CLUSTER MANAGEMENT: FROM ECONOMIC AGGLOMERATION TO LEVERAGING INNOVATION

Maria (Mariza) Tsakalerou
Department of Production Engineering & Management,
Democritus University of Thrace, Xanthi, Greece

Abstract

Businesses clusters are defined as geographical concentrations of vertically and horizontally integrated firms in related lines of business. As such, clusters are complex and dynamic structures that are continuously evolving. Cluster management consists of the development of monitoring actions and interventions aiming to improve their capacities and capabilities. Strong clusters can promote economic growth by tapping into the unused business potential of a region. As the clustering effect evolves from mere economic agglomeration into an innovation agent, it is important to focus on ways to leverage this potential for development. The objective of this article is to provide a panorama of the issues and the challenges facing cluster management today.

Keywords: Clusters; Innovation; Regional Development

The Concept of Clustering

Clusters are local concentrations of firms in related lines of business together with their supporting organizations. Local productive systems, industrial districts or business networks are examples of clusters and describe the tendency of firms in a particular field to concentrate geographically. By clustering together, it is assumed that firms can achieve economies of scale and scope and lower their business costs. The term business cluster, also known as an industry cluster, was introduced and popularized by Michael Porter in his book The Competitive Advantage of Nations (1990) as an extension of ideas of agglomeration economics presented in Alfred Marshall's seminal work of the previous century, Principles of Economics (1890).

In his own work (Porter 1998a), Porter has eventually defined clusters as geographic concentrations of interconnected businesses, suppliers, service providers and associated institutions in a particular field that compete

but also co-operate. Porter argued that a cluster is a form of network that occurs within a geographic location, in which the proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions (Porter 1998b). Key in this concept is the hypothesis that when enough resources and competences amass to reach a critical threshold in a geographical location, this confers a sustainable competitive advantage over other places in a given economic activity. Porter claimed that clusters have the potential to affect competition by increasing the productivity of the companies in the cluster, by driving innovation in the field, and by stimulating new businesses in the field.

The business cluster concept has grasped the imagination of policy makers and proved extremely popular with governments eager to develop regional policies to promote employment and growth. In an era of globalization, where small and medium-sized firms increasingly have to compete internationally, clusters can play an important role in supporting firm competitiveness by increasing productivity, innovation and firm formation and providing spill over effects to the entire geographical region.

Businesses clusters are typically defined as geographical concentrations of vertically and horizontally integrated firms in related lines of business (Porter 1990). According to Porter (2000) clusters have the potential to increase the productivity of their member companies, to drive innovation, and to stimulate business growth in the field.

Economic Agglomeration

UNIDO defines business clusters as sectoral and geographical concentrations of enterprises that produce and sell a range of related or complementary products and, thus, face common challenges and opportunities (UNIDO 2001). Interestingly, UNIDO differentiates them from business networks which are defined as groups of firms that cooperate on a joint development project complementing each other in order to overcome common problems, achieve collective efficiency and penetrate markets beyond their individual reach. Networks can be horizontal or vertical and they can be developed within or independently of clusters (UNIDO 2010).

Over the years, the concept of Porterian clusters has evolved to include diverse types of agglomeration, yet a globally accepted definition of clusters remains elusive. For most of the world, OECD's broad definition of clusters as geographical concentrations of vertically and horizontally integrated firms in related lines of business appears to be a convenient vehicle for policy-makers (OECD 1999). Industrialized and developing countries alike have been pursuing cluster policies under this umbrella definition that allows for a wide range of activities to stimulate regional development for innovation, sustainability and growth (OECD 2001).

Admittedly, a large part of the popularity of clusters lies in the vagueness and definitional elusiveness of the concept (Martin & Sunley 2003). It is precisely this ambiguity that allows both to apply the cluster concept to different realities and to prevent an accurate policy evaluation. Yet clusters have become a worldwide fad primarily because they have been associated with innovation and the knowledge economy (OECD 1999; OECD 2001). Most national innovation systems and policies from industrial districts to science parks and university research include clusters as an integral part of their arsenal.

The evidence though of a positive association between clusters and innovation capacity is not consistent (Ferreira et al 2012; INNOVA 2008). Similarly, it appears that the thesis that clusters invariably boost business performance and local development is not conclusively proven (Temouri 2012). Despite these weaknesses, the popularity of the cluster concept amongst policymakers remains intact.

Business clusters ride the policy trend of focusing on the distinct potential of individual regions. The reality of the case is that at this point there is not enough empirical evidence to support or reject clusters primarily because of the inherent ambiguities in defining clusters, identifying their members and recognizing their geographical borders.

It has been well established since the last century that economic activity tends to agglomerate over time on a national, regional or urban scale. The observed concentration of economic activity in an area does not necessarily constitute a cluster. Porter's original definition gave rise to a multitude of interpretations (Martin & Sunley 2003), which either extend it to include a wider variety of possible members or reduce it to local supply chain relations alone. Although all interpretations assume that geographical location is a defining characteristic of cluster activity, none of them defines the spatial scale on which such specialized activity should be construed as a cluster.

