
REVIEW ESSAY

**INVESTIGATING CLUSTER EMERGENCE
AND EVOLUTION DYNAMICS**

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Review Essay based on: Dirk Fornahl, Sebastian Henn and Max-Peter Menzel (Eds), *Emerging Clusters. Theoretical, Empirical and Political Perspectives on the Initial Stage of Cluster Evolution*. Industrial Dynamics, Entrepreneurship and Innovation series: Edward Elgar, Cheltenham (UK), and Northampton (MA, USA), 2010, 373 p.

**CLUSTER ANALYSIS: A VAST LITERATURE, BUT FEW INSIGHTS ON
CLUSTER EMERGENCE CONDITIONS AND PATTERNS**

Where do clusters come from?¹ What are the dynamics underlying their emergence and structuring patterns, especially in their initial stage? Are these dynamics primarily rooted in the historical trajectories of the territories nurturing the specific ingredients that lead to clustering phenomena (key role of territorial path-dependency), or may they also be the outcome either of mere accidents (random factors) or purposive action (strategic moves of particular actors and/or public policies)? Beyond, may clusters emerge as the result of a “copycat effect”/ “mimetic isomorphism” (Appold, 2005; Gertler and Levitte, 2005) or from a “chain location” dynamics (Caplin and Leahy, 1998)? In other words, what are the respective roles of institutional and endogenous dynamics, of contingency, of dedicated policies and of strategic decisions? In the two latter cases, which actors appear to be crucial in initiating, accompanying or driving viable clustering processes? Finally, are these dynamics sector-sensitive (i.e. mainly driven by the properties and specific evolution of a given industry or technological field), or may they display more general features?

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¹ An exemplary possible way to answering such a complex question is provided by Casper (2007) in his analysis of the San Diego biotechnology cluster emergence, structuring and successful development. See also Brail et al. (1999) on the emergence and evolution of Toronto’s Multimedia Cluster, Robinson et al. (2007) on the emergence of Nanotechnology clusters and innovation networks in Grenoble and the Netherlands, or Ter Wal (2010) on the “Inventor Network” in Sophia-Antipolis.

At a time where nearly all National and Regional governments are engaged (or wish to engage) in “cluster policies”, the possible answers to the questions raised above are crucial and question the simplistic opposition of bottom-up vs. top-down emergence dynamics. Indeed, it has become so widespread (especially among policy-makers) that the initiation (be it from scratch) of clustering processes is not only “decidable” and feasible, but also leading (automatically in the imaginary of some enthusiastic policy-makers) to positive outcomes (in terms of innovation, economic growth, territorial competitiveness and jobs) that one may think that clustering dynamics are self-evident. Unfortunately, the accumulation of evidence on clustering failures (sometimes despite the huge amounts of money and efforts engaged, as in the exemplary cases of biotechnology in Lombardy² and Taiwan³, or media in Kuala Lumpur⁴) or, at least, on very variable yielded effects of cluster policies across regions and sectors clearly demonstrates that neither intentional actions alone (be they particularly farsighted) nor relying on purely self-organizing processes are likely to result automatically (or reasonably) in positive and viable clustering effects⁵. Successful clusters, and specifically “innovation clusters”, are neither “miracles” nor “chimera” (Hamdouch, 2010)⁶. They are the outcome of mixed, complex and uncertain dynamics, underlying at the same time “visible hands” and “invisible hands”, strategic moves and chance factors, path-dependent constraints and path-creative processes, institutional building blocks and decentralized micro-decisions⁷.

Yet, and paradoxically, despite this “rush” of policy-makers nearly everywhere for initiating “cluster policies” and the contrasted outcomes these policies have yielded, and while the theoretical and empirical literature on cluster analysis has literally “boomed” during the last two decades (for a review, see e.g. Hamdouch, 2010), very few attention and research efforts have been devoted to the analysis of cluster emergence conditions and evolution patterns. This gap has started to be filled only recently, especially within the theoretical

² See Orsenigo (2001).

³ See Dogson et al. (2008).

⁴ See Bunnell (2002).

