the economic, institutional, and technological environments since the 1970s (Birch, 1981; OECD, 1996a, 1999, 2000, 2001; Arzeni and Pellegrin, 1997; Porter, 1998; Bergman and Feser, 1999; Reynolds et al., 2001). In effect, the intrinsic rigidity of the independent large firm-based system was incompatible with the fast pace of change in the environment resulting in an increase of unemployment. Consequently, a shift of emphasis from mass to flexible production, from independent firm-based to regional network-based system, and from established firms to new firms emerged as part of the solution (Piore and Sabel, 1984; Saxenian, 1994; Nohria, 1992, 1996; Castells, 2000). *Finally*, from a public policy standpoint, several authors highlight the importance of the entrepreneurial climate in fostering economic development through the creation of new companies (Malecki, 1994; Reynolds et al., 2001). Given the spatial variations of entrepreneurial activity across regions (Reynolds et al., 1994), it is worth studying how clusters, a special regional context, moderate the relationship between entrepreneurship and development.

Although all of these reasons invite to analyse the moderating effect of clusters on the relationship between entrepreneurship and development, there are no studies on this cluster moderating

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effect. Researchers have studied specific kinds of clusters, such as industrial districts (Visser, 1999; Fabiani et al., 2000) and scientific parks (Westhead and Storey, 1994), using as unit of analysis established small and medium sized companies (focus on size) rather than entrepreneurship (focus on new firms). Those studying founding and failure rates (Hannan and Freeman, 1989; Baum and Mezias, 1992; Lomi, 2000; Sorenson and Audia, 2000) have focused on only one industry and one dimension of clusters – i.e. agglomeration of economic activity, without analysing societal level outcomes of the entrepreneurial activity.

Given this research need, the main thrust of this paper is to explore, from a literature review standpoint, whether clustered entrepreneurial activity generates more development than non-clustered. However, any answer to this question will depend on how development, entrepreneurship, and clusters are defined and measured. Also, in order to identify the potential causes of the moderating effect of clusters on the relationship between entrepreneurship and development, it is necessary to isolate three different impacts: entrepreneurship on development, clusters on development, and clusters on entrepreneurship. Therefore, the aim of this paper is threefold: to review the conceptual and operational definitions of entrepreneurship, clusters and development; to review the literature on the impact of entrepreneurship on development as well as that on the impact of clusters on development and entrepreneurship; and to put forward suggestions for future research. These aims set the scope of the paper (Figure 1).

The focus is to analyse whether entrepreneurial activity develops its potential contribution to development better inside clusters rather than outside them (discontinuous line in Figure 1). To address this research need, this paper analyses the relationships indicated with a continuous line in Figure 1. Given the focus on clusters, other interesting relationships such as the impact of development on entrepreneurship and the effect of entrepreneurship on clusters are out of the paper's scope.[2] Theories behind each concept are explained briefly and representative bibliography is given in the appropriate place. The most extensive analysis will be that devoted to clusters, on which subject there is neither consensus nor available data to accomplish cross-sectoral and longitudinal research as there is in the cases of entrepreneurship and development.

Given this focus, the paper brings together relevant literature from the development, entrepreneurship and cluster fields. The link between concepts was derived from combined keyword searches in several search engines and specialised journals. Additionally, due to the policy nature of the topic, there was a search of publications and websites of multilateral organisations. Appendix A shows the sources of information analysed during the literature review.

The *findings* of the paper are threefold. First, entrepreneurship is positively associated with economic growth. Given the importance of entrepreneurship in changing the economic and social structure of the economy, more research on the impact of entrepreneurship on development – i.e. focus on capabilities rather than on output – is

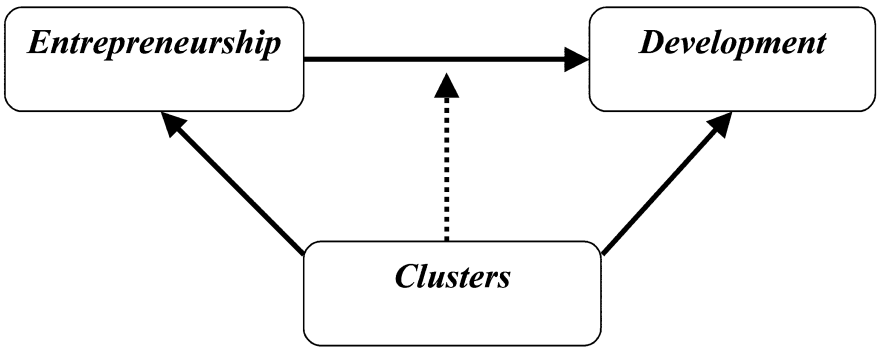


Figure 1. Research focus.

needed. Second, it is difficult to reach empirical generalisations on the impact of clusters on development and entrepreneurship given conceptual and methodological constraints. Both positive results and caveats are found at different levels of analysis and at different stages of development of a cluster. Finally, given the previous finding, it is difficult to generalise on the impact of clusters on the association between entrepreneurship and development. Consensus on and validity between conceptual and operational definitions of clusters; consideration of context as well as process and, therefore, quantitative and qualitative methods; and differentiation between levels of analysis controlling for cluster stage and strength are the main criteria for future studies to consider to disentangle the impact of clusters on entrepreneurship, development and the association between entrepreneurship and development.

This paper is organized as follows: the next section reviews the concept of development and its operational definition in the entrepreneurship field; section three and four review the concepts and measures of entrepreneurship and clusters, respectively, as well as their impact on development. Section five reviews the impact of clusters on entrepreneurship. Section six concludes.

2. Development – conceptual definition and measurement

Several books have undertaken the task of classifying and explaining the theories of development.[3] A review of the literature reveals that there is a great deal of variation in the way development is defined and measured. One reason for this is that the term "development" has strong policy implications for society as a whole. Therefore, different stakeholders with different views (economists, business leaders, labour leaders, and public officials) intervene in its conceptualisation and measurement. However, the historical evolution of the concept shows three main conceptualisations: economic growth, economic development, and development (Allen and Thomas, 2000; UNPD, 1992; Sen, 1990). Table I shows different definitions and their associated measures according to the literature.

Two main distinctions are in order. The first one is between economic growth (Table I reference 1) and economic development (Table I references 2 and 3). While economic growth is a quantitative change in the scale of the economy in terms of investment, output, consumption, and income, economic development is a qualitative change, which entails changes in the structure of the economy including innovations in institutions, behaviour, and technology (U.S. Department of Commerce, 2000). The second important distinction is between traditional economic development definitions and measures (Table I references 1 to 3) and the new view of development (Table I references 4 to 6). The traditional view understands development as the capacity of a national economy to generate and sustain an annual increase in its gross national product (GNP) and/or income per capita. This view prevailed until the 1970s and defined development as an "economic phenomenon in which rapid gains in overall and per capita GNP growth would either 'trickle down' to the masses in the form of jobs and other economic opportunities or create the necessary conditions for the wider distribution of the economic and social benefits of growth" (Todaro, 2000, p. 14). The new view of development emerged during the 1970s when many underdeveloped countries had realised their economic growth-targets during the 1960s but the levels of living of the masses of people remained unchanged. The situation worsened during the 1980s, when the distribution of the benefits of development was concentrated in the richer scale both within and across countries (PNUD, 1992; Todaro, 2000). Thus, economic development was redefined as reduction of poverty, inequality, and unemployment within the context of a growing economy.[4]

The literature uses the previous conceptualisation and measures of development at both national and regional levels. However, regional economics focuses on explaining how regional disparities, especially in unemployment rates, arise and why they persist over time. This focus has been the centre of regional policy since the 1950s and will continue to dominate discussion of regional policy issues in the future (Armstrong and Taylor, 2000, p. 3).

The literature on entrepreneurship and development takes GNP/capita and job creation as indicators by which to measure economic devel-

TABLE I
Alternative definitions of development

Reference	Term	Definition	Measurement
1 Allen and Thomas, 2000	Economic growth	"A continued increase in the size of an economy, i.e. a sustained increase in output over a period"	Variation in GDP
2 U.S. Department of Commerce, 2000: 1	Economic development	"Economic development is (. . .) about enhancing the factors of productive capacity – land, labour, capital, and technology – of a national, state or local economy"	GNP Job creation
3 Bernstein, 1983 (cited in Allen and Thomas, 2000)	Economic development	"Raising the productive capacities of societies, in terms of their technologies (more efficient tools and machines), technical cultures (knowledge of nature, research and capacity to develop improved technologies), and the physical, technical and organisational capacities and skills of those engaged in production".	Raising in the productivity of labour
4 Sen, 1990, 1997, 1999	Development	"Expansion of human freedom to live the kind of lives that people have reason to value" (Sen, 1997: 21). This freedom is achieved by the expansion of people capabilities	Literacy rate Life expectancy rate Health rate Agricultural expansion Industrial development People's political participation Real income per capita
5 United Nations Development Programme, 1992	Human development	"The purpose of development is to create an environment in which all people can expand their capabilities, and opportunities can be enlarged for both present and future generations"	Human Development Index (HDI): a weighted index that combines three indicators: life expectancy at birth, educationalattainment, and per capita income
6 UK Department of the Environment, Transport, and the Regions, 1997	Sustainable development	"Ensuring a better quality of life for everyone, now and for generations to come"	Three broad themes: – Environment (ex. local air quality) – Society (ex. road traffic accident/1000) – The economy (ex. rate of long term unemployment)

opment (Birch, 1981; Brock and Evans, 1989; OECD, 1996b; Arzeni, 1998; Reynolds and White, 1997; Reynolds, 1999; Reynolds et al., 2001). Strictly speaking, the first indicator is a measure of economic growth while the second one is an indicator more related to the new view of development given the human, social, and economic implications of getting a job. The validity of job creation as a measure of development increases if it is related to both outputs – in order to measure economic productivity – and quality jobs – in order to include the human and social dimensions of development. Quality jobs encompass not only economic (wage level, pension provision, car allowances) and social (holiday entitlements, sick pay, safety and health, working hours, security of

employment, child care) benefits but also morale and job satisfaction (OECD, 1996b). Future research can benefit from this simpler measure as opposed to the more complex ones suggested by the new view of development.[5]

3. Entrepreneurship – definition, measurement, and impact on development

3.1. *Defining and measuring entrepreneurship*

Entrepreneurship as a field of study is relatively young (Cooper et al., 1997).[6] The *definition of entrepreneurship* has evolved from a trait or supply side (who is the entrepreneur) to a context or demand side approach (the influence of firms and markets on how, where, and why new enterprises are founded) (Thornton, 1999). The literature on entrepreneurship and development defines entrepreneurship as either the creation of new economic activity (Low and MacMillan, 1988; Shane and Venkataraman, 2000), often resulting in the creation of new organisations (Schumpeter, 1934, p. 66; Gartner, 1989; Reynolds, 1999), or the pursuit of innovation (Schumpeter, 1934; for a review, see Wennekers and Thurik, 1999; Davidsson et al., 2001).

From the work of Birch (1981), entrepreneurship was measured in terms of size – i.e., small and medium sized enterprises (SMEs). Yet, if entrepreneurship is the creation of new organisations, it is not consistent to measure it in terms of existing firms. Now the focus is on the phenomenon itself given data availability not only on new firms creation (Reynolds et al., 2001) but also on the entrepreneurial process – i.e. the gestation, birth, and growth of firms[7] (Reynolds, 2000).

3.2. *Entrepreneurship and development*

The link between entrepreneurship and development has been approached mainly from an economic standpoint, theoretically as well as empirically, focussing on economic growth rather than on development.