If an economic activity is not homogeneously spread over space, a boundary can always be drawn to define a potential cluster. Even Porter admits that drawing cluster boundaries involves a creative process (Porter 1998a).

The most popular spatial scale for cluster policy is at the regional level, but the number of clusters reported by relevant organizations is often conflicting severely (Martin & Sunley 2003; Crawley & Pickernell 2012). It would appear then that defining the geographical boundaries of clusters requires merely the consolidation of specialized economic activity without necessarily paying attention to the linkages between the actors involved. Yet Porter insists that cluster boundaries should encompass all firms with strong linkages and should safely leave out those with weak and non-existent

linkages (Porter 1998b). The problem of course is in differentiating between strong and weak linkages and no appropriate definitions have ever been provided.

Leveraging Innovation

The presentation up to this point has elucidated the problems present in defining clusters, in assessing their performance and in developing coherent, science-based policies. But this is not a polemic on clusters; rather it is an attempt to establish the groundwork for a more sober analysis. The primary challenge for cluster management is how to leverage innovation to benefit the firms in the cluster as well as the geographic region as a whole. The secondary challenge is of course to be able to identify the themes, the sectors and the actors that will make such leveraging successful.

It has been theorized, for instance, that the advantage of clusters, if there is one, has to do with the flow of information in business networks (Sureephong et al 2007; Christopherson, Kitson & Michie 2008) and the production, dissemination and absorption of knowledge (Diaz-Perez, Aboites & Holbrook 2012; Charoensiriwath 2009).

Within this framework, there is a crucial distinction between knowledge that can be codified using symbolic forms of representation (explicit knowledge) and other forms of knowledge that defy this representation (tacit knowledge). Tacit knowledge is recognized as a pillar of the learning economy and for a number of scholars provides the explanation for the persistence of local clusters in spite of a globalizing environment and a networked world (Gertler 2003; Cong & Weng 2011).

The assumption is that firms located in clusters benefit from local knowledge spill overs. Empirical data on the knowledge advantage of clusters remains ambiguous and further research is needed (Cai, Lian & Li 2009; Huber 2012). The innovation leveraging of clusters that provides them their competitive advantage is relational and not necessarily spatial.

Intellectual capital has been identified as the defining variable of business information flows (Bontis 1998, Bounfour & Edvinsson 2005, Lee 2008). Thus shifting the focus to intellectual capital as the interpretive variable for modeling business clusters introduces the major discriminants of industry sector (service vs. manufacturing), company size (big vs. small) and economic geography (developed vs. developing countries) as variables in the business cluster model.

Interestingly enough, the same distinction is made by OECD (2010) in its Innovation Policy Handbook. According to OECD, cluster policies should be promoted by different policy streams that explicitly or implicitly focus on:

- places (leading or lagging regions and economies);

- sectors (dynamic or exposed, service or manufacturing); and
- actors (small and medium or large enterprises, established firms or startups).

COUNTRY	CLUSTER SECTOR	STRENGTH STRENGTH
CHINA	Capital Goods	✔✔
GERMANY	Pharmaceuticals & Biotechnology	✔✔
INDIA	Banks	✔
INDIA	Pharmaceuticals & Biotechnology	✔
INDONESIA	Consumer Durables & Apparel	✔
MALAYSIA	Technology Hardware & Equipment	✔✔
SOUTH KOREA	Hotels Restaurants & Leisure	✔
TAIWAN	Software & Services	✔✔
TAIWAN	Semiconductors & Semiconductor Equipment	✔✔
TAIWAN	Technology Hardware & Equipment	✔✔
TURKEY	Automobiles & Components	✔
UK	Banks	✔✔
USA	Pharmaceuticals & Biotechnology	✔✔
Based on data from: data.isc.hbs.edu/iccp/		
data.isc.hbs.edu/iccp/		

Table 1: Major Cluster Strengths around the World

The fundamental advantage of focusing on intellectual capital, as a vehicle for studying business clusters, is that there is a multitude of research studies that assess its effect on firm performance (Dumay 2013). For clusters it is difficult to assess the performance of a single firm, and most studies focus on the cluster's success as a whole (Schmitz 2000, Asheim & Isaksen 2002, Motoyama 2008).

As the concept of clusters is still evolving, cluster management should focus on specific sectors and countries that are leaders in innovation and where cluster export output is observable at world level. Such thematic clusters can be identified for each country based on data of the International Cluster Competitiveness Project (ICCP) of the Institute for Strategy and Competitiveness at Harvard University, which is directed by Professor Michael E. Porter. These innovative clusters are characterized as strong

when their export value exceeds the mean for similar clusters around the world (Table 1).