⁵ Yet, several examples in some countries or regions (e.g. Bangalore and Hyderabad in India respectively in software and biotechnology, Beijing and Shanghai bioclusters in China, some of the “Competiveness Poles” in France in various sectors, Tama IT and biotech cluster in Japan, etc.) are truly puzzling cases as they are rather successful examples while being genuine emanations of an initial political “will”. On Chinese bioclusters’ relative success, see for example Hamdouch and He (2009).

⁶ In Chapter 12 of the present book, Rolf Sternberg refers to similar ideas when he talks about “Neither planned nor by chance” knowledge-intensive clusters emergence dynamics.

⁷ For an extensive theoretical discussion of these issues and a series of empirical illustrations, see Hamdouch (2009) and (2010), and Forest and Hamdouch (2009). See also Depret and Hamdouch (2011, this issue) on the specific case of clustering and networking dynamics in biopharmaceuticals.

“emerging” frameworks composing the “Evolutionary economic geography” approach (for a recent “sum”, see Boschma and Martin, 2010).

The core focus and added value of this book, *Emergent Clusters*, lie precisely here. Based on solid contributions by prominent specialists in this research field, the book provides an in-depth theoretical examination and enlightening sectoral case studies (aquaculture, banking, biochips, diamond trading, greentech, ICT, ink jet printing, media, etc.) in geographically varied areas (countries, regions, cities) of the very processes leading to the emergence and growth of viable clusters. Moreover, it demonstrates with clarity that “cluster policies” cannot be designed *ex nihilo* (and, sometimes, “in abstracto”) and implemented from the expression of a mere political will, be it strong and accompanied with substantial (financial) resources. Clustering phenomena are intrinsically complex, uncertain and very diversified regarding the emergence and evolution patterns they may display. Finally, the merit of the book is to show from various angles that there are no general “recipes” that could be implemented. Replicating incautiously in one place and/or within one sector what has relatively succeeded in another place/ sector is just as vain as dangerous. The context and the conditions in which a cluster can emerge and develop are time-space contingent, sector-sensitive and institutionally embedded. In short, the emergence and sustainability of a cluster and the evolutionary path it is susceptible to follow are eminently idiosyncratic.

It is impossible in this short review essay to go into detail in the presentation of each of the rich contributions that compose the book. Rather, I will only signal in the next section the core topics addressed by the different authors and the varied sectoral cases they investigate. When relevant, I will also complete this presentation by some key references or examples. I will then conclude in the last section by pointing out some crucial pending issues regarding further research on cluster emergence and evolution dynamics.

A QUICK “NAVIGATION” IN EMERGENT CLUSTERS

The book starts with a conceptual overview (Chapter 1) in which the editors put in perspective the three core issues underlying the volume, i.e.: (i) The respective roles of accidents, path-dependency and strategic action; (ii) The institutional and endogenous dynamics leading to cluster emergence in a given place/ industry; (iii) The specific patterns of a cluster emergence and growth. Their approach, which connects conceptual issues with factual insights and case studies, gives the general tonality of the book and provides a rationale to its organization in four parts. The three first parts cover each of the core issues posed above while the fourth part provides a sort of “analytical closing-loop” linking “Cluster emergence and emergence of cluster politics”. A detailed index (19 pages) completes usefully the book and allows the reader to “navigate” in it quite easily.

Part 1 is focused on the way various processes (mere accidents, path-dependent processes and strategic/ policy actions), and their possible combination, intervene in cluster emergence dynamics. It offers insights from varied industries and differentiated territorial/ institutional settings and contexts. The part is organized in three chapters. Chapter 2 by Phil Cooke is about “Jacobian