From the theoretical standpoint, Todaro analyses five leading theories of economic development, named stages of growth, structural patterns of development, dependence, neoclassical, and new endogenous growth theory (Todaro, 2000, p. 78). Entrepreneurship falls in the latter, which includes technological innovation as well as human capital as endogenous variables in the model that explains economic growth (Morris, 1998, p. 38; Wennekers and Thurik, 1999, p. 36; Todaro, 2000, p. 101; Porter et al., 2000, p. 14). Endogenous growth theory emerged to overcome the shortcomings of the traditional neo-classical theory. This theory attributes economic growth to labour and capital, but leaves unexplained 50% of historical growth in the industrialised nations, which is called "Solow residual". Therefore, "neoclassical theory credits the bulk of economic growth to an exogenous or completely independent process of technological process" (Todaro, 2000, p. 99). The origin of the new endogenous growth theory can be traced to the work of Schumpeter, who introduced the idea that changes in technology introduced by entrepreneurs contribute to development (Schumpeter, 1934), through a process of "creative destruction". Baumol, based on Solow's finding that gross output per man-hour variation was due to technical change (Solow, 1957), was one of the first to argue that despite the role of the entrepreneur in fostering innovations that drive technical change, the economic formal models are "entrepreneurless" (Baumol, 1968, p. 51). He concluded that to promote economic growth it is key to examine the determinants of the payoff to entrepreneurial activity and to encourage it. In a later work he concludes that the entrepreneur acts according to the prevailing "rules of the game" – the reward structure in the economy –, and that these rules undergo significant changes from one period to another and help to dictate the effect on the economy via the allocation of entrepreneurial resources (Baumol, 1990, p. 25). This line of reasoning is endorsed by Kent (1982) and Kirzner (1982), who view economic development not as an increase in the per capita production of goods and services but rather as a change in the total economic and social structure in a population's standard of living. Kent summarises the role of the entrepreneur in economic development through not only his influence on both the supply and demand sides of the growth equation but also on the phases of the stage theories. Kirzner concludes that entrepreneurship will most thrive where rewards are paid to those with sufficient insight to exploit opportunity

(Kirzner, 1982). Reynolds and White (1997) and Reynolds et al. (2001) build a bridge between the previous theoretical arguments and their empirical demonstration. Reynolds and White (1997) back the argument that entrepreneurial activity is generally not included in formal economic models, refusing empirically each of the assumptions on which they are built. The explicit inclusion of entrepreneurship in a formal model to explain economic growth takes place in the GEM model (Reynolds et al., 1999).

From the empirical standpoint, the link between entrepreneurship and economic growth has been explored and demonstrated since the pioneering work of Birch, in which he showed, through a longitudinal analysis, that SMEs were the main factor of job creation in the U.S.A. (Birch, 1981). This impulse was followed by successive research on the topic, which confirmed Birch's findings and extended them to the creation of new enterprises as well as the "creative destruction" of established ones (Reynolds, 1999) through not only cross-sectoral and cross-national analyses (Brock and Evans, 1989; OECD, 1996b; Arzeni, 1998; Reynolds, 1999; Reynolds et al., 2001; Audretsch and Thurik, 2000), but also longitudinal ones (Audretsch and Fritsch, 2000, cited in Wennekers and Thurik, 2001). Longitudinal studies are the most important ones in the study of entrepreneurship and development given the time lag between the creation of new enterprises and the variation in rates of economic growth and development.

The increasing support for the positive association between entrepreneurship and economic growth seems to diminish the importance of some negative impacts attributed to entrepreneurship such as disrupting research and development projects and reducing the incentive for firms to invest in human capital (Florida and Keeney, 1990).[8] However, given the importance of entrepreneurship in changing the economic and social structure of the economy, the entrepreneurship field would benefit from more research on the impact of entrepreneurship on development – i.e. focus on capabilities rather than on output. This is a major challenge for future studies on societal level outcomes of entrepreneurship.

4. Clusters – definition, measurement, and impact on development

Economic geographers, economists, sociologists, researchers in business and management, and policy makers have witnessed an increased interest in the study of clusters during the 1990s. Evidence of this interest are the bulk of books (Weiss, 1988; Porter, 1990; Pyke and Sengenberger, 1992; Saxenian, 1994; Van Dijk and Rabellotti, 1997; Steiner, 1998; Crouch et al., 2001), publications of national and international organisations (Nadvi, 1995; OECD, 1996a; OECD, 1999; Ceglie and Dini, 1999; World Bank, 2000; UNIDO, 2001; Porter et al., 2001; Schwab et al., 2001; DTI, 2001; OECD, 2001a; OECD, 2001b; Observatory of European SMEs, 2002), and papers published since 1990 that are related to clusters and similar concepts.

One of the main reasons for this increased interest in clusters is the presumed impact of clusters on firm performance, regional economic development, and country competitiveness. As a consequence, several multilateral organisations, such as the OECD, UNIDO, the World Bank, UNCTAD, the European Commission, and others are assessing and using cluster strategies as tools for economic development (Enright and Fflowcs-Williams, 2001).

This section analyses whether this renewed interest in clusters is justified and how clusters relate to development. Given that the answer to this latter point will depend on the conceptual and operational definitions of clusters as well as the space over which development is measured, the following sections address these issues, focusing on key contributions around which significant bodies of literature have evolved and yielded different answers to the question about clusters and development.

4.1. *Clusters – Evolution of the concept and potential impact on development*

Clusters existed long before the industrial revolution – silk in China and trade services in the cities of the Hanse are some examples. "During and after the industrial revolution clusters magnified and multiplied: steel and shipbuilding in Glasgow, cars in Detroit, watches in Switzerland, machinery in

Southern Germany, to name but a few" (Steiner, 1998, p. 2). Nowadays, clusters are found in both developed and developing countries, including all industry types and typical placeless ones such as telemarketing in Omaha, call centres in Sydney, and software in Bangalore (Enright, 2001).

This variety of clusters poses a problem of definition.[9] For example, clusters have been defined (either implicitly or explicitly) by some authors as a geographically proximate group of firms producing basically the same product or service (Marshall, 1966 (1890); Arthur, 1990; Sorenson and Audia, 2000); by others, as a group of interrelated industries (Porter, 1990) located in close geographic proximity (Porter, 1998); by others as networks of firms, specially SMEs (Becattini, 1989), and related institutions within geographical boundaries (Saxenian, 1994); by still others as groups of firms using the same core technology and linked to other groups of firms on the basis of technology (Tushman and Rosenkopf, 1992; Wade, 1995).[10] However, it is necessary to have a framework to link these different dimensions of clusters. To that end, this section addresses the historical evolution of the cluster concept and reviews the main schools of thought that both gave shape to current conceptualisations of clusters and provided different answers to the question about clusters and development. Table II summarises the evolution of the cluster concept, the associated schools of thought, the context in which the theoretical development took place, and the antecedents and consequences of clusters. The following sections group different schools of thought around the most important stages in the evolution of the cluster concept.

Genesis – Industrial Districts and External Economies[11] *(1890–1920).* The work of Marshall (Marshall, 1966 (1890)) on localisation economies is recognised as the point of departure of the current literature on clusters. Marshall's rationale for what he called "industrial districts" (Marshall, 1966, p. 225) is associated with the role of the localisation of industry – i.e. "concentration of small businesses of a similar character in particular localities" (Marshall, 1966, p. 230) – in generating external economies of scale. These economies are external to the firm but internal to the geographic area, and increase the efficiency of each individual firm. Four main forms of external economies can be found in Marshall's work: economies of specialisation arising from inter-firm division of labour in complementary activities; economies of labour supply arising from the local pool of specialised labour; economies of information and communication arising from the joint production of no-standardised commodities and the presence of local subsidiary trades; and the acquisition of specialised skills and the promotion of innovation and innovation diffusions – in modern terminology technological spillovers – arising from both the mutual knowledge and trust and the industrial atmosphere created within the district through frequent interchange between local actors (Marshall, 1966, pp. 225–230, 264; Zeitlin, 1992, p. 280; Martin and Sunley, 2001, p. 6; Malmberg and Maskell, 1997, p. 31; Asheim, 2000, p. 415).[12] Marshall's industrial district perspective has five main features. First, the historical reference of comparison is the internal economies of scale of large firms that spawned after the second industrial revolution. This explains why only interdependent small firms, which through an extensive division of labour in complementary activities generate economies of specialisation, integrate Marshallian districts. Second, these economies of specialisation increase the efficiency of the SMEs. Although Marshall links his macro-analysis of growth to his micro-analysis of increasing returns to firms and industries (Rostow, 1990, p. 170), the focus is on the individual small firm's efficiency as a result of the external economies created within the district. Third, proximity is a precondition for the emergence of small firms' interlinked activities that generate economies of specialisation, which, in turn, increase SMEs' efficiency. Fourth, spillovers, mutual knowledge and trust that emerge from interdependences among specialised actors in close proximity are the socio-cultural factors of the district. Amazingly, the founder of neo-classical economics has set the basis to analyse the non-economic dimension of clusters that has received much attention since the resurgence of the concept of cluster in the 1970s. Fifth and finally, there is neither indication of how the process of industrial localisation starts, nor mention of why it starts in certain places and not in others (Martin and Sunley, 2002).

TABLE II
Clusters – Evolution of the concept

	1890s 1920s	1970s	1980s		1990s onwards				
	Genesis	Impasse	New Industrial Districts			Clusters			
Context	International Division of Labour based on Comparative Advantage	Mass production – Large firm's dominance	IT revolution Suspension of free convertibility Oil crisis			Fast-changing technology Deregulation Globalisation			
School of Thought	Marshallian (Marshall, 1930 (1890))	No interest in industrial districts given the dominance of vertical integrated	Italian School (Becattini, 1979, 1989, 1990)	Flexible Specialisation (Piore and Sabel, 1984; Sabel and Zeitlin, 1985)	Californian School (Scott, 1988; Storper and Scott, 1989)	Porterian (Porter, 1990, 1998)	New Economic Geography (Krugman, 1991)	Innovation approach to clusters (Innovative Milieu, Nordic School, Geography of innovation)	Cultural-institutional approach to clusters
Lens	Economics	firms drawing on internal economies of scale to produce standardised	Socio-economics	Institutional	Economic Geography Transaction cost economics	Business and Management	International Economics	Sociology Economic Geography Regional economics	Socio-economics New Institutionalism
Cluster concept	Industrial District	goods for predictable markets. However,	Industrial Districts	Industrial Districts	Flexible production complexes	Industrial Cluster (1990) Cluster (1998)	Industrial localisation	Innovative Milieu Learning regions	Local industrial systems
Stressed cluster dimension	Industrial	there are important antecedents for cluster approach	Industrial Territorial Socio-economic	Institutional	Industrial	Industrial (1990) Industrial and Territorial (1998)	Industrial	Territorial Inter-organisational Industrial	Inter-organisational Industrial Territorial
Main Thrust	External economies	such as growth poles (Perroux) and industry complexes	Socio-economic and historical roots	Flexible specialisation as alternative to mass production	Transaction costs	Competitiveness	External economies and increasing returns to scale	Environments for innovation knowledge spillovers	Inter-organisational networks
Cluster Environment	Inter-firm division of labour, local pool of specialised labour, subsidiary trades, and trust	(Czamanski and de Albas)	Local social, cultural political, and historical factors	Vertical disintegration Institutional factors	Vertical disintegration	Any of the elements of the diamond, including chance Porter, 1998: 237)	Economies of scale and increasing returns	Tacit and embedded knowledge, territorial speificities, and cumulative learning	Organisational and social proximity Embeddedness isomorphism
Impact of clusters	External economies (economies of specialisation, economies of labour supply, economies of information and communication, and knowledge spillovers), which in turn increases small firms' efficiency		Shared vision and organisation, which in turn contribute to both: firm efficiency and local socio-economic development	Economic growth and employment	Lower transaction costs	Firm productivity Regional/national competitiveness through improving productivity, fostering innovation, and facilitating commercialisation of innovation via start ups	Marshallian external economies International trade Uneven development (core-periphery argument)	Firm Innovation Knoweldge spillovers Learning regions	Firm legitimation Firm performance Regional development

Impasse – The prevalence of mass production (1920s–1970s). Marshall's seminal work on industrial districts is the starting point of almost all of the subsequent theoretical proposals on clusters. However, there was an impasse of more than half a century between Marshall's work and the renewed interest in clusters in the early 1970s. This lack of interest can be explained by the preponderance, between 1920s and 1960s, of the vertically integrated corporation drawing on internally generated scale economies to produce standardised goods for a predictable market (Amin, 2000, p. 149). As Scott and Storper point out, "many leadings industrial sectors were converted to mass production methods" and "various institutions and practices were constructed to regulate the social and economic effects of mass production" (Scott and Storper, 1992, p. 3).

