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Cluster Analysis and the Forest Sector — Where Are We Now?

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Abstract

This paper provides a synthesis of cluster analysis used in empirical research on industrial competitiveness. It combines 10 years of experience of cluster research conducted in OECD countries—recorded by OECD working groups—with the experiences and views of the author on the topic.

Special focus is on the forest cluster, which has attracted less attention internationally compared to other industrial sectors. The purpose of this overview is to produce input for the subsequent stage of IIASA's cluster study in investigating the competitiveness of the European forest cluster from a EU enlargement view.

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Cluster Analysis and the Forest Sector — Where Are We Now?

Esa Viitamo

1 Introduction

Since the industrial revolution and the formation of modern national economies, business managers, politicians, and scientists have all struggled with the same problem: how to sustain economic growth and competitiveness to secure future business opportunities and the well-being of citizens. Until the early 1990s, there were two competing institutional solutions to tackle this question—the market-based economy and the centrally planned economy. However, neither has worked according to its principal theories, and neither has been able to solve the puzzle completely. The collapse of communism in Russia and Eastern Europe and the structural problems faced by capitalist economies have given some indication that a more workable system might be a principally market-led economy where the main duty of the government is to maintain conditions for innovative business activity, intervening only when private incentives are too weak or distorted to promote economic growth.

The collapse of communism was an important turning point in economic history. As the two economic systems gradually converged, new ideas concerning the determinants of national prosperity and competitiveness saw the light of day in the West. Central to this new economic paradigm was the empirical finding that prosperous companies and industries are seldom isolated, rather, the opposite is true. Their success is highly dependent on the larger economic entity—or cluster—to which they belong. Thus the key to understanding competitiveness is examining the linkages within these clusters. Another important feature of the cluster approach is its goal of clarifying the duties appropriate to the business sector and to the government in an effort to create a more ideal system.

This paper summarizes the essence of the cluster approach, the ways it has been applied in empirical research and in policy design and implementation during the past 10 years. This overview also serves as a starting point for a more extensive case study on the competitiveness of Europe's forest clusters and the impacts of the European Union (EU) enlargement. The objective here is to highlight the issues that are important in extending the scope of the approach. For example, with the globalization of industries and markets, is "cluster" a meaningful concept? If so, what refinements and modifications are necessary? What can be gleaned from past national cluster research at the European level, and what are the relevant policy questions? These and other issues are discussed in the subsequent sections.

2 Clusters and Related Concepts

Defined at the most general level, an entity consisting of profit seeking actors with synergistic, reciprocal linkages may be called an economic cluster. Before its introduction in economic literature "cluster" had related connotations in other branches of science. Although the term was established in economic research during the last decade, industrial agglomerations and clusters have been the focus of scientific research as long as modern national economies have existed. One of the earliest and most well-known works on the topic is that of Alfred Marshall, who developed a theory explaining the formation of industrial districts at the end of the 19th century. Also central to the development of the theoretical basis of the cluster concept were Ronald Coase's theories of the boundaries of firms, first published in the 1930s (Coase, 1937), and Joseph Schumpeter's views of the dynamics of competition, also presented at that time. They and other economists outside the mainstream paved the way for new institutional economics, which has become an established theoretical framework in economics for explaining clustering.

2.1 Clustering Entrepreneurs

The development of industrial clusters should be seen as a long-term process originating with the rise of industrial capitalism towards the end of the 1900s. In his extensive work on the history of industrial capitalism, Chandler (1990) mentions three major drivers behind the growth of modern enterprises in three leading industrial countries—the USA, Germany, and Great Britain. These drivers, *economies of scale and scope* in manufacturing, and distribution and *transaction costs* of hierarchical governance structures,[1] were constantly changing as a result of technological development, market growth, and changes in the institutional settings of the countries. Common to successful entrepreneurs were the ability to exploit these factors in their cost-minimizing efforts and the ability to respond to the changes in altering them. In explaining the growth and clustering of activities within enterprises, Chandler's description also implicitly highlights the mechanisms of the formation of industrial clusters:

> *"Because the context, that is, the specific situations, in which such decisions were made differed greatly from industry to industry, from country to country, and from one time period to the next, the content of managerial responses differed widely. These responses varied from industry to industry for economic reasons, such as the availability of markets, supplies, capital, and labor—and also because each industry had its own production technologies and distribution requirements. They varied from country to country for cultural reasons. Educational and legal systems affected both the day-to-day operations and long-term strategic decisions: national differences in educational systems influenced the training and recruitment of managers and workers, while national legal systems defined in different ways the basic rules of the game. They varied from one period to the next*

[1] Economies of scale lead to savings through the integration of similar functions; economies of scope lead to savings through the integration of different but related functions. Transaction costs are usually invisible and consist of all expenses caused by the governance structure of a transaction (see, e.g., Williamson, 1985).

> *for the obvious reason that the technologies, markets, and competition confronting the enterprise and the industries and nations within which they operated differed substantially, often dramatically, in each decade from the 1880s to the 1940s"* (Chandler, 1990).

In the 1980s, clustering was regarded mainly as a company strategy for diversifying into new business areas. Examples provided by management sciences include Porter's early theories on growth and competitive strategies (Porter, 1985), which he later transferred from the company level to the industry and national levels in his path-breaking work. One of the earliest expressions of a cluster concept in economics was that defined by Buzzell and Gale (1987), who used the term to designate the overall company portfolio of related business units with synergistic effects.

Without getting locked into specific governance structures between markets and hierarchies, the key determinants of clustering are those proposed by Chandler. The presence of economies of scale and scope implies that there are grounds for coproduction and integration of activities. The relative transaction costs of alternative governance structures determine the boundaries of the companies in a cluster. Other proposed contributory factors for clustering are information externalities and risk sharing, which are actually special cases of Chandler's determinants applied to intangible links.