cluster emergence” (i.e. a cluster formation based on the sectoral variety available in a certain region) and examines the emergence patterns of “green technology” clusters in California, Norway, North Jutland and Wales as the combined result of the Schumpeter’s “railroadization” innovation form (one of the five forms of innovation identified by Schumpeter, based on the presence of large investments in transport, communication and knowledge infrastructures⁸) with technological convergence processes (based on regionalized technological “related variety”). Chapter 3 by Ansgar Dorenkamp and Ivo Mossig is focused on the dynamics that supported the emergence and evolution of the German broadcasting industry from the mid 1980’. They show how this has been initiated and sustained both from past decisions and from a series of accidental events related to strategic private decisions as well as shifts in regulation policies. Finally, Chapter 4 by Sebastian Henn and Eric Laureys shows how strategic action can spur a “re-birth” process of clustering and sustained development in “old” industrial or trading sectors. The re-emergence after World War II of the more than five centuries old Antwerp diamond district exemplifies how, beyond chance and contingent factors, it is the deliberate action of some key actors (here, the decision to return to Antwerp of some Jewish refugees who emigrated due to the German invasion of Belgium in May 1940) that has been crucial in rebuilding the diamond trading cluster⁹.

Privileging another, yet complementary and partly overlapping angle of analysis, the three chapters composing Part 2 focus on the role of institutional and endogenous dynamics that may explain cluster emergence. Here, the key attention relates to the nature of externalities and cumulative processes that sustain a viable clustering process within specific national/ regional contexts and sectors. Analyzing the historical process that led to the development of the German audiovisual sector since the early eighties, Chapter 5 by Anne Otto and Dirk Fornahl is focused on the way human capital inflows (both from intra-regional and inter-regional origins) have been crucial in feeding some media clusters in their emerging stage. By contrast, growing media clusters are rather mainly relying on the availability of a local labor market (see also Chapter 3 above for a complementary view on media clustering dynamics in Germany). Adopting a co-evolutionary approach, Gin Avnimelech and Morris Teubal analyze in Chapter 6 how the creation of a Venture Capital (VC) infrastructure has been crucial in initiating and sustaining a clustering dynamics in Israel around ICT activities in the 1990’. While VC companies have been at the source of many start-up creations and have acted as “gatekeepers” in their integration in

⁸ On the key role of knowledge infrastructures in initiating and nurturing regional clustering dynamics, see also the various contributions gathered in Moulaert and Hamdouch (2006).

⁹ This “happy” re-birth of a cluster after a period of brutal decline demonstrates once again the idiosyncratic character of the factors that may affect the life cycle of a given industry in a certain place. Indeed, contrary to the Antwerp Diamond District, the Birmingham Jewellery District has been unable to stop its decline all along the 20th Century (especially after the shocks induced by the two World Wars), even if a more positive evolution in recent years toward its transformation into an “urban creative district” can be hypothesized (see De Propriis and Lazzarotti, 2010).

key global innovation networks, the multiplication of growing firms in the Israeli ICT cluster has stimulated the arrival of new VC operators which in turn have stimulated further start-up creations... This cumulative dynamics is in line with what have been observed elsewhere in ICT, especially in Asia, where local clustering dynamics have (though following various specific patterns) more or less replicated the Silicon Valley model — what Bresnahan et al. (2004)¹⁰ have labeled the “New Silicon Valleys”. The key role of institutional settings in cluster emergence is also stressed in Chapter 7, yet through a very specific angle of analysis — namely, the role of standards —, in a particular sector (the salmon aquaculture industry) and in a developing country that has been a latecomer in this industry: Chile. In this chapter, Paola Perez-Aleman shows how small-scaled Chilean companies have been able to learn collectively through the standardization of quality control and product and production normalization, and subsequently to improve their production and their export competitiveness. As a result, these small companies have grown dramatically since the late eighties and Chile has become today one of the two World co-leaders (with Norway) in this industry.