Although important in their respective areas, only few studies were tangentially related to the cluster phenomenon. One of them is Perroux's work on development and growth poles, considered as one of the antecedent of the filière – value chain – approach in the 1970s in France (Steiner, 1998); the other one is related to agglomerative and spatial complexes (Czamanski and Czamanski, 1977; Czamanski and de Ablas, 1979). The first stream focuses on the economic dimension of clusters – i.e. economic linkages among firms – and is intrinsically non-spatial. For Perroux there is no reason to link the spatial space and the economic space (Feser, 1998). However, Perroux's idea of propulsive industries for growth is an antecedent of Porter's focus on successful industries in international markets to define the most competitive clusters (Porter, 1990). The second stream – i.e. spatial complexes – focuses on the concept of industry complex – i.e. group of industries connected by important flows of goods and services – and shows that industrial agglomerations emerge as a result of not only a common attraction to urban centres but also interaction among several industries (Steiner, 1998). Both streams differ from the Marshallian one in that the latter is characterised by independent small firms, while both growth poles and industrial complexes encompass large companies. In particular, large firms are the motors of growth poles due to their supposed greater innovative capacity than that of small firms, generating a pole output larger than in the rest of the economy (Asheim, 2000).

New Industrial Districts – The crisis of mass production (1970s–1980s). In the late 1970s and early 1980s there was a renewed interest in industrial districts. The main reason for this interest was the impact of the drastic changes in the economic, technological, institutional, and political contexts since the mid 1970s on the prevalent industrial organisation model at that time – i.e. mass production or independent large firm-based industrial system. The suspension of free convertibility of dollar into gold in 1971, the oil crisis in 1973, the IT revolution initiated with the invention of the microprocessor in 1971, the declining power of organised labour, and the liberalisation process initiated by neo-liberal governments in U.S. and U.K. during the 1980s, are only some of the key facts that impassed pressure on the Keynesian model of growth and its related industrial organisation system based on large firms and mass production – i.e. "Fordism". The intrinsic rigidity of this system was incompatible with the fast pace of change in the environment, resulting in an increase of unemployment. At the same time, several industrial regions such as the Central and Northeast Italian regions and Southern California and the Bay Area in U.S., based on vertical disintegration, inter-industrial networks, and local labour markets arouse outside the heartlands of mass production (Storper and Scott, 1989). Therefore, a shift of emphasis from mass to flexible production and from independent firm-based to regional network-based systems – i.e. clusters – took place. All these changes, together with their social, economic, institutional, and geographical consequences are well documented in the literature (Piore and Sabel, 1984; Scott, 1988; Storper and Scott, 1992; Saxenian, 1994; Nohria, 1996; Castells, 2000), and were analysed through several theoretical perspectives or schools of thought. Each of them has shaped the cluster concept and its relationship to development in different ways. The most important schools are the Italian School, the Institutional or flexible specialisation school and the Californian School.

The Italian School (Becattini, 1979, 1989; Brusco, 1992; for a review, see Pyke et al., 1990; Pyke and Sengenberger, 1992; Cosentino et al.,

1996) applied Marshall's framework to interpret the small-firm development in the Central and Northeast Italian regions. However, this school extended and modified Marshall's original ideas, specially the historical and territorial specific socio-cultural factors driving external economies. Becattini contends that the unit of analysis should change from firms and sectors to industrial districts – cluster of interconnected firms located in a small area (Becattini, 1989). In other work he emphasises the socio-economic dimension of industrial districts, in which "community and firms tend to emerge" (Becattini, 1990, p. 38). From this perspective, the industrial district is a "socio-territorial entity which is characterised by the active presence of both a community of people and a population of firms in one naturally and historically bounded area" (Becattini, 1990, p. 38). Both the change of the unit of analysis from firms and industries to industrial districts and the focus on socio-economic factors underlying their emergence have led to emphasise the impact of industrial districts not only on firm efficiency but also on local economic development. Given that industrial districts are composed mainly by SMEs, firm efficiency is increased due to the benefits of external economies of scale and scope. Regarding local development, it is fostered by both SMEs' shared vision and organisation according to several principles. Among these principles are local networks, entrepreneurship, flexibility, collective efficiency, and the existence of trust (Sengenberger and Pyke, 1992). This endogenous development view differs from the neo-classical one, in which financial resources and imported technology is seen as the key sources of development. The socio-economic notion of the district was extended by sociologists such as Bagnasco and Trigilia who highlighted the impact of historical family and political inheritances (Zeiltin, 1992, p. 281).

In short, the Italian school emphasised two dimensions. First, the focus is on both the success of the community of firms and the individual small firms efficiency. Second, the success of the districts lies not only on economic factors but also and mainly on historical and territorial specific socio-cultural ones. However, the Italian School faces two main weaknesses. First, its generalisations are based on Italian examples that have long historical roots difficult to replicate (Amin and Robins, 1990; Zeiltin, 1992, p. 283). Second, the diversity of industrial districts both inside and outside Italy challenges the idea of a canonical model based on successful localised Italian SMEs (Zeiltin, 1992; Rabellotti, 1995; Rabellotti and Schmitz, 1999).

A second school of thought analysed the resurgence of industrial districts from an institutional perspective (Piore and Sabel, 1984; Sabel and Zeitlin, 1985). Its central claim is that "we are living through the second industrial divide. (. . .) [We] see two potential contradictory strategies for relaunching growth in the advanced countries. The first strategy builds on the dominant principles of mass-production technology (. . .). The second strategy veers sharply from established technological principles and leads back to those craft methods of production that lost out at the first industrial divide" (Piore and Sabel, 1984, p. 6). This second strategy is called "flexible specialisation" (Piore and Sabel, 1984, p. 17). Generalising from the industrial districts of Italy to other cases – especially West Germany –, Piore and Sabel argue that small innovative and sectorally focused firms are an alternative to the mass production model and its resulting dependence on big firms, and therefore a solution to foster growth and employment. Although Piore and Sabel acknowledge the convergence between big and small firms, they associate their flexible specialisation model to the vertically disintegrated, small firm industrial system, as in the case of Marshall and the Italian School. The main contribution of the flexible specialisation school to the evolution of the cluster concept is the argument that the industrial district is an important spatial manifestation of the flexible specialisation model. The need for inter-firm collaboration and trust gives rise to the tendency for spatial agglomeration. Therefore, it acknowledges that dynamics forces for economic growth such as technological learning are localised and territorially specific, with specific institutions playing an important role (Storper, 1997). This latter line of reasoning was developed some years later by Amin and Thrift (Amin and Thrift, 1994), who developed the concept of institutional thickness to refer to the existence of relations between development institutions, firms and organisations, and politicians

at the local and regional level whose close associations are thought to be instrumental in creating growth.

A third school of thought that emerged in the 1980s was the Californian School (Scott, 1988; Storper and Scott, 1989). Focussing on the peculiarities of the industrial geography of Southern California and the Bay Area in U.S., this school proposes a transaction cost view of clustering. The argument is that uncertainty is met via externalisation of activities leading to vertical disintegration of production chains either to minimise risks or to maximise the benefits of specialisation. However, this vertical disintegration increases transactions among firms leading to an increase in transactions costs. To overcome this issue, firms cluster geographically materialising flexible production complexes. Therefore, agglomeration of firms is the result of the minimization of inter-firm transaction costs (Scott, 1988; Storper, 1997). This model extends the original flexible specialisation model and contributes to the evolution of the cluster concept in two dimensions. First, it includes not only SMEs but also large firms. Second, it allows any mix of sectors rather than only manufacturing (Storper, 1997, p. 11). However, one of the main shortcomings of the transaction cost explanation of the clustering process is its focus on traded interdependences. These input-output relations between firms are not enough to explain clustering in some capital-intensive and high technology sectors. For example, Liebeskind et al. study of the biotechnology sector in California shows that the sourcing of the most critical input in this industry – i.e. knowledge – is based on social networks rather than on market transactions (Liebeskind et al., 1996). Some years later, Storper will argue that there is another and more important reason than traded interdependencies for the agglomeration of firms: the existence of untraded interdependencies, "which take the form of conventions, informal rules, and habits that coordinate economic actors under conditions of uncertainty" (Storper, 1977, p. 5) and constitute region-specific assets in production. Thus, the original transaction cost economics framework that focused on localised input-output transactions is complemented with a sociological approach to analyse localised untraded relations. This is another application of the sociological factors – i.e. the "industrial atmosphere", mutual knowledge and trust – mentioned by Marshall.

Clusters – Territories amid globalisation and rapid technological change (1990s onward). In the late 1990s two contextual features extended the importance of the cluster phenomenon: the heightening of the globalisation process (Held et al., 1999, pp. 13, 431) and radical technological change (Longhi and Keeble, 2000, p. 45). Both processes have made the geographical and network-innovation dimensions of clusters more prominent. This increasing interest in clusters amid globalisation and technological change is, at a first glance, counter intuitive. How are clusters explained in a context of increasing globalisation? Why should geographic location matter when drastic technological changes have reduced transportation and communication costs and barriers?

The traditional explanation for the co-existence of globalisation and clustering of economic activity hinges its roots in the title of the third chapter of Book I of the Wealth of Nations: "the division of labour is limited by the extent of the market" (Smith, 1999 (1776)). This means that regional specialisation depends on globalisation (Steiner, 1998). Therefore, "globalisation will be accompanied by more, rather than less, specialisation; and hence, by implication, will lead to further spatial concentration of such activity" (Dunning, 1998, p. 15).

Although important, the principle of specialisation does not explain the kind of activities that will be concentrated in clusters. To get a more specific explanation, it is useful to distinguish between traditional and modern theories of trade. Traditional trade theory – i.e. Heckscher-Ohlin model – is based on Ricardian comparative advantage, and argues that nations will specialise in those industries in which they have comparative factor advantages. The relative factor endowments of different countries are thus the main reason for international trade and specialisation. Therefore, the principle of comparative advantage states that countries with dissimilar resource endowments will exchange dissimilar goods. This theory, which is based on conditions of perfect competition and relative immobility of factors of production, helps to explain only part of world trade – inter-industry trade between developed and developing coun-

tries. However, much of the world trade is between countries with similar factor endowments; besides, they exchange very similar products (Storper and Chen, 2000), which are based on knowledge-intensive activities (Dunning, 1998). This intra-industry trade is essentially a result of both consumer desires for diversity in the choice of products and internal economies of scale (Armstrong and Taylor, 2000). This means that competition is based on innovation, quality and dynamic efficiencies – i.e. those depending of the rate of learning and the capacity for innovation – rather than on low cost. Given that knowledge spillovers, a key element of the innovative activity, tend to be spatially restricted (Audretsch and Feldman, 1996), especially when they are based on informal or social ties (Audretsch and Stephan, 1996), it turns out that globalisation triggers the clustering of economic activity via the concentration of innovation, making local regions a key source of advantage (Audretsch, 2000).

In sum, globalisation triggers regional specialisation and concentration of innovative activity. These, in turn, have a positive impact on trade. This process relies on competitive advantage, external economies, increasing returns to scale, and non-economic factors rather than on comparative advantage, low costs, and perfect competition. Within this context, the cluster literature has divided into two streams in the 1990s: the economic one, which highlights the economic externalities mentioned by Marshall; and the socio-economic and innovation one, which highlights the territorial, social, institutional, and cultural factors underpinning cluster dynamics. This latter approach is called the network paradigm (Powell, 1990; Conti et al., 1995) and is characterised by both the opening of the black box of territorial specificities and the measuring of innovation externalities that occur within clusters. Porter's theory of competitiveness (Porter, 1990, 1998, 2001) and Krugman's new economic geography (Krugman, 1991) fall into the economic stream. The second stream encompasses the innovative milieu school (Aydalot, 1986; Camagni, 1991; Maillat, 1996), the Nordic School of innovation and learning (Lundvall and Johnson, 1994; Malmberg and Maskell, 1997; Lundvall and Maskell, 2000), the geography of innovation approach (Jaffe, 1989; Feldman, 1994; Audretsch and Feldman, 1996; Audretsch and Stephan, 1996; Zucker, Darby and Armstrong, 1998; Zucker, Darby and Brewer, 1998), and the cultural-institutional approach (DiMaggio and Powell, 1983; Powell, 1990; Saxenian, 1994; Ingram and Roberts, 2000).[13] Each of these schools of thought are analysed below.