2.2 The Diversity of Concepts

Among the notable industry-level approaches related to clustering in the pre-Porterian era are the filiére research conducted in France in the 1970s, which looked at the dependencies between industries based on input-output (I/O) linkages; Dahmén's development blocks; and Krugman's refinements of the Marshallian theory on industrial districts (see, e.g., Krugman, 1991; 1995). Common to all these approaches, though to a varying degree, was the view of clusters as geographical agglomerations. This was also a distinctive feature of Porter's definition, which he introduced in his country case studies at end of the 1980s. His findings and the policy implications, presented in *The Competitive Advantage of Nations* (Porter, 1990), brought the concept and the cluster approach to the forefront, and served as the benchmark for a series of national cluster studies conducted in subsequent years. For Porter, clusters were primarily agglomerations concentrated within national borders. However, by emphasizing the importance of geographical proximity, his definition also allows a cross-border interpretation.

To identify internationally competitive industrial clusters, Porter outlined cluster charts, which took a standard form consisting of primary goods, specialty inputs, machinery for producing the primary goods, and associated services. While classifying the clusters vertically as upstream industries, industrial and supporting functions and downstream industries, the charts were later amended with supporting and related industries and customers from his diamond model (see Section 3). The notion of inter-industry linkages as a driving force for competitiveness and the visualization of cluster charts have been unanimously regarded as Porter's main contributions to cluster research.

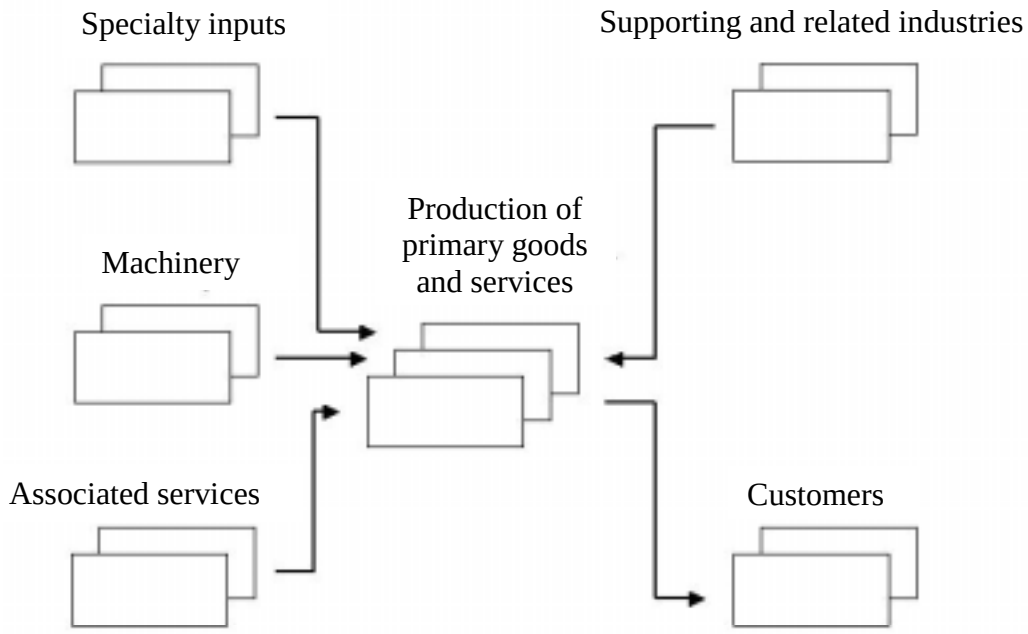

Figure 1: A Porterian cluster chart.

It should be noted that because the charts are intended to describe vertical relations between the primary industries and other sectors, they contain both companies with strong linkages as well as companies with weak or non-existent linkages. Practical difficulties with these presentations include the arbitrariness of locating the activities in different boxes and the lack of a clear principle determining which activities to include in the cluster.[2] It should also be stressed that clusters are not isolated entities, rather, activities and industries may belong to several clusters, which contributes to externalities between them. This is particularly true for service industries.

Since Porter's introduction of the cluster concept, there have been several interpretations of it in the empirical research. Probably the best-known summary of the different cluster concepts and their dimensions is the classification presented by Jacobs and De Man (1996). They found three broad groups of definitions used in cluster research: regionally concentrated and related agglomerations, vertically linked value chains and networks, and Porterian industry groups.

Because of the multitude of cluster definitions, there has been a need for a more detailed classification taking into account the various dimensions of clusters. Table 1 presents a typology of cluster definitions. In reality, clusters are usually multidimensional and, independent of their visible structure, the primary determinants in forming clusters are

[2] The clusters also do not show the relative importance of the determinants.

those proposed by Chandler. Furthermore, a closer examination reveals that all the dimensions in Table 1 are consistent with Porter's charts.

Table 1: A typology of cluster definitions based on different dimensions.

Dimensions of Jacobs and De Man	**Level of focus**	**Form of clustering**	**Presence of Chandler's drivers**
Geographical	Micro, meso	Spatial clustering	Economies of scale and scope, transaction costs
Horizontal	Meso, macro	Clustering within industry groups	Economies of scale and scope, transaction costs
Vertical	Meso	Clusters of adjacent stages in value chains	Economies of scale, transaction costs
Lateral	Micro, meso	Diversified clustering based on common activities and knowledge	Economies of scope, transaction costs
Technological	Micro, meso	Diversified clustering based on common technology	Economies of scope, transaction costs
Focal	Micro, meso	Clustering around a central actor, i.e., a company or a research institute	Economies of scale and scope, transaction costs
Quality of network	Micro	Clusters as networks	Economies of scale and scope, transaction costs

While exhaustive, Jacobs and De Man's classification lacks a sound methodology. Moreover, the stated dimensions are in fact special cases of more general dimensions like level of focus of economic activity and Chandler's drivers (see Table 1). One crucial dimension is the mode of interaction between actors in the cluster. Roelandt and den Hertog (1999a) have identified four kinds of linkages in empirical studies:

- trade or transaction linkages,
- innovation linkages,
- knowledge flow linkages, and
- common knowledge base or common factor conditions.