The four chapters in Part 3 focus on a crucial component of cluster emergence analysis, i.e. the role of firm formation and spin-off dynamics in initiating clustering and growth dynamics within specific locations (see also Chapter 6 above). Each of the four chapters explores specific patterns of these dynamics in various sectors and territorial-institutional contexts. Based on an original evolutionary economic geography approach, and paying a central attention to the way spin-off processes and agglomeration economies combine dynamically, Chapter 8 by Ron Boschma and Floris Ledder studies the long historical evolution (1850-1993) of the banking cluster in Amsterdam. The authors show how this cluster came to dominate the Dutch banking industry through benefiting from a “window of locational opportunity” in the life cycle evolution of this industry. Chapter 9 by Donald Patton and Martin Kenney deals with the way universities can play a crucial (institutional) role in the emergence and evolution of “research-based clusters”. Their analysis builds on two detailed cases (respectively the University of Wisconsin-Madison, and the University of Illinois at Urbana-Champaign) over the period 1957-2006 and shows how these two universities have seeded and created a favorable local environment for entrepreneurship, start-up formation and clustering in various sectors (Information Technology, Engineering, Biology, Medicine and Physical Sciences). Chapter 10 by Max Peter Menzel moves a step forward in cluster formation and evolution analysis as the author studies “second generation growth” through spin-off phenomena. Based on the case of two core locations of biochip industries in Germany (Berlin and Jena), this study shows how, beyond cluster emergence, spin-offs from incumbent firms prove to be a crucial dynamic factor in sustaining the viability and growth of a cluster. Chapter 11 by Elisabeth Garnsey, Erik Stam and Brychan Thomas completes this part. It analyzes the conditions and patterns that have lead to the emergence and development of the ink jet printing industry in Cambridge (UK) since the 1970'. Here also, spin-off processes (in

¹⁰ For a broader discussion of such dynamics, see Hamdouch (2010).

successive waves) appear to have played a crucial role in initiating and consolidating the clustering process over time¹¹.

Finally, Part 4 comprises two chapters that attempt to disentangle the crucial issue of how cluster policies may influence the emergence of viable clusters. Related both to the top-down vs. bottom-up debate and to the transferability of cluster-policies models across countries or regions, this issue is occupying a growing room in the literature. In Chapter 12, Rolf Sternberg provides a two-fold analysis of policy-related cluster dynamics in high-tech sectors. First, he offers a theoretical account of these dynamics by discussing some key pieces of the literature. He therefore derives two bundles of factors (respectively demand and supply factors) that intervene in a cluster path-creation process. In a second step, he uses this approach for a comparative analysis of a sample of 10 major high-tech clusters in various sectors and countries (from the Silicon Valley, the “Research Triangle”, the Great Boston ... in the United-States to Munich, Grenoble, Cambridge ... in Europe and Kyushu in Japan). He concludes, though unsurprisingly, that the role of policy varies in cluster emergence (from nearly null to very strong impact) in different “Varieties of Capitalism”. Finally, in a complementary approach, but here specifically applied to cluster policies in Germany, Matthias Kiese in Chapter 13 studies the role of cluster policy transfer and institutional learning across countries and regions. He examines these transfers and learning processes in several regional cases and shows how they combine in various ways with other processes (especially with path-dependent regional learning and with the role of consultancies as “gatekeepers”) in explaining specific outcomes of clustering processes through policy diffusion and institutional learning.

**MOVING AHEAD:
SOME SUGGESTED PATHWAYS FOR FURTHER INVESTIGATION ON
CLUSTER EMERGENCE AND EVOLUTION DYNAMICS**

To be sure, this book and the various insights it provides constitute a clear step towards better understanding how clusters come out to emerge and evolve within specific territorial, institutional, historical and sectoral contexts. The diversity of research angles and territorial/ sectoral cases offered in the different chapters are as illuminating and complementary as challenging. Indeed, if the valuable (though not always truly original, but rather mobilized in a renewed perspective) insights they each provide on cluster emergence and evolution patterns are unquestionable, the different chapters also (even indirectly) point to much of what we still need to understand about clustering (and possibly, “successful clustering”) dynamics. On the one hand, as a cross-reading of the chapters in the book suggests, clustering dynamics result probably from a combination of various processes — self-organized as well as intended mecha-

¹¹ Many other examples exist of these “genealogical” and “ecological” local spin-off processes in the explanation of viable clustering processes (e.g. the Silicon Valley, Route 128 and the Paged Sound Region in United-States, among others, Uppsala in Sweden, several clusters in India and China, etc.). For a brief account and references on this clustering form, see Hamdouch (2010) and Hamdouch and Depret (2009).

nisms, path-dependent and at the same time randomly influenced trajectories, primarily sector-driven and institutionally shaped patterns, etc.). These combined processes may, or may not, lead to a lasting/ successful evolution pattern of the cluster that has emerged. On the other hand, the way these various “ingredients” combine and/or interfere on each other remain partly unclear. If different processes have contributed to a cluster emergence and consolidation over time, which of them has really been the most “decisive”? Or, if several factors and processes combine in the cluster emergence-evolution dynamics, are there “logical” or “efficient” ways in which these processes should chronologically operate? Finally, can sector-specific dynamics (especially if operating at the global level) be balanced by territorial-institutional particularly favorable factors?