Porter's theory of competitiveness (Porter, 1990), which some authors consider as the starting point of the current renewed interest in clusters (Rosenfeld, 1997; Steiner, 1998; Martin and Sunley, 2002), has been adopted by several regional and national governments and international organisms to foster competitiveness. Porter defines clusters as "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities" (Porter, 1998, p. 199). He proposes a framework to analyse firm productivity and regional/national competitiveness where location is a main source of competitive advantage within a context of a global economy. In effect, "the roots of productivity lie in the national and regional environment for competition" (Porter, 1998, p. 7); "(the) presence of clusters suggests that much of competitive advantage lies outside a given company or even outside its industry, residing instead in the *locations* of its business units" (Porter, 1998, p. 198). How location affects firm's productivity and regional/national competitiveness? Porter argues that these outcomes are strongly influenced by the *quality of the business environment* (Porter, 1998, p. 198). This business environment is created through the interactions between four factors – i.e. Porter's diamond: context for firm strategy and rivalry; factor (input) conditions; demand conditions; and related and supporting industries (Porter, 1990, 1998). These factors are enhanced when the concerned firms are geographically localised (Porter, 1990, p. 157). The development of and the interaction between the factors of the competitive diamond enhance competitiveness in three ways: improving productivity, fostering innovation, and facilitating the commercialisation of innovation by easing the creation of new firms (Porter, 1998, p. 213; 2001). It is important to distinguish Porter's view of clusters in 1990 from his conceptualisation of clusters in the late 1990s. In his 1990's book Porter defines clusters in

sectoral terms – i.e. industries related by vertical and horizontal links. The literature calls this conceptualisation sectoral cluster (OECD, 1999; DTI, 2001; Sternberg, 1991). Although Porter acknowledges the importance of regions, clusters are defined mainly as an industrial rather than a territorial phenomenon.[14] In contrast, Porter's definition in 1998 is more comprehensive and includes three main dimensions: the sectoral, the geographical, and the network ones. Porter's reference to economic geography (Porter, 1998, pp. 227–230) and to socio economics (1998, pp. 225–227) stresses the importance of these latter two new dimensions. Despite the inclusion of the regional and network dimensions in his conceptualisation of clusters, the methodology to define clusters is still similar to that of 1990: the first step is the creation of an industrial cluster template based on industrial interdependences and the second one is the application of this cluster template to different regional levels (Porter et al., 2001). Therefore, although territorial as well as socio cultural specificities are acknowledged in Porter's conceptualisation, these important factors are exogenous in his model. In other words, the specific causal mechanisms that link territorial and socio-cultural factors to both the process of clustering and the generation of competitive advantage are not included in the model.

The second school of thought that belongs to the economic stream of clusters is the new economic geography of Krugman (Krugman, 1991). Stressing that the "most striking feature of the geography of economic activity" is concentration (Krugman, 1991, p. 5), Krugman argues that increasing returns to scale have a "pervasive influence on the economy, and [they] give a decisive role to history in determining the geography of real economies" (Krugman, 1991, p. 10). Increasing returns affect economic geography at local scale – via the location of particular industries –, urban scale – via the emergence of cities –, and national scale – producing the uneven development of whole regions (the core-periphery argument). The existence of increasing returns to scale at the plant level means that individual producers are motivated to concentrate geographically their production in order to benefit from the resulting internal economies. Krugman explains the reasons for localisation of industries in terms of Marshall's sources of external economies – i.e. local pool of specialised labour, local subsidiary industries, and technological spillovers (Krugman, 1991, p. 36). These factors lead to the clustering of economic activity at the local level. At a higher level of analysis, assuming that upstream and downstream producers are subject to increasing returns, as barriers to trade are reduced, "backward and forward linkages tend to concentrate the upstream and downstream producers in a single location" (Krugman, 2000, p. 55). This market-size effect leads to centre-periphery patterns within nations, which produce regional divergence due to a process of cumulative causation. Also, increasing returns at the level of industry or external economies can lead similar countries in terms of factor endowments to specialise in the production of different goods. Therefore, Krugman explains regional specialisation and trade in terms of increasing returns and imperfect competition rather than in terms of comparative advantages and perfect competition. However, clustering forces are not the only ones at work. In a latter work, Krugman explains the countervailing dispersion or centrifugal forces: immobile factors of production, land rents, and pure external diseconomies (Krugman, 1998). Therefore, the combination of clustering or centripetal forces and dispersion or centrifugal forces will determine either the concentration or the dispersion of industries. A clear contribution of Krugman to the cluster literature is the formalisation of the causes for agglomeration, trade, and regional growth. However, this same emphasis on formal economic models has led him to set aside important clustering factors such as technological spillovers or flows, which "are invisible; they leave no paper trail by which they may be measured and tracked (. . .)" (Krugman, 1991, p. 53). In fact, of all the abovementioned centripetal and centrifugal forces, formal models only include the market-size effects and immobile factors (Armstrong and Taylor, 1999). So far, these models show that geography matters "when it comes to trade, despite the decline over time of transport costs and barriers to trade" (Armstrong and Taylor, 2000, p. 138). However, as in the case of Porter, there is no indication of the territorial and socio-cultural specificities that are conductive to the clustering process.

The focus on innovation and the role of territorial and socio-cultural specificities together with the network dimension highlighted by the Italian School is further developed by the network approach to clusters, which includes sociological constructs such as embeddedness (Polanyi, 1944; Granovetter, 1985), social networks (Powell, 1990; Nohria and Eccles, 1992), and untraded interdependencies (Storper, 1997).

A first approach within this network stream is the geography of innovation one. Its main thrust is to measure knowledge spillovers, which were not analysed by Krugman. This literature links knowledge spillovers to the geography of innovative activity and demonstrates both theoretically and empirically that knowledge spillovers are important to innovation and tend to be spatially restricted (Jaffe, 1989; Patel and Pavitt, 1991; Feldman, 1994; Audretsch and Feldman, 1996), especially when they are based on informal ties (Audretsch and Stephan, 1996). The spatial link between knowledge spillovers and innovation based on the microeconomic linkages across actors such as scientists and firms is the main contribution of this literature to the cluster approach. However, it says little about how economic activity is organised within a given geographic space (Audretsch, 1998, p. 24).

The second school of thought within the network approach is the innovative milieu introduced by the GREMI group. An innovative milieu is a territorially based system of relationships between different economic and social actors that leads to innovation (Aydalot, 1986; Camagni, 1991, p. 130). This approach emphasises the importance of inter-firm relationships, territorial socio-economic embeddedness, and dynamic local collective learning process to firm innovative activity (Keeble and Wilkinson, 2000). The innovative milieu approach contributes to the evolution of the cluster concept stressing the territorial dimension of networks of multiple actors (firms, governmental agencies and not-for profit organisations such as universities) to foster innovation. However, as Storper points out, it does not identify the economic logic by which territorial specificity makes technological and organisational dynamics better (Storper, 1997).

Close related to the innovative milieu approach is the Nordic School of innovation and learning (Lundvall and Johnson, 1994; Malmberg and Maskell, 1997; Lundvall and Maskell, 2000). This school stresses the concepts of learning economies (Lundvall and Johnson, 1994; Lundvall and Borras, 1998) and regions (Asheim, 1997; Maskell and Malmberg, 1999), which overlap with the concept of national innovation systems (Freeman, 1987; Lundvall, 1992; Lundvall and Maskell, 2000). In fact, it is proposed to see clusters as reduced-scale national (OECD, 1999) and regional (OECD, 2001a, p. 8) innovation systems. These streams of the literature stress the role of knowledge as a strategic resource and learning as a key process of economic development. The argument is that knowledge has an informal and tacit (Polanyi, 1967) dimension. This type of knowledge is embedded in the social and territorial context and therefore is difficult to codify and transfer through formal mechanisms. This means that informal personal contact is necessary in order to transfer knowledge, which leads to the geographical concentration of innovators. Therefore, non-market factors such as socio-cultural, institutional, and political ones appear as paramount for cluster dynamics (Saxenian, 1994; Malmberg and Maskell, 1997). Sociological constructs such as embeddedness of economic activity (Polanyi, 1944; Granovetter, 1985) and social capital (Coleman, 1988; Putman, 1993) appears to be the major driving forces underlying innovation.

These sociological factors are the foci of the cultural-institutional approach to clusters (DiMaggio and Powell, 1983; Powell, 1990; Saxenian, 1994; Ingram and Roberts, 2000). Clusters or local industrial systems are conceptualised as networks of firms and related institutions within geographical boundaries (Saxenian, 1994, p. 4). This school of thought argues that the social, institutional, and cultural factors underlying the interdependence of economic actors are more important than the economic and technical – i.e. external economies – ones to firm performance and local economic development (Saxenian, 1994). Therefore, a systemic and relational view replaces the atomistic view of interdependences among firms. These interdependences do not occur in a non-spatial dimension, but they are embedded

in the social and institutional setting of the cluster. In analysing the impact of clusters on firm performance and economic development, this stream emphasises a typical trade-off between the advantage of being embedded in the local economic structure and the disadvantage of being located near competitors (Baum and Haveman, 1997; Sorenson and Audia, 2000; Ingram and Roberts, 2000). There is no conclusive evidence, but given the importance of the social structure for the clustering process, balancing cooperation and competition seems to be the way of getting the most of the above-mentioned trade-off. In particular, it is argued that ties embedded in social relationships enhance collaboration, mitigate competition, and foster information exchange, which in turn improve the performance of organisations (Ingram and Roberts, 2000). Additionally, in clusters with a strong division of labour, the differentiation among clustered firms leads to functional complementarities that create mutualistic effects and therefore neutralise the negative effect of sourcing from the same resource pool.

A main critic to the network approach to cluster is its emphasis on the socio-territorial embeddedness of knowledge and innovation. The individual or human capital dimension is also important and therefore it is not necessary to be locally embedded to transfer knowledge. Zucker et al. (1998) demonstrated this in the biotechnology industry analysing star scientists. Audretsch and Stephan (1996) found that 70% of knowledge is transferred via formal arrangements that do not need a territorial dimension. Finally, Rallet and Torre (1998) found that organisational proximity contributes to technology transfer and innovation diffusion more than geographical proximity. Despite the importance of these studies, their conclusions do not mean that arms length and non-territorial social networks are the only factors that matter to innovation diffusion. A more balanced approach, answering under what conditions territorial embeddedness matters is required. It seems that proximity matters when knowledge spillovers are informal. On the other hand, when knowledge is transmitted through formal mechanisms such as participation in boards or joint ventures, proximity appears to be less important (Audretsch and Stephan, 1996).

4.2. *Summing up – Do clusters matter to development?*

The previous section showed that the different schools of thought share the idea that economic activity tends to be sectorally concentrated and geographically clustered. However, as Table II shows, each school of thought has contributed its own vocabulary and set of assumptions, stressed different cluster dimensions and components, and identified different causal chains to associate clusters to firm efficiency and local development. To complicate the picture, different researchers have elaborated different definitions and typologies of clusters. This conceptual variety introduces a source of noise in studies on clusters and development because different units of analysis are dealt as they were only one – i.e. clusters.

An additional obstacle to reach conclusions about the relation between clusters and development is the variety of research designs in empirical studies.[15] There is an increasing number of case-based studies that have used different conceptual and operational definitions under the same label. The same problem appears in more quantitative designs. In effect, Table III summarises representative quantitative studies on clusters, showing that researchers have studied the effects of clusters at different levels of analysis, adopted multiples measures of this concept, and chosen different performance criteria. Particularly problematic is the mixing of different units and levels of analysis, given that several studies take the positive impact of clusters on firm performance as evidence of the contribution of clusters to development, assuming that firm-level outcomes translate directly to regional and national levels. This is not only a methodological flaw but also an oversimplification, as both economic history and theory demonstrates (Aghion and Williamson, 1998). This section aims to clarify this second source of variation – i.e. the impact of clusters at different levels – in the answer to the question about clusters and development. The review of the impact of clusters at the firm, regional, and national levels will help to avoid fruitless debates that either justify or critic cluster initiatives mixing arguments at different levels of analysis.