On a more general level, a division can be made between tangible and intangible linkages, that is, transaction and information—or innovation—linkages, which act as basic determinants in defining clusters. The interpretation of a cluster as an innovation network has its origins in the 1980s, when national innovation systems (NISs) were evolving into a separate theoretical framework for the design of technology and science policy (Roelandt and den Hertog, 1999b). This new interpretation of clusters is gaining popularity among scientists and policy-makers. One definition of NISs is that of Metcalfe (1995):

> *"NIS is a set of institutions which jointly and individually contribute to the development and diffusion of new technologies and which provide the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artifacts which define new technologies."*

Thus, implicit in the NIS approach is viewing industrial clusters as *reduced-scale NISs* with equivalent dynamics, system characteristics, and interdependencies (Roelandt and den Hertog, 1999a).

Innovation activity consists primarily of producing and exchanging intangible inputs and outputs characteristic of the business activities in services industries. Consequently, the service sector, which already accounts for over 65% of the gross domestic product in Western countries, has gained a prominent position in the new cluster approach. According to the findings of innovation studies (OECD, 1999a; Miles, 1998; see also, Leiponen, 2000), services—especially knowledge-intensive business services (KIBS)—have a central role in producing and disseminating state-of-the-art information. The importance of services for clusters is reinforced by the fact that many manufacturing industries, like those in the forest cluster, are increasingly service intensive in their production of outputs and use of inputs (Viitamo, 2000).

As illustrated in Section 3, innovation and transaction clusters overlap to a certain extent, but there may also be substantial differences depending on the industry and country. This is because transactions generally reflect business-to-business relations within value chains, whereas innovation clusters are intangible information networks that also comprise many non-profit organizations, universities and public R&D centers, and other institutions. Nevertheless, as indicated in Table 2, NIS and cluster analysis are parallel in their different level of focus, and there is a distinct convergence between them in the empirical research. Merging the approaches will result in a refined and extended cluster concept based on multifaceted linkages.

Table 2: Level of focus of NIS and cluster approaches (Roelandt and den Hertog, 1999b; OECD, 1999a).

Level	**NIS analysis and the main focus**	**Cluster analysis and the main focus**
Micro	Internal capabilities, links surrounding the firm	A network of suppliers around a core enterprise
Meso	Knowledge links among interacting firms with common characteristics: sectoral, spatial, and functional clusters	Inter- and intra-industry linkages in the different stages of the production chain of similar end products
Macro	The economy as a network of interlinked sectoral clusters or the economy as networks of institution with knowledge interaction	Linkages within and between industry groups, specialization pattern of national economies or regional economies

Like clusters, innovation systems were originally defined within a national context, but with globalization they are becoming increasingly interdependent. For example, in their study on the economic convergence of regions and technology diffusion within the EU, Clarysse and Muldur (2001:293) demonstrate that strong cooperative links exist between NISs, especially in the most advanced urban regions. For industrial clusters, innovation linkages are the main drivers of structural change because they are more susceptible to the accelerating technological change than are transaction linkages. This

implies that, not only the structures, but also the relative importance of the activities for the competitiveness of clusters are in continuous flux.

3 Porter's Diamond Model

As important as Porter's contribution to the development of cluster research has been his diamond model explaining the competitiveness of industries and nations. Because of the ongoing intensive scientific debate it generated in the 1990s, the diamond model must also be discussed in this paper. The intention here is not to go into the details of the model, but to give an overview of its basic principles. The following section deals with the methodology and briefly addresses criticism of the model, which has interesting implications on the Europe-wide cluster approach.

3.1 General Remarks

The main characteristic of Porter's diamond model is its deductive and heuristic nature. It is deductive in that it tries to summarize Porter's empirical findings of the determinants of competitiveness in several countries in one generalized framework. Its heuristic nature follows from this generality and means that it is theoretically loose, based on subjective—although realistic—conclusions of the mechanisms explaining the competitive performance. Because of its heuristic and qualitative nature, the model is difficult to test, which is typical of the theories in strategic management from which the diamond is derived. Nonetheless, the model can be seen as an attempt to develop an institutional macromodel that, intentionally or not, embraces several theories of economics and management science.

The simple logic behind the diamond model is that a nation's competitiveness depends on the competitiveness of the industries and companies forming its industrial clusters.[3] The model is usually applied to an industry level, but can also be applied at the company or country level. Performance—that is, the international competitiveness of an industry—is a function of the national industry-specific diamond and the quality and interplay of its primary determinants. In explaining current performance by past factors, the model is backward looking.