For instance, Pharmaceuticals and Biotechnology appears to be a very strongly clustered sector in the US with 9 innovative biotech clusters with significant concentrations in New York State, New England, the San Francisco Bay Area and Los Angeles. Similarly, the Software and Services sector appears to be very strongly clustered in Taiwan. A "digital content industry corridor" has taken shape in the Greater Taipei area, with most companies being located in Taipei city center, in Chungho City and Hsintien City of Taipei County, or in the Nankang and Neihu industrial districts of Taipei City. Similarly, the shipbuilding industry in China is heavily clustered in Chongqing, Northern China.

Second-level examination of the innovation leveraging of successful clusters around the world reveals that there are fundamental differences between clusters in the service and clusters in the manufacturing sector of the economy.

Service vs. Manufacturing Clusters

The process of defining a cluster and identifying its members is not standardized. Worldwide there are two databases providing cumulative data on clusters:

- the Cluster Mapping Project - managed by the Institute for Strategy and Competitiveness at Harvard Business School; and
- the European Cluster Observatory - managed by the Center for Strategy and Competitiveness at the Stockholm School of Economics.

A careful examination of these databases reveals that there three major types of economic agglomeration:

a. design-intensive and artisanal industries producing output largely but not exclusively for final consumption;
b. high-technology companies and their associated supply-chain partners; and
c. service firms exploiting the availability of local skills and expertise.

While services are one of the three key types of regional agglomeration, service clusters have received limited attention in the literature generally focusing on the need for accessibility to clients (Daniels 1993). Business services are frequently encountered in the software, health care, and tourism and leisure industries (OECD 2006). Recently there has been a dramatic growth of service clusters in knowledge-intensive and professional services especially in small- and medium-sized enterprises (European Commission 2012).

KNOWLEDGE-INTENSIVE HIGH-TECH SERVICES:	• Post and telecommunications • Computer and related activities • Research and development
KNOWLEDGE-INTENSIVE MARKET SERVICES:	• Air and water transport • Real estate activities • Renting of machinery and equipment
KNOWLEDGE-INTENSIVE FINANCIAL SERVICES:	• Financial intermediation • Insurance and pension funding • Activities auxiliary to intermediation
OTHER KNOWLEDGE-INTENSIVE SERVICES:	• Education, health and social work • Recreational and sporting activities • Cultural activities
KNOWLEDGE-INTENSIVE BUSINESS SERVICES:	• Computer and related activities • Research and development • Legal, technical and advertising

Table 2: Indicative Knowledge-Intensive Services

Knowledge intensive services in particular are services and business operations heavily reliant on professional knowledge and thus their employment structures are heavily weighted towards scientists, engineers, and other experts. Often they form collaborative linkages with local universities to secure the supply of qualified, yet lower-cost personnel (Rothaermel & Ku 2008). Knowledge intensive services include ICT, renewable energies, space-based services, creative industries, digital media, mobile telecommunication and sustainable construction (Europe INNOVA 2009).

The classification of knowledge intensive services and knowledge intensive business services in Table 2 (adapted from Europe INNOVA 2009) is based on the demand side and provides for a detailed overview of the business activities covered.

Service clusters, and particularly knowledge-intensive are most often organized as horizontal networks between firms that compete for the same market. In such networks there is a rapid flow of business-related knowledge among the firms primarily due to human factors, which is often contrasted to the slower flow of information in manufacturing clusters (Cai, Lian and Li 2009; Ferreira et al. 2012).

As cluster characteristics become important *a priori* success factors, policies should be designed in ways that public and private investment is leveraged towards facilitating networking and cluster development and towards innovative actions that ensure that the cluster evolves with market changes. Often cluster policies are sectoral policies locking-in existing firms and technologies at the expense of other business activities and possibly serving as barriers to cross-sectoral collaboration.

Service clusters appear to be more resilient to varying levels of innovation finance and to the presence of a weak entrepreneurial culture. In addition they are more amenable to facilitate networking and to initiate collective projects. Within the general context of modeling the business cluster phenomenon, special emphasis should thus be placed on studying clustering in the service sector as opposed to the manufacturing sector.

Conclusion

Evaluations of cluster policies are rare and often not very robust. This is due in part to uncertainties in identifying the cluster and in isolating the impact of the policy intervention. Assessments thus far tend to focus mainly on cluster performance (OECD 2010).

As cluster performance changes over time it is difficult to disentangle performance that can be linked to the clustering effect, from general business development trends in the cluster area of activity. Cluster assessments typically proceed through cluster performance indicators and their changes over time (member satisfaction with cluster services, number of joint projects among members, etc.). At the same level, the impact of policy interventions is also difficult to assess due to time lag and attribution problems.

The crucial challenge for cluster management is thus to able to leverage effectively the innovation potential of a cluster. Benchmarking best cluster practices around the world and identifying the sectors that can provide the most benefit becomes essential in this context.

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