TABLE III
Clusters and development – Empirical Studies

Level of analysis	Cluster concept	Study	Method of measurement	Scope		Dependent variable	Result
				Time	Space		
Firm	Agglomeration of competitors	Ingram and Roberts, 2000	Political boundaries	1998	Sydney Hotel Industry	First model – Hotel performance (revenue per available room) Second model – Existence of friendship	*Positive* "Hotels perform better if their managers have friendships with competitors and if those competitors are themselves friends" (Ingram and Roberts, 2000, p. 390) "Friendships are more likely between managers whose hotels are close competitors (. . .). Existing friendships are more likely to persist, and new friendships are more likely to form, if the other individual manages a competing hotel" (Ingram and Roberts, 2000, p. 390).
Firm	Marshallian Industrial district	Fabiani et al., 2000	LQ employment and expert opinion based on Local Labour Market Areas (LLMAs)	1982–1995	Italy All the LLMAs, 199 industrial districts	ROE and ROI Labour cost per capita	*Positive* Firms in industrial districts have higher profitability (ROE and ROI) and higher productivity (labour cost per capita) across time than non-districts firms controlling for size and sector
Firm	Cluster (geographically localised employment)	Baptista and Swann, 1998	Regional employment in a firm's own industry	1975–1982	UK	Innovation in terms of technologically significant and commercially successful innovations	*Positive* Strong statistically association between innovation and cluster strength measured in terms of own-sector employment
Firm	Industrial District	Visser, 1999	Expert judgement – boundaries of the cluster defined by the main roads surrounding it	1993	Lima – Peru Garment industry	Firm performance (several indicators such as employment size and growth, sales and wages)	*Positive* Clustered firms perform better than non-clustered ones due to clustering advantages such as lower costs and information spillovers
Local labour market areas (LLMAs)	Marshallian Industrial district	Sforzi, 1992	LQ employment and expert opinion based on Local Labour Market Areas	1971–1981	All industries across Italy 61 Marshallian Industrial districts	Growth in manufacturing employment Growth in total employment	*Positive* "Marshallian Industrial districts experienced the fastest increase in employment both in manufacturing [36.7%] and in total employment [37.6%] between 1971 and 1981" (Sforzi, 1992: 106)

TABLE III
Clusters and development – Empirical Studies

Level of analysis	Cluster concept	Study	Method of measurement	Scope		Dependent variable	Result
				Time	Space		
Regional (State level)	Cluster	DTI UK, 2001	LQ employment Input/output analysis Employment review Activity analysis Expert opinion	1991–1998 (page 17)	UK All industries (manufacturing and services) and regions 154 clusters	Export performance (it is based on sectors rather than regional clusters). Job creation (page 43)	*Mixed* Job creation in the clusters for most of the regions is no better than the regional average and in same cases significantly worse. Exceptions include London, the South East, and Eastern regions where overall job creation is significantly better than regional average (page 9).
NUTs 2 and NUTs 3	High technology clusters	Keeble and Wilkinson, 2000	Selection of well-known clusters of high technology SMEs using cluster analysis and based on the NUTS2 and NUTS3 classification	1999	Europe 10 high technology clusters	Innovative capability Competitiveness Regional disparities	*Positive* – Innovative capability and competitiveness "Clusters of high-technology SMEs play an important role in strengthening innovative capability and competitiveness at the regional/local, national, and EU levels" (p. 230) *Negative* – Regional disparities Clusters of high-technology SMEs can intensify existing economic and social regional and national disparities
Regional	Local Production System	Debru and Saget, 1999	LQ for local concentration of SMEs Expert for cooperative and competition patterns, related activities, and shared culture	1999	France All industries and regions – except Ile-de-France 226 clusters	Growth	*Positive* Regional clusters have on average an equal or better growth than the French average
Regional (State level)	Geographically localised knowledge	Jaffe (1989); Feldman (1994); Audretsch and Feldman (1996)	Political boundaries	1982	U.S.	Innovation measured in terms of patents (Jaffe, 1989) or new product innovations (Feldman, 1994; Audretsch and Feldman, 1996)	*Positive* Innovation process tends to be highly localised.
Country	Clusters	Porter, 2001	Political boundaries – Country	1999–2001	75 countries (Global Competitiveness Report)	Productivity measured in terms of GDP/capita	*Positive* The micro business environment – Porter's diamond – explains much of the variation in overall national productivity.

TABLE III
Continued

Level of analysis	Cluster concept	Study	Method of measurement	Scope		Dependent variable	Result
				Time	Space		
Country	Sectoral Clusters	Porter, 1990	Use of sectoral cluster templates to identify internationally competitive sectors based on exports/FDI Use of I/O tables and expert opinion to identify linkages among sectors	1978–1985	U.S., Switzerland, Sweden, Germany, Japan, Italy, Korea, and UK	Share of the sector in world exports	*Positive* The most international competitive industries are found in clusters – industries related by horizontal and vertical links – within each country. The systemic nature of the diamond produces clustering (1990: 157)
Multilevel Regional Local	Local Production System – clusters of SMEs	Rodriguez-Pose, 2001	Political boundaries	1977–1994	France, Germany, Italy, and UK	Change in Regional shares in national GDP Change in Local Shares in national GDP	*Mixed* Positive association between the density of LPS and growth (p. 43) Some regions increased their share of national GDP (Bavaria, East Anglia, Veneto, etc) while others not (Baden-Wurttemberg, Emilia-Romagna) Some localities increased their share of national GDP (Bologna, Cambridge, Lower Bavaria, etc) while others not (Brescia, Parma, Sttutgart) Conclusions: LPS based on networks of SME are not a panacea for high growth. This is mainly an urban phenomenon (pp. 43, 45) and the best economic performances occur when metropolitan spaces and LPS meet
Multilevel: Region Metropolitan Area Economic Area	Traded Clusters (concentrated in some areas and selling to other regions or nations)	Porter et al., 2001. Clusters of Innovation: Regional Foundations for US Competitiveness	Identification of traded industries and creation of an inter-industry cluster template using correlation of industry employment or locational correlations to identify the most interrelated industries Application of the template to a specific region using employment and firm data – i.e. LQ –	Year of origin of the cluster – year 2000	US – Atlanta, Pittsburgh, the Research Triangle, San Diego, and Wichita 15 clusters	Overall Economy: Employment, Unemployment, Wage, Wage growth, Cost of living, exports Innovation output: patents, establishment formation, VC investment, IPOs, fast growth firms	*Positive* "Regions with a higher percentage of workers in traded industries, and with a larger portfolio of relatively strong and growing clusters, tend to be more prosperous" (Porter et al., 2001:A-2).

Clusters and firm performance. The surveyed schools of thought argue that, at the firm level of analysis, firms within clusters are better off than firms not within them. Both external economies (Marshall, 1966; Krugman, 1991; Porter, 1998) and the special competitive (Porter, 1998) and socio cultural (Becattini, 1989; Saxenian, 1994) environments within clusters foster firm efficiency, innovation, and performance. Table III shows that quantitative studies at the firm level, although employing different conceptual definitions and measurements of clusters, support the hypothesis that clusters foster firm performance (Ingram and Roberts, 2000; Fabiani et al., 2000; Visser, 1999) and innovation (Baptista and Swann, 1998). However, different answers to the question about clusters and firm performance might result according to the stage of the life cycle (Pouder and St John, 1996; Porter, 1998; Enright, 2001) as well as the degree of development (Arthur, 1990; Baptista and Swann, 1998; Enright, 2001; Porter et al., 2001) of a cluster. Regarding the former, the same forces promoting firm productivity and innovation in an initial stage can offset clusters' positive impact in a later stage due to congestion and competition effects. For example, physical infrastructure within clusters contributes to firms productivity lowering transaction costs and increasing the quality of services. However, this argument seems to be true either for clusters in their initial stage of development or for non-high growth clusters. As clusters grow, saturation within the cluster may generate diseconomies of scale, reflected in higher cost of living, real estate prices, and salaries of technical personnel (Pouder and St. John, 1996). The dynamic reasoning used for physical infrastructure could be applied to other causal mechanisms such as the existence of entrepreneurial profits (Schumpeter, 1934), institutional forces (DiMaggio and Powel, 1983), the quality of the environment (Raco, 2000), and managers' mental models (Prahalad and Bettis, 1986). Besides cluster stage of life cycle, a second important variable that could yield different answers to the question about clusters and firm performance is the degree of development of the cluster, given that firm performance is expected to be higher in strong clusters compared to weak clusters (Baptista and Swann, 1998; Porter, 1998, 2001; Enright, 2001).

Clusters and local development. The majority of the revised schools of thought relates the presence of clusters to local development. However, with the exception of Krugman, none of them are theories of regional growth (Feser, 1998). Therefore, what follows is an explanation of the impact of clusters on local development placing the arguments of the revised perspectives within the framework of mainstream theories.

Marshall provides the basis to understand how micro-level business relationship could influence regional development; however, he focuses mainly on firm efficiency, without an explicit explanation of how clusters contribute to local economic development. This explanation is found in Hirshman who, coining the concept of growth centres, proposes a regional extension of Perroux's non-spatial growth poles (Feser, 1998). According to Hirshman, regional growth is promoted via public directed capital in few key propulsive sectors in underdeveloped areas. This growth-centre strategy was applied in the 1960s and 1970s and it was a failure given the little attention paid to the economic and social prerequisites necessary for growth centres to work (Feser, 1998). The growth-centre strategy is one of the variants of traditional regional policy (Armstrong and Taylor, 2000) or what is known as exogenous development or development from above perspective in the regional development literature. This regional policy approach aims to achieve functional integration wherein leading regions expand into lagging regions and resources of lagging regions are made more accessible to leading regions. Therefore, the source of development relies on factors external to the local system, emphasising the mobility of capital and labour. In this approach the key is the pursuit of growth through central government policies and urban and large-scale enterprises based on standardisation and capital intensiveness.

The 1980s witnessed a shift of emphasis from this exogenous development approach to the opposite strategy – i.e. endogenous or indigenous development or development-from-below (Garofoli, 1992; Nelson, 1993; Armstrong and Taylor, 1999). This endogenous development strategy aims to create regional autonomy through integration of all aspects of life within a territory defined by its culture, resources, landscape and

institutions. The source of development relies on the local economic and social system where entrepreneurship, SMEs, and innovation play a key role for competitive advantage. Clearly, the schools of thought that stressed both the territorial specificities and SMEs composition of clusters – i.e. the Marshallian, Italian, Flexible specialisation, Innovative Milieu, and Cultural-institutional schools – fit within this indigenous development strategy. As Table III shows, quantitative studies within either of the above-mentioned schools support this strategy (Keeble and Wilkinson, 2000; Debru and Saget, 1999).

Another mainstream theory that sheds light on the potential contribution of clusters to local development is the endogenous growth theory.[16] While the endogenous development perspective stresses that the key factors promoting local development are found within the region, endogenous growth theory stresses that technological change or productivity increase, considered an exogenous factor by neoclassical economics, is determined within the growth model. In other words, what was previously taken as given – i.e. technological change – is now explained (Todaro, 2000; Fine, 2000). Therefore, the level of growth is a function of not only the stock of capital but also the rate of technological change, assumed as given in old growth models. New growth theory extends the old one in two ways. First, it determines not only the level of growth but also and mainly the rate of growth of an economy because technology is variable. Second, investments in human capital and R&D are the two main strategies to affect the rate of technological change or productivity improvements, which offset diminishing returns to capital investment. This is the main point of departure from old theories of growth, which assume diminishing returns. The acceptance of increasing returns to scale implies that non-pecuniary externalities and therefore market imperfections are acknowledged. Here it lays the most important link between new growth theory and clusters. If physical proximity and networks, two main components of clusters, foster externalities – and therefore knowledge spillovers as a special kind of externalities –, and these externalities foster growth – as the new growth theory argues –, therefore clusters foster growth. Clearly, all the schools of thought analysed in this paper without any exception are consistent with this endogenous growth theory explanation and therefore offer an interesting theoretical argument to support the relationship between clusters and regional growth. In particular, as Table III shows, the works of Jaffe (1989), Feldman (1994), and Audretsch and Feldman (1996) have found that knowledge spillovers are important to innovation and tend to be spatially restricted.

Finally, the last mainstream theory that helps to explain the link between clusters and local development is Krugman's New Economic Geography. As it was seen in the analysis of this school, Krugman argues that increasing returns affect economic geography at several levels. At the regional level increasing returns lead to the clustering of economic activity and the concentration of development in specific areas where the process started due to chance or historical accident (Krugman, 1991). Then, a process of cumulative causation and inflexibility starts: "once an outcome (. . .) begins to emerge it becomes progressively more 'locked in'" (Arthur, 1989, p. 117). Cumulative causation and lock in effects are not always positive in terms of local development. At least five potential negative cases can be identified: a region with few clusters; clusters specialised in only one industry; congestion effects; disparities within the region; and disparities between regions. The first four cases are explained below; the issue of regional disparities will be analysed in the next section – i.e. clusters and national development.