3.2 The Main Determinants and Their Characteristics

While the model is intentionally industry or cluster specific, there are determinants common to all clusters within a nation. In this sense the most distinctive determinant is *factor conditions*, by which is generally meant the endowment of factors of production. These can be divided into basic factors like natural resources, climate, geographic location, the size of the semiskilled workforce, etc., and advanced factors such as modern communication infrastructure, universities, and the size of the educated

[3] According to Porter the basic determinant of competitiveness is productivity. It also depends on innovation, which has country-specific characteristics. This is why Porter emphasizes the importance of the home base for companies in their efforts to create and sustain competitive advantages.

workforce. Another division can be made between general and industry-specific factors, meaning the extent to which different clusters are interlinked on the production input side. In particular, continuous investments in the advanced and specialized factors are the most important for sustaining competitiveness. There are three main rationales for this view: advanced and specialized factors are more difficult for competitors to imitate; technological change transforms advanced factors into basic factors; and, to a certain extent, advanced factors can compensate for a lack of basic factors or for disadvantages in them.[4]

It should be clear, however, that simply having the most sophisticated factors is not enough to ensure that a cluster will be competitive. What has not been stressed enough in the model is the co-functioning of these factors, which transforms potential competitiveness into actual competitiveness. This transformation is determined by the aforementioned NIS with its formal and informal institutions. Porter's categorization can be amended by incorporating the NIS, which is the most critical determinant influencing competitiveness.

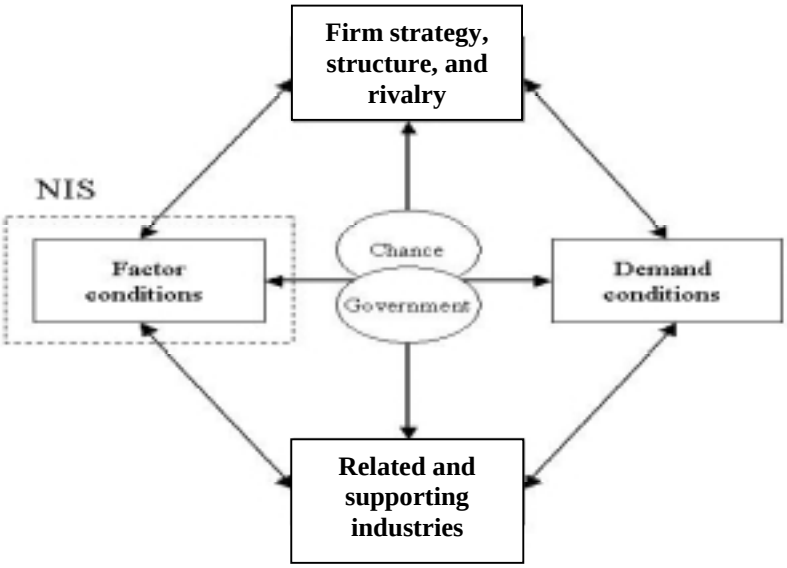

Figure 2: Porter's diamond, modified slightly.

Despite the globalization of markets, Porter emphasizes the position of domestic customers as a core component of competitiveness in *demand conditions*. This is because producers are most sensitive to the needs of their spatially and culturally closest customers, and they form the most important source of pressure to innovate and to continuously improve products. Large domestic markets are usually a competitive advantage, since they encourage large-scale investment in production facilities and technological development. But more important than quantity of demand is its quality.

[4] The last argument is of special importance and is empirically sound. The success of numerous national industries can be explained by the scarcity of important factors of production, which encourages innovation.

The competitive advantage is greatest when domestic demand is the most sophisticated and the needs of domestic buyers anticipate those of buyers in other nations.

The third determinant in the diamond, *firm strategy, structure, and rivalry*, is a relatively disjointed collection of attributes associated with horizontal competition within the industry. It is partly a non-cluster-specific element, because it embraces potential market entry of companies in other industries and competition caused by substituting products. Furthermore, there are country-specific patterns of organizing companies, management styles, rivalry, etc. Although the goals of different stakeholders and the way incentive mechanisms work are of great importance, the driving force in this determinant is the rivalry between domestic competitors. Hence geographical and cultural proximity matter much as they do for the demand conditions. The logic here is that the more uniform the business environment is for competing companies, the more intensive is the rivalry that encourages innovation.

The fourth corner of the diamond includes two kinds of industries. The *supporting* industries are vertically linked input and machinery providers, like those in the cluster charts corresponding to the vertical dimension in the typology of Jacobs and De Man (1996). Internationally competitive domestic suppliers are very important in providing state-of-art technology to customer industries. Again, it is better that these suppliers be domestic, for the reasons given above. Thus the competitive impacts within the transaction relationship also flow in the opposite direction, and the mechanisms are equivalent to those in the demand-conditions determinant.

From the perspective of the key industry, *related industries* are those that share common resources such as technology, production processes, marketing, etc., or those that produce complementary products. This means that economies of scope exist between industries relating to the lateral and technological dimensions in the typology of Jacobs and De Man (1996). The mechanisms at work between industries and their suppliers can also be found between related industries. Like supporting industries, related industries are inherently non-cluster-specific, and they channel the competitive effects and spillovers between clusters.

These four determinants form a complex, interlinked system where, to use Porter's definition of the dynamics, every element is affected by the other three. Reaping the maximum utility of the system usually requires the presence of all elements, but to some extent the insufficiency of one element can be compensated for by an abundance of the others. Sometimes the diamond itself has been interpreted as a cluster. However, although the diamond model has some elements in common with the cluster charts, the two are not equivalent. The model simply indicates how successful clusters work, or how clusters should work in order to become successful. Porter's notion that what really matters is the quality of the determinants, not their quantity, illustrates the qualitative nature of his approach.

Finally, two external factors influence the basic determinants. The policy actions of the *government* are aimed at strengthening the competitive impacts generated by the diamonds. A policy may also have unintended harmful effects, like those resulting from directly subsidizing or defending uncompetitive industries. Hence, the ideal role for the government is that of a background actor ensuring favorable conditions for business

activities. The other external factor, *chance,* is more or less beyond the control of nations. By altering the relationships within the diamond, chance may cause profound changes in the relative competitiveness of industries. Examples of such discontinuities are wars, inventions, or sudden increases in input prices.