These issues are for the most still under questioning and demand further in-depth investigation. Similarly, several crucial topics that were beyond the scope of this book still deserve additional analysis and empirical work: Are clusters the relevant or the only form of industrial agglomeration that can be envisaged? Does innovation necessarily require clustering? If so, are there typical cluster morphologies? Is there a “hierarchy” of clusters within a given sector (“first class”, “second class” and even “third class” clusters), and if so, on which performance criteria can this classification be founded? Also, do clusters follow specific “life cycles”, and then which factors may explain “cluster resilience” and survival or “re-birth”¹²? Finally, do clusters (whatever their “class”) localized in different regions or countries collaborate, network or even build “cluster alliances”? All these issues are critical, especially for defining, when relevant, adapted clustering policies (Hamdouch and Depret, 2009).

A last bundle of even more demanding challenges regarding cluster analysis is confronting (and probably “disturbing”) the researchers. At the theoretical level, much is still to be done for example on the clarification (and, possibly, the formalization) of the articulation of networks and clusters. In particular, what is the role of actors’ networking (be it strictly local or conversely widely “open”) in nurturing, consolidating and/or amplifying clustering dynamics, either at the local level or across various regions or countries (phenomenon of “Global Innovation Networks”; see Ernst, 2006, and Hamdouch and He, 2009)? At the methodological-disciplinary level, given the obvious multidimensional factors underlying cluster emergence and evolution dynamics (as demonstrated in all the contributions in this book), one can only but be convinced by the need to progress towards better integrated competences and insights from varied/ complementary social sciences that have clear insights to offer for the understanding of clustering phenomena. Historical economy and geography¹³,

¹² This issue of cluster and territorial resilience is at the core of a fast-growing theoretical and empirical research stream. For a recent review and discussion of this literature, see for example Christopherson, Michie and Tyler (2010). See also below the reference to Glaeser (2005) on the specific case of Boston, a genuinely “resilient” place.

¹³ Edward Glaeser (2005) offers a demonstration of the usefulness of such an approach, which he applies with *maestria* to the case of Boston as it has evolved and “reinvented” itself at three crucial periods in its long history since 1630.

innovation and spatial economics, spatial econometrics¹⁴, evolutionary economic geography (Boschma and Martin, 2010), social networks analysis (see e.g. Sørensen, 2003; Ter Val and Boschma, 2009), the “new science of networks” (Watts, 2004), organization science, political science, ... all have obviously something to contribute to our understanding of how clusters come to reality, survive, and may change (and grow or decline). Finally, at the empirical level, one key challenge lie in the difficulty to gather primary-detailed data (Ter Val and Boschma, 2009). At the same time, there is an urgent need for harmonizing-unifying empirical research protocols in order to facilitate comparative investigations leading to more robust, general knowledge on cluster formation dynamics. Finally, combination-articulation rather than substitutability-opposition of empirical methods (spatial econometrics, data analysis, case-studies and historical monographs, network analysis, etc.) is still to “emerge” and develop.

All in all, this book has plainly played its intellectual and scientific role, i.e.: providing undoubtedly new enlightening pieces of theoretical and empirical knowledge on “emerging clusters” that, inescapably, raise new intellectual and scientific questioning and challenges. In this way, it perfectly demonstrates how the effort for better understanding under-investigated phenomena can result in an “emerging knowledge” which, in turn, is an invitation for further exploration.

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¹⁴ A useful account on the achievements of spatial econometrics during the last thirty years can be found in Anselin (2010).

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