The first case of potential negative impact of clusters is that in which a region has only one or two clusters as drivers for growth. In this case, the region has a higher risk of regional depression before economic or competitive shocks than a more diversified region. The decline of the coal, iron, and steel complex of the Ruhr (Grabher, 1993) and of the Swiss watch industry (Glasmeier, 1994) are only two examples. While it is true that the largest places will develop multiple clusters (Porter, 1998), the majority of regions have little prospect of developing more than one or two viable clusters (Bergman and Feser, 1999). Yet, this argument does not take into account the ability of clusters to overcome economic crisis. Some

authors argue that the failure cases could be attributed either to specific cluster features or other causal processes rather than to the intrinsic nature of clusters. For example, the issue of regional depression due to cluster failure has several counter-examples, such as the cases of Silicon Valley and the Ruhr Valley in Germany (Rosenfeld, 1997). In the former case the industry shifted into the personal computer and equipment industry, while in the later case the industry took advantage of the local expertise to build a new cluster around environmental technologies. These examples show that clusters, like industries, are able to respond to competitive shocks and new demands. Yet, the specific capabilities and processes that lead to the revitalisation of clusters remain unknown.

A close related negative case appears when clusters include only one industry, showing a highly specialised pattern. This makes a cluster more vulnerable to industry shocks. Also, as Glaeser et al. (1992) have shown, regional diversity is more important than regional specialisation to industry growth. This can explain the mixed results of some specific quantitative cluster studies shown in Table III. For example, the existence of deep clusters – i.e. those with the most industrial and institutional linkages – is associated with better regional employment growth in U.K. (DTI, 2001, p. 9). Also, better regional performance in Europe is related to the intersection between clusters and metropolitan spaces, which comprise several industries (Rodriguez-Pose, 2001). This latter case shows that although clusters entail a richer industrial dimension than single industries and cities (Porter, 1996), it is difficult to distinguish between urban, industry, and cluster specific externalities.

A third negative effect appears in high-technology clusters. Although they help to increase the wealth of the region, they also create social divides within it (Keeble and Wilkinson, 2000), as in the case of Telecom City, Bangalore (OECD, 2002), and Silicon Valley (Harrison, 1994, p. 114).

Finally, the cumulative process of clustering can harm the environment, given that in many growth regions economic and social concentration has created environmental problems, which may undercut future competitiveness (Raco, 2000).

In sum, although there are several theoretical arguments and empirical evidence to support the positive association between clusters and local development, this association seems to be contingent to some cluster features, such as the intensity of inter-organizational networks within the cluster and its industry span. Also, it is important to analyse the association between clusters and local development within the appropriate time horizon. For example, Tuscany and Emilia Romagna's productivity growth and employment were higher than the national average during the 1980s. However, the same regions showed an average annual income growth rate below the average Italian rate during the 1990s (Capello, 1996; Rodriguez Pose, 2001).

Clusters and national development. Four of the discussed schools of thought relate clusters to national development, although in different ways. First, Piore and Sabel propose the regional version of flexible specialisation – i.e. industrial districts – as an alternative to mass production to generate economic growth and employment (Piore and Sabel, 1984). Second, Porter argues that national competitiveness is based on the quality of the business environment – i.e. his competitive diamond. These factors are enhanced when the concerned firms are geographically localised, as it is demonstrated by the concentration of the most international competitive industries in strong clusters (Porter, 1990; DTI, 2001). Porter has found evidence for this argument testing statistically across a broad sample of countries (Porter, 2001). Specifically, using his conceptual framework for the study of clusters to measure the microeconomic context, he demonstrated that this context explains much of the variation in overall national productivity, measured in terms of GDP per capita (Porter, 2001). Porter argues that this study challenges the notion that microeconomic improvement is automatic if proper macroeconomic policies are instituted. Third, Krugman argues that increasing returns affect economic geography at different levels. At the large level, he develops a core-periphery model in "which the interaction of demand, increasing returns, and transportation costs drives a cumulative process or regional divergence" (Krugman, 1991, p. 11).

Therefore, contrary to the constant returns models of neoclassical economics that deny externalities, Krugman argues that divergence rather than convergence between regions is the norm. Finally, the Nordic School emphasises the knowledge and learning dimensions of economic development (Lundvall, 1992) and their embeddedness in specific social and institutional national environments. This school of thought stresses the systemic nature of clusters and acknowledges both virtuous and vicious circles as a function of the fit or misfit, respectively, between the economic, institutional, and social elements of the innovation system (Lundvall and Maskell, 2000). Therefore, it is the working of systemic interrelation of factors rooted in specific environments what makes development possible. The Nordic School offers an extension of endogenous growth models, which highlight that complementary investments in human capital and R&D are needed in order to financial and physical capital produce their expected benefits (Todaro, 2000, p. 101). This can be seen in developing countries, where lower levels of investments in human capital, R&D, and supporting institutions offset the potential high rates of return of investments in financial and physical capital (Ranis et al., 2000)

Two main issues arise from the previous arguments the association between clusters and regional disparities, and the transferability of cluster initiatives across regions and countries. Regarding the first issue, cluster initiatives imply a policy-led attempt to strengthen regional concentrations. As a consequence, cluster initiatives do not take fully into account the minimisation of regional disparities in growth and income, which is not only one of the indicators of development (UNDP, 1992) but also a traditional goal in regional policy (Armstrong and Taylor, 2000). However, from a neoclassical economics perspective and contrary to Krugman's cumulative causation process, this should not be an issue given that the free flow of factors of production will lead to a convergence of development across regions. General empirical studies do not provide a definite answer on this debate (Armstrong and Taylor, 2000), although one of the few cluster specific studies that addresses the divergence problem concludes that even when clusters of high-technology SMEs in Europe contribute to regional competitiveness they also can intensify existing economic and social regional and national disparities (Keeble and Wilkinson, 2000). Some argue that these regional disparities may result from inadequate national policies to balance regional development rather than from the nature of clusters (Sengenberger and Pyke, 1992). In this view, it is argued that national socio-economic policies and clusters policies should go hand in hand because they complement and reinforce one another. Regarding the issue of transferability, there is consensus that clusters are not transferable among regions (OECD, 2001a, p. 9), or more broadly, from one society to another, for clusters are embedded in social systems of production distinctive to their particular society (Hollingsworth, 1997).

4.3. *Measuring clusters*

Both the different cluster's conceptualisation and the different levels of analysis described in the previous sections explain the varying arguments regarding the methodology to identify clusters. This third source of potential variation in findings in clusters studies is the focus of this section.

The approaches so far include both quantitative and qualitative techniques. The proposed methodologies and their evaluations are shown in Table IV.[17] To overcome the pitfalls of each methodology, there is a general consensus in the literature that in order to truly identify clusters it is necessary to conduct both qualitative and quantitative analyses (Rosenfeld, 1997; DTI, 2001). For instance, "although inter-industry transactions (. . .) can sometimes be detected in input-output tables, neither the character of relationships among firms nor the benefits of clustering can be discerned in this way" (Doeringer and Terkla, 1999). Traditional quantitative measures are inadequate to discover important features present in some clusters such as social infrastructure, entrepreneurial energy, shared vision, and level of collaboration, and therefore are unable to "distinguish a simple industry concentration from working clusters" (Rosenfeld, 1997).

Yet, combining quantitative and qualitative approaches faces a number of methodological bot-

tlenecks and complexities that complicate the comparability of cluster studies. From a qualitative standpoint, the rich reality comprised in the concept of cluster makes it difficult to agree on descriptors of the cluster concept. From a quantitative standpoint, existing official national and international data sources for cluster analyses are limited by conventions on official classification systems of economic activities and industries. These sources were not designed to cover inter-industry and inter-firm linkages. Besides, cluster analysis needs input-output data at very low levels of aggregation (three or four-digit industry code level), and only a few countries such as the U.S.A., Canada and Denmark have detailed input-output tables (Roelandt and Hertog, 1999).

An additional source of complexity is the lack of correspondence between conceptual and operational definitions of clusters, as Table V shows. This table permits to discover the phenomenon under study from the method employed to identify it. In effect, independently of the label they use, some authors are studying agglomerations, based either on firms (Baum and Mezias, 1992; Lomi, 2000; Sorenson and Audia, 2000) or on employment (Baptista and Swann, 1998; Glassman and Voelzkow, 2001) within a single industry; others focus on interrelated industries without considering regional boundaries – i.e. sectoral or value chain clusters – (Porter, 1990; Roelandt et al., 1999); yet others study single or interrelated industries within specific geographical boundaries, including concentrations of either SMEs – i.e. industrial districts – or firms of different sizes – i.e. clusters. Clearly, the methods used in these studies do not converge to capture similar attributes of the cluster concept, indicating a much-needed dialogue on the definition and dimensions of clusters. In this regard, Figure 2 attempts to link different concepts used in the cluster literature and their associated techniques to identify and measure them. It is argued that future studies will not add to the current confusion if they clearly specify the type of cluster under study and use the appropriate technique associated with that type of cluster. This is one of the major methodological challenges cluster studies face in order to have a stronger empirical foundation to support both theoretical arguments and policy designs.

5. The impact of clusters on entrepreneurship

The existence of national (Audretsch and Thurik, 2000; Reynolds et al., 2001) and regional (Reynolds et al. 1994) variations in entrepreneurship means that territorial specificities matter to firm creation. Given that clusters comprise more than this geographical dimension, several authors argue that regions where strong clusters operate benefit from higher start-up rates. This section analyses different arguments and associated empirical evidence of the impact of clusters on entrepreneurship.

It is argued that clusters foster entrepreneurship providing established relationships and better information about opportunities; lowering entry and exit barriers; opening up niches of specialization due to the low degree of vertical integration; fostering a competitive climate and strong rivalry among firms that impose pressure to innovate due to the presence of close competitors; providing role models and the presence of other local firms that have "made it"; capturing important linkages, complementarities and spillovers from technology, skills, information, marketing and customer needs that cut across firms and industries, which is key to the direction and pace of new business formation and innovation; providing access to physical, financial, and commercial infrastructure; easing the spin offs of new companies from existing ones; reducing risk and uncertainty for aspiring entrepreneurs; and providing a cultural environment where establishing one's own business is normal and failure is not a social stigma (see for example Pyke and Sengenberger, 1992, p. 20; Saxenian, 1994, pp. 30–41, 111–118; Rosenfeld, 1997; OECD, 1998, p. 93; Porter, 1990, 1998, pp. 205, 224). Despite the plausibility of these arguments and some empirical evidence supporting them (Saxenian, 1995, p. 125; Baptista and Swann, 1999; Oakey, 1995), they present two main weaknesses. First, the main[18] focus is on the absolute creation of firms rather than the net start-up rate – i.e. births minus deaths or churning rate; second, cluster advantages to entrepreneurship are assumed as permanent, with independence of the cluster stage.

Taking a more dynamic view, some authors

TABLE IV
Measuring clusters: Alternative methods

Methodology	Reference	Definition	Advantages	Disadvantages
		Quantitative methods		
Specialisation Indicators			Easy Inexpensive	It focuses on sectors and political boundaries rather than on clusters
– Location quotients using plants (LQP)	DTI, 2001: 13	Degree of agglomeration of an industry and degree of specialization of a locality according to plants. LQ = % industry in the location/ % industry in the nation in terms of plants	It can supplement other methods It allows to identify the most important industries in the region	It does not capture intra-cluster linkages (dti, 2000:A2 18–19; Feser and Bergman, 2000)
– Location quotients using employees (LQE)	Glassman and Voelzkow, 2001	Degree of agglomeration of an industry and degree of specialization of a locality according to employment. LQ = % industry in the location/% industry in the nation in terms of employment		1 It does not capture intra-cluster linkages (DTI, 2000:A2 18–19; Feser and Bergman, 2000) 2 It is not possible to infer the degree of concentration of particular branches from the total number of employees, given the effects of firm size on the statistics (Glassman and Voelzkow, 2001: 84)
– Gini Coeficients	Krugman, 1991; Glassman and Voelzkow, 2001	Degree to which a particular branch is unequally dispersed over localities. It measures the degree to which the regional distribution of employment in a particular industry deviates from the regional distribution of the same variable as a whole. The index may take on values between zero (totally even distribution) and 0.5 (total concentration in one industry) (Krugman, 1991)		1 Same weaknesses as LQ using employment 2 There is no “bottom line” against which to interpret results. It only indicates the degree to which an industry deviates from a situation where its employment is distributed over regions precisely in the same way as the total employment in the country (Malmberg and Maskell, 1997) 3 It is sensitive to the size of the particular industry and the number and size of the geographical areas within the country (Malmberg and Maskell, 1997)