3.3 Assessments and Broadening the Scope

Porter's pursuit of creating a general framework for solving problems associated with the national competitiveness was ambitious and was carried out at the expense of scientific robustness and excessive generalizations. This and its backward orientation have been the main criticisms leveled against the model. Some of the criticism is clearly justified, but the model has also been accused of not explaining something it never intended to explain. An extensive summary of the criticism can be found in Penttinen (1994); the focus here is on issues relevant to broadening the model's scope to the European level.

One general line of debate concerns the geographical area where competitive advantage is really created. By sticking to the national perspective, Porter's model stresses the importance of the home country and competition between domestic companies as the main sources of competitive advantage. Thus it ignores the impacts of international business activities, i.e., the strategies of multinational enterprises (MNEs) and foreign direct investments (FDIs). In reality, competitive clusters are usually transnational, concentrated especially in neighboring countries. This demonstrates that some key determinants of diamonds may be located outside national borders, and that national diamonds in fact exploit the strengths of various countries in many ways.

At the time Porter's book was published, MNEs were already seen as a driving force of economic integration. According to Dunning (1991; 1993), they are responsible for fostering networks of national diamonds of competitive advantage. Dunning notes that:

> *"Porter underestimates the quite fundamental changes which have taken place over the last decade or so in MNEs' trans-border activities… Particularly within Europe, MNEs are one of the main driving forces of economic integration. Through their internalization of intra-EC markets, MNEs are regionalizing the national diamonds of member countries… The principles of the diamond may still hold good—but its geographical constituency has to be established on very different criteria"* (Dunning, 1993; Penttinen, 1994).

One implication of the backward-looking nature of the model and its disparagement of MNEs is the implicit assumption of the harmony of interests between governments and industries. In this respect the Finnish paper industry provides an illustrative example. For decades, until the mid-1990s, almost all paper industry exports were marketed through a common association, or cartel. Because international activities during that time period were mainly limited to exports, increasing the amount of exports was the logical common goal for companies, the cartel, and the government.[5] Now, as

[5]As Heikkinen (2000) puts it in his monograph on Finnpap, the Finnish paper trade association: what was an advantage for the association was also an advantage for the industry and, no doubt, that was an advantage to the nation.

enterprises have become larger, multinationally oriented, and more independent, the alignment of interests is gradually disappearing; the objectives of the government and the industry are no longer always the same.

Associated with the underestimation of the MNEs' role in the model, Porter naively argues that FDIs in general weaken the competitive base of a host country's industries, since those countries become importers. Correspondingly, he sees outward FDIs as a sign of a competitive advantage for industry in the investing country. This kind of strict categorization had its counterpart in the mercantilist trade policy of the 17th century, when exports were regarded as good (and imports, bad) for a country. While capital no longer has any national identity, nations compete fiercely for investments irrespective of their origin. Although it increases uncertainty with respect to the continuity of business activity within a country, free capital mobility in general increases the welfare from the perspective of wider economic entities like Europe. Among the many national success stories based on FDIs are the rapidly growing information and communication technology (ICT) cluster in Ireland and the local clustering of activities around the global ABB Corporation.

Another main criticism stems from Porter's US-centric way of looking at the world and, consequently, from his attempt to apply the model to smaller European countries. As for the European countries, it has often been the case that, with or without sophisticated domestic demand, the home markets are just too small to support the development of a certain industry, which necessitates an export orientation from the very beginning. This has been characteristic for resource-based industries in the Nordic countries, suggesting again that essential parts of national diamonds may locate elsewhere without any compelling need for domestic transactions.

Many authors have also argued that Porter's view on "blessedness" of the rivalry is too simplistic, and that intensive rivalry, especially between domestic companies, does not always guarantee efficient markets and a competitive advantage. As many empirical cases have shown, fierce price competition may lead to the decline of companies, even in high-tech industries, implying that the means of competition do matter. Moreover, with small domestic markets, economies of scale may allow only one or a small number of producers. This does not necessarily imply inefficiency if the domestic market is contestable[6] or there is enough international competition. Contrary to Porter's argument, history demonstrates that international success is possible through collusive behavior, with Germany and Finland providing good examples. Efficient inter-firm market behavior is a function of many industry characteristics and is always some combination of rivalry and cooperation.

The model also equates rivalry with inter-firm competition, although the latter is really just the visible aspect of the former. MNEs, like those in the forest industry, usually consist of several business units located in a number of countries and competition for the parent company's common investment funds can be fierce. Intra-firm competition may consume corporate resources and give biased signals of the competitiveness of business units, but in general it is a significant factor in maintaining the efficiency of the

[6] Contestable markets necessitate free market entry, which guarantees efficiency even if the number of incumbent firms is small (Tirole, 1988).

corporation as a whole. For instance, in the case of the European clusters, intra-company rivalry enables management to respond to differences in competitive advantages between regions.

Despite the widespread criticism and some obvious shortcomings of the diamond model, the overall conclusion drawn from appraisals of it is that, with the above remarks, it may still be a workable framework for analyzing competitiveness. The main advantage of the model is its genuine attempt to systematically identify the determinants of competitiveness and to show how they are interrelated. As illustrated by the examples above, many of the model's pitfalls disappear if the scope is broadened geographically from the national to the multinational level.

This is quite obvious, as the construction of the model drew heavily on US conditions. The argument that the model is unsuitable for the small open economies of Europe can be countered with the argument that clusters need only be redefined using a broader geographical perspective. Because of the structural similarities between the economies of the USA and the EU, it is possible, at least with some modifications, to apply the model to the EU clusters as well. The formal integration of the EU, with its common administration and policies, has itself contributed to the creation of Europe-wide clusters.

Furthermore, the growth of MNEs and development and application of new communication technologies are continuously decreasing transaction costs and the importance of geographical proximity as a factor of competitive advantage and removing obstacles caused by regional cultural differences. These facts contribute to the most important building block of clusters: the common awareness of being a part of a larger system. To go even further, if we accept that there are Europe-wide clusters based on the criteria mentioned above, we implicitly accept the existence of even broader global clusters led by MNEs, which have instant access to global information flows.

4 Methodologies and Policy Implications

4.1 Historical Setting

Despite (and because) the critical debates provoked by the diamond model, Porterian thinking has had a considerable impact on industrial policy-making in the West. As a general framework, the cluster approach replaced the traditional sectoral approach in formulating and implementing industrial policy in the majority of Organisation for Economic Co-operation and Development (OECD) countries. There were many reasons for this reorientation, some of which were country specific; but there were also strong common contributory factors.

Toward the end of the 1980s, Western economies were showing diminishing growth rates and structural difficulties, especially with respect to the size of the public sector. For some countries the turn of the decade brought a deep recession, which called for immediate action to revise the policy strategies. An important factor that worsened economic conditions was the collapse of communist regimes in Russia and Eastern

Europe, which led to a subsequent collapse of important export markets for Western Europe. Of course, this discontinuity had a tremendous political facet too, stimulating the debates on the role of governments and the extent to which governments should intervene.

These factors created a demand for fresh ideas on competitiveness and national prosperity—and Porter had a well-timed supply. Independent of the strengths and weaknesses of the original theory, the attractiveness of the cluster approach lay in its recognition of the central role of the inter-industry linkages in the formation and development of competitive advantages. An immediate implication for industrial policy-setting was that these linkages would cause specific policy actions to have extensive cumulative effects—negative or positive—on larger parts of the economy. Of course, this was nothing new to the majority of economists, but for many national governments it was something new and was sold efficiently by Porter.

4.2 Methodology and Analytical Tools

While the cluster approach has become a standard framework for policy-making, a wide spectrum of analytical methods and techniques is used in the empirical research. This follows directly from the multitude of definitions and dimensions of the clusters outlined in Section 2. Critics argue justifiably that the diversity of approaches means that results and conclusions cannot be compared across countries and industries. A counterargument is that the versatility demonstrates the flexibility of the approach, enabling the user to consider country-specific factors and to focus on relevant research problems accordingly.

As for the methodologies, the main distinction can be made between hard (i.e., quantitative) and soft (i.e., qualitative) methods, which have been used in varying combinations. Common to all the studies based on the former line of research is the use of industrial statistics and various statistical techniques for mapping clusters. The latter method has been used in industry case studies relying more on qualitative information provided by company interviews, etc.; consequently, in these studies the emphasis of the analysis is more on intuitive reasoning.

Analysis based on Porter's diamond is distinctive in other respects, as well. It is characterized by the predefined structure of the clusters (the charts) and the explicit objective of explaining their competitiveness. For quantitative analysis, clusters are determined by measurable linkages or similarities between industries and companies. Instead of trying to explain the competitiveness explicitly, their primary objective is to differentiate between clusters according to specific attributes such as structural forms or innovation patterns. As can be seen from Table 3, case studies and input-out (I/O) analysis have dominated the empirical research.[7]

[7]Correspondence analysis departs essentially from the others by its very definition of clusters. So it is questionable whether it should be regarded as a tool for cluster analysis in the first place. However, correspondence analysis is closely related to the clustering in statistics and it is a useful tool in classifying industries.

Table 3: Main cluster methodologies and associated techniques. Modified from Roelandt and den Hertog (1999b).

Methodology	**Technique**	**Primary data**	**Focus**
Quantitative	Input-output analysis	Input-output matrices, innovation surveys	Trade linkages between industries in the value chain in the economy
Quantitative	Graph analysis	Innovation surveys, input-out tables	Cliques and other network linkages between firm and industry groups
Quantitative	Correspondence analysis	Innovation surveys	Groups of firms or industries with similar innovation styles
Qualitative	Case studies conducted in the framework of Porter's diamond model	Qualitative data combined with trade statistics and national accounts	Factors affecting the competitiveness of industries and nations

I/O analysis, which contains country-specific variations, has been widely used since long before the cluster research era to sort out the dependencies between industries. By using a chosen aggregation level, I/O tables indicate how industries are related through forward and backward transaction linkages. In doing so, they reveal the concentration of trade within clusters of industries. The identification of clusters in this way is based on certain rules that determine the minimum share or quantity of trade flows required to place the industries in a cluster (see, e.g., Roelandt *et al*., 1999; DeBresson and Hu, 1999). These rules may be exclusive, but some studies allow industries to belong to several clusters. Here the choice depends on, among other things, the availability of data on different industry classifications.

Often supplemented by other data sources and techniques, I/O tables permit the application of a wide array of statistical methods and model constructions at both the national and regional levels. The analysis yields a systematic picture of clusters and their relative significance with respect to production, employment, or other economic magnitudes. By exposing the quantifiable dependencies within clusters, the resulting cluster maps show how changes in economic conditions in one industry are reflected in other parts of clusters and in the surrounding economy. This is of importance for policy-making, where the externalities caused by discrete policy measures are quite often ignored.

Despite of its many advantages, there are also some drawbacks and limitations associated with I/O analysis. Apart from problems concerning the reliability of the primary data and comparability across countries,[8] I/O analysis is inherently static and

[8] The time lag between the construction of the tables and the compilation data on which they are based is typically several years, which decreases the validity of the tables. This is a serious problem, especially for rapidly developing clusters. The I/O tables usually can be disaggregated from the original industry classification to the desired level, but only at the expense of the reliability of the data, which are taken

descriptive, and as such is not a sufficient basis for formulating conclusions on the development and competitiveness of clusters. This is due to the very definition of the cluster being based on the volumes of transactions. As noted in Section 2, this definition contrasts with the strengthening view emphasizing innovation and knowledge diffusion as driving forces in forming clusters and sustaining their competitiveness. Of course, industry linkages of high volumes of transactions are often associated with intensive innovation activities, but this is not necessarily so (see Section 5.2).