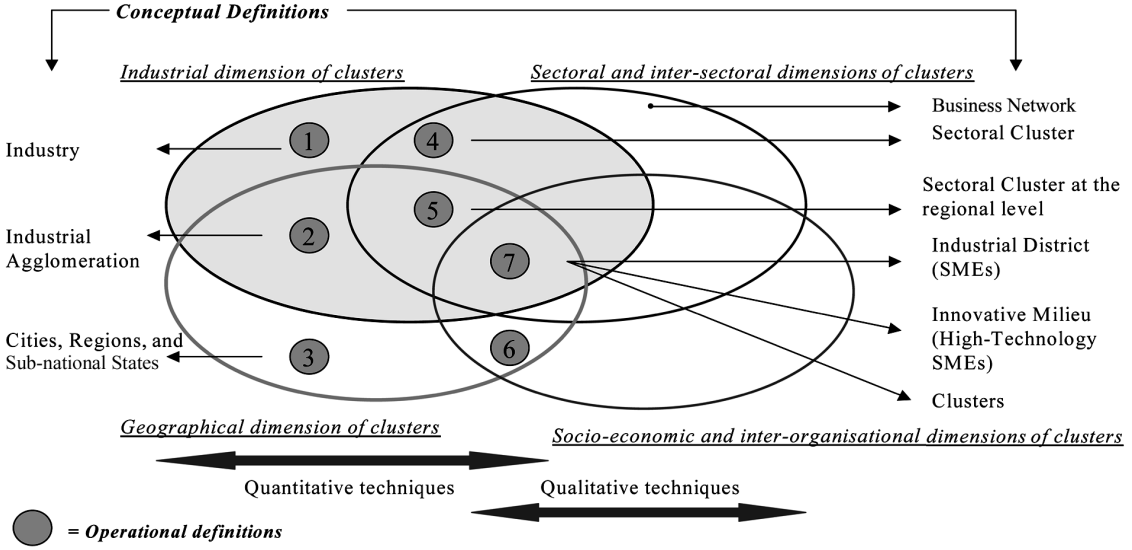
TABLE IV
Measuring clusters: Alternative methods

Methodology	Reference	Definition	Advantages	Disadvantages
Input/output trade	OECD, 1999: 221; Bergman and Feser, 2000; DTI, 2000: Annex 2	Focus on trade linkages between industry groups in the value chains of the economy.	1 Comprehensive and detailed 2 Specially useful in vertically-integrated clusters 3 It allows to discover the key linkages in a region using quantitative data	1 It does not address whether relationships really exist between the individual firms 2 High level of aggregation 3 Some key industries are not represented, while others are over-represented. 4 Focus on inter-sectoral linkages, loosing information about intra-sectoral ones. 5 It neglects supporting institutions
Input/output innovation	OECD, 1999, 2001	Survey-based matrix that identifies inputs and outputs of innovative activity	Provide information not available from I/O tables, R&D, and patent data	Data only available in few countries such as Canada, Italy, China, Denmark, and Finland (DeBresson and Hu, 1999: 29)
Correspondence analysis	Porter et al., 2001; Feser and Bergman, 2000	For instance, factor analysis, principal components analysis, multi-dimensional scaling and canonical correlation. These techniques aim to identify groups or categories of firms or industries within a region or with similar innovation styles.		
Graph theory/ network analysis	OECD, 1999	Visual identification of cliques and other network linkages between firms or industry groups.	1 Visualisation aids 2 Easy Interpretation and analysis	1 Methods not developed yet 2 Software still limited
		Qualitative methods		
Expert opinion	Porter, 1998; Glasmeier, 1994	Survey to regional experts such as industry leaders, public officials, and other key decision makers using interviews, focus groups, Delphi survey techniques, and other means of gathering key information.	1 Relatively cost and time effective 2 Detailed contextual information	1 Difficult to generalise 2 Difficult systematic data collection
Case Studies	Porter, 1998; Glasmeier, 1994	Along the lines of Porter's studies conducted in various countries	1 It provides knowledge about the real economy 2 It contributes to the recognition that networks cut across different industries 3 It captures the role of institutions	1 Porter's diamond is basically an heuristic device 2 Results are hard to compare across clusters

TABLE V
Matching conceptual and operational definitions of clusters

Source	Level of analysis	Concept: Method: Quantitative: Gini	LQE	LQP	I/O	X/FDI	Corr. A.	Graph	Other	Qualitative: Case	Exp Op	Polit. boundary
					Industrial Cluster							
Porter, 1990	Country				X	X				X	X	X
Roelandt et al., 1999	Country				X	X				X	X	X
					Geographical Concentration or Organisational Density							
Baum and Mezias, 2000	City								X[1]			X
Lomi, 2000	Country City								X[2]			X
Sorenson and Audia, 2000	State City								X[3]			X
					Industrial District							
Sforzi, 1992	Local labour market areas		X				X				X	X
Visser, 1999	City									X	X	X
					Local Production Systems							
Glassman and Voelzkow, 2001.	Federal state (Lander) (pp. 86–88) Travel to work areas (pp. 80, 88)	X	X									X
Rodriguez-Pose, 2001	Region Cities											X
Debru and Saget, 1999	Region		X								X	X
					Cluster							
Baptista and Swann, 1998;	Region								X[4]			X
Bergman, 1998; Feser and Bergman, 2000	Federal State		X	X	X		X	X				X
Keeble and Wilkinson, 2000: 31	NUTs 2 and NUTs 3						X			X	X	X
Porter et al., 2001.	Region Metropolitan Area Economic Area		X		X	X	X	X		X	X	X
DTI, 2001	Region Local authority districts		X		X	X					X	X

[1] Absolute number of firms within the analysed geographical area.
[2] Absolute number of firms within the analysed geographical area.
[3] Absolute number of firms within the analysed geographical area.
[4] Absolute value of regional employment in a firm's own industry.



1 = Standard industrial classification codes (SIC, NAICS, NACE, etc)
2 = Specialisation indexes (location quotients, Gini coefficients; inverse Herfindhal index)
3 = Political and Administrative boundaries at several levels (States, Metropolitan Areas, Economic Areas, Counties, NUTs, etc)
4 = I/O tables and industrial cluster templates – i.e. inter-industry trade patterns using I/O data at national level and applying either correlation (Porter, 2001) or factor analysis (Feser and Bergman, 2000) to identify the most interrelated industries
5 = Cluster template applied to an specific region
6 = Local Labour Market Areas (LLMAs) and expert opinion. LLMAs are travel-to-work distance areas where the majority of the resident populations social and economic relations takes place (Sforzi, 1992)
7 = Some of the previous quantitative techniques complemented with in depth case studies and expert opinion

Figure 2. Matching conceptual and operational definitions.

argue that the start-up rate increases during the initial stage of a cluster and then decreases in a more mature stage. The reasons behind this process are different, though. Schumpeter (1934) argues that successful pioneer entrepreneurs remove the obstacles faced by entrepreneurial activity in its early stages. This produces the "clustering of the followers" up to the point of eliminating entrepreneurial profit. Pouder and St. John (1996), referring to high growth clusters in their origination phase of evolution, argue that clusters may be viewed as an incubator for start-ups and spin-offs. At a later stage, congestion effects, mimetic behaviour and homogeneity in managers' mental models stabilise entry. Finally, organisational ecology theory argues that at low levels of organisational density legitimation processes dominate and, therefore, the net founding rate is positive. However, at high levels of density, competition processes dominate and therefore the net founding rate decreases (Hannan and Carroll, 1992). Despite the strong initial empirical support for this argument, results differ according to the level of analysis at which the model is specified (Carroll and Wade, 1991; Lomi, 1995, 2000).

The dynamic view analyses the net start-up rate and provides different answers to the question about the impact of clusters on entrepreneurship based on the stage of the cluster. However, it faces two limitations. First, from the cluster point of view, it is based on only one industry and one dimension of clusters – i.e. agglomeration of economic activity. The inter-industrial, inter-organisational, and network dimensions of clusters could produce different patterns of start-up evolution. Second, from the entrepreneurship point of view, the analysed dynamic perspectives focus

only on the context of entrepreneurship, without considering firm specificities. In particular, population ecology studies take as unit of analysis the population and thus treat foundings as identical additions to homogeneous organisational populations, without considering the characteristics of new organisations (Baum and Haveman, 1997). This misses two key attributes of entrepreneurship: the role of human volition and organisational learning, and the generation of different outputs at the firm level (Bygrave and Hofer, 1991).

In sum, the previous analysis suggests that linking process and context at different levels of analysis, considering both organisational and relational density (Baum and Oliver, 1996; Aldrich and Martinez, 2001), are two main criteria to consider in future studies on the impact of clusters on entrepreneurship.[19]

6. Conclusions and directions for future research

Does clustered entrepreneurial activity contribute to development more than non-clustered? Given the promises of entrepreneurship and clusters to foster development as well as the lack of studies on the moderating effect of clusters on the relationship between entrepreneurship and development, this paper aimed to set the basis to answer the above question. The terms were defined as follows: entrepreneurship is the creation of new organisations; cluster is a geographically proximate group of firms and associated institutions in related industries, linked by economic and social interdependences; and development is the expansion of capabilities rather than the increase in output. To identify potential causes of the moderating effect of clusters on the impact of entrepreneurship on development, the paper focused on three different impacts: entrepreneurship on development, clusters on development, and clusters on entrepreneurship. Thus, the paper reviewed the literature related to these relationships, around which the following conclusions and suggestions for future research are grouped.

First, the literature review on the impact of entrepreneurship on development reveals that there is a positive association, theoretically as well as empirically, between entrepreneurship and economic growth. Given the importance of entrepreneurship in changing the economic and social structure of the economy, more research on the impact of entrepreneurship on development – i.e. focus on capabilities rather than on output – is needed. This is a major challenge of future studies on societal level outcomes of entrepreneurship.

Second, despite some preliminary positive findings, several factors do not permit empirical generalisations on the impact of clusters on development. The reviewed schools of thought related to clusters have contributed their own vocabulary and set of assumptions, stressed different cluster dimensions and components, and identified different causal chains to associate clusters to development. Additionally, methodological bottlenecks and data constraints make case studies the most used research method, complicating the comparability and generalisability of results. Also, researchers have not been consistent in matching the label they attach to the phenomenon under study and the techniques they use to identify it. Finally, researchers have studied the effects of clusters at different levels of analysis, adopted multiples measures of this concept, and chosen different performance criteria. Particularly problematic is the mixing of different units and levels of analysis, assuming that firm-level outcomes translate directly to regional and national levels.

Separating the impact of clusters at different levels is a first step in reaching conclusions on the relationship between clusters and development. At the *firm level*, although using different conceptual and operational definitions, empirical results show a positive effect of clusters on firm performance and innovation. However, different results might be expected in future empirical studies that control by both the stage and strength of the clusters under analysis. At the *regional level*, both endogenous development perspective and endogenous growth theory provide the basis to explain the positive results of clusters on regional development. These results come from studies based mainly on the schools of thought that stress territorial specificities and SMEs composition of clusters as well as the schools of thought that focus on knowledge spillovers.

However, some negative impacts of clusters on development have been documented in four cases: regions with few clusters, clusters specialised in only one industry, and clusters producing congestion effects and social divides within a region. Whether these negative effects are connatural to clusters or a matter of inadequate policy design is still an issue under debate. A positive step to contribute to the debate is to agree on what kind of cluster the discussion is about – see Figure 2. For example, the current interest in clusters makes policymakers call cluster policy what in fact is a mere industrial policy based on sectors. The same mistake occurs when clusters are selected according to what policymakers wish for their economies rather than to the capabilities – physical, human, and social – that are present in the region. These cases are not cluster policies at all and it would be wrong to attribute their results to a cluster approach to regional development. Finally, at the *national level*, there is quantitative support for the hypothesis that the business environment created by clusters fosters national competitiveness. However, given that cluster initiatives imply a policy-led attempt to strengthen regional concentrations, the issue of regional disparities is not taken into account. This suggests that regional and national policies should be coordinated to avoid both regional disparities and destructive competition between regions.

Third, it is argued that clusters positively affect entrepreneurship given informational, relational, competitive, economic, cultural, and institutional advantages. However, when considering a more dynamic perspective the impact of clusters on entrepreneurship seems to be a function of the stage of the cluster. Yet, the empirical test of this hypothesis has been based on the organisational ecology perspective, which focuses on density within a given industry rather than on clusters. Also, its choice of populations as unit of analysis and its focus on context does not consider the individual characteristics of new organisations, a key element in studying the entrepreneurial process.