To increase its explanatory power, I/O analysis can be—and has been—supplemented with primary data compiled by surveys on the innovation activities of industries. Based on the data from these surveys, which usually have been carried out independent of cluster analysis, it is possible to construct matrices similar to I/O tables to show the concentration and patterns of innovation linkages between industries. A comparison of these matrices—presuming equivalent industry classifications—yields additional information on the relative importance of the linkages for competitiveness and implications on how successful innovation translates into transaction volumes within clusters.

Prior to conducting a case study, clusters and their core industries must be identified. This can be carried out through I/O analysis. If the explicit objective is to identify internationally competitive clusters, the standard technique is to calculate revealed competitive or comparative advantage using trade statistics. This method, introduced by Porter, has been applied in many country studies. The logic here is that relatively large market shares of international trade indicate competitiveness, which is then explained qualitatively in Porter's diamond framework. This second phase rests heavily on the researchers' insight and ability to identify the actual determinants of competitiveness.

Compared with purely quantitative methods, monographic case studies offer decided advantages in many respects. In general they facilitate understanding of the *real* functioning of the economy by providing more in-depth information on the cluster linkages. More importantly, they try to answer the fundamental question of why some industries succeed in certain countries while some do not. At their best they are multidisciplinary, showing the dynamics of the competitiveness and capturing the richness and variety of innovative behavior within clusters.

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from the multitude of primary statistics. In most cases, I/O coefficients include only transaction flows in the *business-as-usual* state, excluding investments over a certain threshold. Hence they underestimate the real tangible and intangible flows between industries.

Table 4: Dimensions of cluster analysis in selected countries. After Roelandt and den Hertog (1999b).

Country	Level of analysis			Cluster techniques					Cluster concept
	Micro	Meso	Macro	I/O	Graph	Corres.	Case	Other	
Australia		X	X			X	X	X	Marshallian industrial districts
Austria		X	X	X			X		Networks of production and innovation
Belgium	X				X			X	Networks of production and innovation
Canada		X	X	X			X		Systems of innovation
Denmark	X	X		X	X		X		Resource areas
Finland	X	X					X		Clusters as unique combination of firms
Germany	X	X		X		X			Similar firms and innovation styles
Italy		X		X					Inter-industry knowledge flows
Mexico		X	X				X		Systems of innovation
Netherlands		X	X	X			X		Value chains and networks of production
Norway			X	X					Value chains and networks of production
Spain		X		X			X		Systems of innovation
Sweden		X					X		Systems of interdependent firms in different industries
Switzerland	X	X				X	X	X	Networks of innovation
UK	X	X					X		Regional systems of innovation
USA		X		X		X	X		Chains and networks of production

The criticism against Porter's model discussed in Section 3 extends to his methodology as a whole (Penttinen, 1994). The majority of the problems stem from the methodology's qualitative nature and its ambitious objective of explaining competitiveness. In general the lack of rigor gives researchers too many degrees of freedom to draw conclusions, which consequently may stay obscure. Furthermore, because of the unsystematic techniques, the results are difficult to compare across industries and countries.

Using export market shares as an indicator of competitiveness alone is not without its problems. Large market shares may also reflect monopoly power or economies of scale in technology forcing the industry to export even if doing so is not always profitable. Furthermore, international trade is increasingly internal transfer of intermediate products within multinational companies, which may be explained by factors with only

weak connections to the real competitiveness of the industry in a country.[9] To conclude, there are many other complementary indicators of competitiveness—such as productivity, profitability, prices, quality of factors of production, etc.—that should be taken into account.

Nevertheless, the weight and explanatory power of trade statistics increase by broadening the scope to the EU level. While the I/O tables describe the industry linkages within the national context, trade statistics describe linkages between countries and their industries within an equivalent but larger institutionally integrated entity. They also reveal the degree of specialization and geographic concentration of production and trade, which are expected to increase as a consequence of integration—such as with the EU enlargement.[10]

Although consistent with the Porterian approach in emphasizing that it is the ability to create and to maintain sophisticated factors of production that matters, the new cluster approach that defines clusters as reduced forms of NISs has brought about a change in the primary focus. It has also brought into question the suitability of the available analytical methods. For the empirical research, this assumes a departure from structural analysis toward methodologies that enable *jumping* into the clusters to identify the competitive mechanisms of the interplay between actors. This will be achieved through improved consistency between the traditional quantitative and qualitative methods and through the extension of the analytical tools to those applied in the research on institutions.

4.3 Cluster Research as a Policy Process

In the effort to increase competitiveness, cluster research serves two general purposes. First, it helps enterprises to see their position and significance in a context beyond their day-to-day business environment. An increased awareness of cluster linkages broadens the scope of actual business opportunities, contributing to networking and knowledge spillovers between actors in the cluster.

Second, and more important, cluster studies serve as a tool for policymakers trying to enhance the competitiveness of industrial clusters. By acknowledging the central role of government, the cluster approach indicates a strong policy orientation. This is important to note as it gives direct implications of the current economic difficulties faced by the Central and East European Countries (CEEC). After the collapse of the communist

[9] Contrary to the market share logic, an industry may still be competitive while exporting little and having relatively large domestic market shares, or if imports are high in relation to exports. Examples of this kind of trade pattern can be found in the European pulp and paper industries. Similarly, the true competitiveness of certain niche products may be hidden because of a too-high aggregation level of product classification. In terms of the European paper industry, this shows up in the close equivalence of import and export figures in several countries, indicating a degree of specialization in that industry.