Fourth and finally, the second and third findings regarding the impact of clusters on both development and entrepreneurship, respectively, imply that it is difficult to generalise on the moderating effect of clusters on the association between entrepreneurship and development. In effect, both positive results and caveats are found at different levels of analysis and at different stages of development of a cluster.

Defining clearly the phenomenon under study, associating to it an appropriate operational definition, linking context and process and, therefore, using quantitative and qualitative methods at different levels of analysis controlling for the stage and the strength of clusters are the main criteria for future studies to consider to disentangle the impact of clusters on entrepreneurship, development, and the relationship between entrepreneurship and development.

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Appendix A
Literature review – Sources of information

Topic Source	Entrepreneurship	Development	Clusters
Books		See References	
Journals and Publications	Frontiers of Entrepreneurship Research Entrepreneurship Theory and Practice Small Business Economics Journal of Business Venturing	Economic Development Quarterly American Economic Review Economic Development Review	
		Regional Studies Urban Studies Urban and Regional Development Economic Geography World Development	
	Entrepreneurship and Regional Development		
Multilateral Organizations	OECD	OECD World Bank UNPD	OECD World Bank
International Research Projects	Entrepreneurial Research Consortium (Babson College)	The Global Competitiveness Report (World Economic Forum) Decentralised Development (World Bank)	
	Global Entrepreneurship Monitor (Babson College – London Business School)		
	Local Economic and Employment Development (OECD)		
Bibliographic Search Engines	Dow Jones Interactive LBS Journal Finder Business Source Premier ProQuest Direct ICE – Information Centre for Entrepreneurship BibEc Web of Science		

Notes

[1] Although several researchers have carefully tried to estimate the economic impact of clusters, the lack of consensus around how to define and measure them has prevented me to begin with some striking figures to demonstrate the importance of clusters. For example, it has been said that in the United States 380 clusters of firms employ 57% of the U.S. workforce, produce 61% of the country's output and generates 78% of the nation's exports; or that local industrial districts account for some 30% of total employment and 43% of total exports in Italy (OECD, 1998, p. 93; see Observatory of European SMEs (2002) for a review). Despite the effort in obtaining these figures, the reasons given above suggest trying first to develop a framework to analyse the impact of clusters, setting the basis for both empirically based theories and policy designs on the relationship among clusters, entrepreneurship, and development.

[2] For analyses on the impact of development on entrepreneurship see Reynolds et al. (1994), Verheul et al. (2001), and Sternberg (2001). In short, the basic argument is that growth implies a demand effect, which in turn creates new opportunities for the creation of new firms. A more innovation-oriented argument is that customers place new demands on

products and services creating opportunities for new technological developments. This increasing demand for new products and services trigger the entrepreneurial process in order to discover and exploit the new opportunities. For analyses on the impact of entrepreneurship on clusters, see Sengenberger and Pyke (1992), Rosenfeld (1997), and Porter (1990, 1998). The basic argument is that entrepreneurship is one of the driving forces of cluster development via spin offs (Sengenberger and Pyke, 1992; Rosenfeld, 1997) and increasing rivalry, one of the four components of Porter's competitive diamond, due to the entry of new competitors (Porter, 1990, 1998).

[3] For a review of these theories see for example Cowen and Shenton (1996) who distinguish between imminent development (a spontaneous and unconscious process of development from within) and intentional development (deliberate efforts to achieve higher levels in term of set objectives); Allen and Thomas (2000: chapter 2), who develop a framework that encompasses the different meanings and views of development; Todaro (2000, Chapter 3), who makes a comparative analysis of the theories of development since World War II; Coates (2000, Appendix), who explains the theories of economic growth; and U.S. Department of Commerce (2000), which classifies the theories of economic development according to their basic categories, definition of development, essential dynamic, strengths and weaknesses, and applications. Although this paper does not cover their discussion, these theories are implicit in the following analysis of the meaning and measurement of development.

[4] Even the World Bank, which during the 1980s championed economic growth as the goal of development, has joined the new current. In effect, the World Bank defines its mission as "a world free of poverty" (www.worldbank.org) and emphasises that "development" implies quality of life and "attacking poverty" (World Bank, 1991, 2000).

[5] Based on a positive correlation between income per capita and alternative development indicators such as literacy level, some authors conclude that although taking a wider and multidimensional view of development is conceptually correct, per capita GDP still works as a fairly good proxy for most aspect of development (Ravallion, 1997; Ray, 1998). Despite the sound of this argument, I prefer job creation rather than income per capita as a proxy for development. The former is more related to capabilities than the latter. Besides, simple correlation analysis does not take into account how many people are excluded from the benefits of development and how long they have to wait to receive these benefits. Finally, income per capita can be a misleading indicator for development, given that at least in developing countries the appropriate sequence of investment is human development – economic growth, not vice-versa (Ranis et al., 2000).

[6] For a review of the evolution of the entrepreneurship field over time and its relation with other disciplines refer to Livesay (1982), who reviews historical definitions of entrepreneurship and the theories of entrepreneurship; Gartner (1989), who after a literature review and critic of the trait approach (who the entrepreneur is) proposes that entrepreneurship is the creation of new organisations (what the entrepreneur does); the two special issues of Entrepreneurship Theory and Practice (1991, vol. 16 (2), and 1992, vol. 16 (3), which focus on the entrepreneurship field from an interdisciplinary perspective and the contribution of different disciplines to the field, and vice-versa; Bechard (1997), who studies the most often quoted references in five academic journals, categorises the contributions in three levels: praxeology, scientific disciplines, and epistemology, and draws two paradigms: that of the economy of entrepreneurs and that of the society of entrepreneurs; Cooper, Hornaday, and Vesper (1997), who present an informal history of the field of entrepreneurship; Thornton (1999), who traces the evolution of entrepreneurship theory to Weber and contrast the supply side to the demand side approach to entrepreneurship, and proposes to integrate both approaches using sociological frameworks; and Shane and Venkataraman (2000), who draws upon previous research to create a conceptual framework for the entrepreneurship field.

[7] This information is gathered by the Entrepreneurial Research Consortium, which is a panel study of business start-ups in 10 countries (Reynolds, 2000).

[8] The basis of this argument can be found in Schumpeter, who in Capitalism, Socialism and Democracy (1950) shifts the focus of innovative activity from entrepreneurs to large firms. He describes a virtuous and cumulative process between R&D and innovation in large firms, which increases the gap between the innovative capability and outputs between large and small firms.

[9] For a review of different current definitions of clusters and related concepts see Bergman and Feser (1999), OECD (1999), and Martin and Sunley, 2002. Given the vagueness of the cluster concept, many authors have proposed typologies of clusters outlining different criteria to classify different forms that clusters may take. These typologies can be found in Roelandt and Hertog (1999), who use different levels of analysis; Gordon and McCann (2000), who use different theoretical perspectives; Markusen (1996), who uses different cluster's configuration; Asheim (1997), who uses different degrees of innovative capabilities; Cullen (1998) who defines different elements in organisational learning within SME clusters; and Rosenfeld (1997), Porter (1998), and Enright (2001), who employ different stages of cluster development. Finally, although typologies can be seen as a form of theory (Doty and Glick, 1994), some of the previous types of cluster overlap and are difficult to measure empirically. For this reason, many authors argue that clusters should be characterised along relevant dimensions if they are to be distinguished. This latter approach is found in Jacobs and de Man (1996); Maillat (1996); DTI (2001) and Enright (2001).

[10] I am grateful to a reviewer for the idea of summarising thematic differences in the cluster literature in this way

[11] Economists, geographers, and planners distinguish localisation economies – i.e. those that result from proximity among firms belonging to the same industry or close related industries – from urbanisation economies – i.e. those that result from general urban advantages (Hoover, 1937). Within the former, there is a distinction between agglomeration or location theory and external economies perspective. Location theory calls the benefits of co-location agglomeration economies and argues that they are the result of either the size of the industry (Hoover, 1937; Isard, 1956) or the structure of the industry (Chinitz, 1961). External economies perspec-

tive is rooted in Marshall's work on industrial district (Feser, 1998). While agglomeration economies are a kind of external economies that emerge from large concentrations of economic activity, external economies not necessary emerge from agglomerations. Researchers who define clusters as concentration of firms within single or close related industries (Sorenson and Audia, 2000; Lomi, 2000) follow an agglomeration approach. By contrast, researchers who define clusters emphasising their regional, social and inter-industrial dimensions (Camagni, 1991; Saxenian, 1994) use components of both the agglomeration and external economies approaches as well as sociological constructs such as embeddedness of economic activity. For a review of the literature on different explanations of the clustering of economic activity see Harrison (1992), Feser (1998), and Glasmeier (2000); for a review on the debate between specialisation vs. urbanisation effects see Glaeser et al. (1992), Audretsch (1998), Glasmeier (2000), Feldman (2000), and Rodriguez Pose (2001). I have avoided including these distinctions and debates as part of the evolution of the cluster concept given that, as noted above, different conceptualisations of clusters make it unreal to encapsulate them within a single perspective. Important elements of clusters are not only spatial proximity but also inter-organisational relations and the knowledge and social base underlying clusters dynamics. In this sense, every cluster is an agglomeration, but not every agglomeration – such as cities or a single concentration of firms – is a cluster (DTI, 2001).

[12] These external economies are often referred to as the supply side of the benefits of clustering (Baptista and Swann, 1998). However, Marshall also mentions some demand side benefits of clustering as a function of the type of products. In effect, "shops which deal in expensive and choice objects tend to congregate together; and those which supply ordinary domestic needs do not" (Marshall, 1966, p. 227).

[13] It is hard to differentiate these four schools of thought given that they share several assumptions regarding territorial specificities and the role of socio-economic factors in the working of clusters. For example both the innovative milieu and the Nordic schools argue that innovation, which is key to foster competitiveness, is an interactive learning process in which cooperation and mutual trust is enhanced by proximity. This interaction between innovation and territorial proximity generates learning regions where knowledge spillovers, the central focus of the geography of innovation approach, play an important role. The tacit nature of knowledge makes the social and cultural features of the local environment an important factor to explain innovation and entrepreneurial dynamics' differentials across regions, which is explained by the cultural-institutional approach to clusters. However, in an effort to differentiate the different schools, it could be said that while the innovation approach to cluster analyses geographical proximity in terms of its impact on innovative activity, the cultural-institutional approach stresses the embeddedness of economic activity in particular social and institutional settings to explain the ability of firms to adapt to increasing globalisation and technological change.

[14] See especially his methodology to define clusters in Porter, 1990 Appendix A, where there is no reference to geographical boundaries. One reason is that with the exception of part of Chapter IV, his analysis is done at the country level.

[15] Empirical studies are defined as those that include some kind of data or data analysis. These include both qualitative and quantitative or statistical procedures. The former includes methods such as case studies. The later includes any study using statistical techniques either in a descriptive or explanatory way using empirical data (see Singleton and Strait, 1999; Chandler and Lyon, 2001).

[16] The building blocks of this recent theory are the works of Romer (1986) and Lucas (1988). For a comprehensive treatment of this theory refer to Barro and Sala-i-Martin (1995). For a critical assessment see Fine (2000). The application of new growth theory concepts to development can be found in Morris (1998) and Todaro (2000). The application of new growth theory concepts to competitiveness can be found in Porter et al. (2000, p. 14).

[17] A detailed description of each methodology is beyond the scope of this paper. For a deeper understanding of their foundations and applications refer to Peneder (1995); OECD (1999); DeBresson and Hu (1999); Bergman and Feser (1999); Lichty and Knudsen (1999); Hill and Brennan (2000); Feser and Bergman, 2000; and Austrian, 2000.

[18] Porter recognises that intense competition within a cluster plus lower exit barriers promote not only births but also deaths. This process is argued to be positive for surviving firms, which will be better positioned compared to rivals in other locations (Porter, 1998, p. 225; 2000, p. 25). This reasoning does not explain why the net effect is positive. Most importantly, the net start-up rate is not the central part of Porter's explanation, which is focused on how clusters promote new business formation.

[19] Some studies have applied one or two of these criteria, but the focus has been either on populations of firms belonging to the same industry or on metropolitan vs. rural areas rather than on clusters. For theoretical studies, see Aldrich (1999:Chapter 9), who links processes and context at different levels of analysis from an evolutionary perspective; and Kleppler (1995) who takes a more technical approach and link process and context based on the product life cycle. For empirical studies see Stearns et al. (1995) who propose a model to examine the interaction effects between location, industry, and strategy; and Baum and Oliver (1996), who consider both organisational and relational density at different levels of analysis.

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