[10] One factor that has impeded comparisons across countries and research on transboundary clusters is the difference in the level of aggregation used in production and foreign trade statistics. This is to some extent still the case even in the EU, despite the common goal of standardized and uniform industrial classification.

regimes, many of them have undergone rapid liberalization and privatization, and the position of government has become unclear or its possibilities for intervention have been minimized. With inactive administrations and institutions, it is difficult if not impossible to achieve a stable and controlled economic growth path (see, Eichengreen and Kohl, 1998).

What is meant by cluster-based industrial policy? Is it ultimately nothing more than new justification for traditional actions and initiatives taken by governments to regulate and steer the economy? Furthermore, if there is a multitude of cluster definitions and approaches, is it appropriate to speak about a distinct policy framework? For the first question, the answer is a simple no if one looks only at the policy implementation level. The cluster policy becomes viable only if it meets the specific criteria of the procedure for arriving at certain policy measures. It is then necessary that policymakers understand the mechanisms of the policy-research path and the impacts of their actions. As for the second question, the answer is yes because, independent of the approach adopted, the nature of the policymaking process is generally the same in all cases.[11]

Looking from the process perspective, cluster research and policy can be seen as a part of the internal dynamics of the cluster itself. By using Porter's diamond model (see Figure 2), government (policymakers) and increasingly also industry finance cluster studies conducted by universities and research institutes (sophisticated factors of production). These studies provide accumulated knowledge on the functioning of clusters and the appropriate policy recommendations and the resulting policy design and its implementation influence the interplay of the determinants of the diamond.

The Finnish experiences at the beginning of the 1990s illustrate the overall procedure nicely. In Porter's terminology, *chance* in the form of an unforeseen and deep recession, aggravated by the collapse of communism in the Soviet Union, forced the government to revise its industrial policy. The result was a pronounced need to identify the real origins of national competitiveness, which led to a series of government-initiated industry studies. The perfect match and timing of demand for and supply of new ideas led to the application of cluster analysis in the empirical research. The rapid recovery and successful restructuring of the economy strengthened the position of the cluster approach in formulating industrial policy for subsequent years.

With the increased popularity of the cluster approach in Western Europe has also come an increased chance for side effects, which may lead (or have led) to non-optimal allocation of public finances and other resources. In most cases publicly funded research projects aiming to create entirely new clusters, have failed because of inadequate *diamonds*. In initiating cluster research programs within a certain branch of the administration, policymakers may simply be trying to advance their own careers or to obtain more public finances. In some cases, the cluster concept has been used only as an excuse to continue old-style policy-making.[12]

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[11] According to the definition presented by Boekholt and Thuriaux (1999), cluster policy comprises policy activities that aim to stimulate and support the emergence of networks, strengthen the inter-linkages between the different parts of the networks, and increase the added value of their actions.

[12] A related strategy is using the cluster concept for lobbying purposes or to draw public attention to the importance of certain industry groups. Where the aim is to transmit objective information to support

4.4 The Dynamics of Cluster-Based Policy

As implicitly pointed out in previous sections, cluster definitions—with their various dimensions—and choices of analytical techniques and methodologies are strongly interdependent. Taking into account the third variable, policy issues, the picture becomes even more complex. For example, choosing one cluster definition a priori means locking in to certain analytical tools and vice versa. The outcome of the research process, if based on objective reasoning, can then be a limited set of policy recommendations.

Especially in the early 1990s when, inspired by Porter's book,the cluster research boom started to sweep over Western Europe, it was not always clear what the proper division of labor between policy-making and research should be. Quite often, the process started with policymakers setting out the general objective of identifying the cluster structure of a country and researchers arriving at some definitions by certain criteria. The cluster structure was then determined, accompanied by some policy recommendations following from the analysis. These *first-round* studies often lacked the straightforward link from the analysis to the conclusions, resulting in quite general recommendations, which were based more on common sense.

On the other hand, conducting this kind of procedure was understandable, because no systematic cluster policy, as it is understood today, existed. Even if the implications were obscure, the important outcome of these exercises was the general awareness that clusters are central to the competitiveness and prosperity of nations and therefore should be investigated more closely. So, the first round of cluster research laid the foundation for adopting the cluster approach as a general template in designing and implementing industrial policy.

Common to the evolving cluster policies was the incorporation of the traditional industrial and regional policies with science and technology policies. However, since the countries differed in their initial economic conditions and cluster interpretations accordingly, they arrived at different policy priorities. In general, Boekholt and Thuriaux (1999) have distinguished four policy regimes, grouped as *models*. The *national advantage* model, which follows directly from the Porterian line of reasoning, aims to improve the competitive conditions of clusters that are, based on certain criteria, important for a country (e.g., Finland, Denmark, and Canada). For the *small and medium-sized enterprises* (SME) model, the cluster policy is equivalent to promoting networking between SMEs. Here, public agencies work as brokers to initiate collaboration, which is usually a prerequisite for enterprise innovation (e.g., USA, New Zealand, Australia, and Norway).

Initiatives to stimulate clustering have been most explicit at the sub-national level, where the outcome has been dependent on, among other things, the distribution of decision-making power between the central and local authorities. This *regional policy* model is also in line with Porter's argument in that many of the competitive advantages

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policy-making, the welfare effects are clearly positive. On the other hand, if the primary objective is to gain advantages and a higher profile by presenting overestimated figures of an arbitrarily defined cluster, the harmful impacts accumulating through incorrect policy actions may be considerable.

of nations are actually local (e.g., Wales, Styria, the Basque region). The fourth policy approach can be called the *research-industry relations* model, where the principal objective is to stimulate collaboration between industry and research institutes to make better use of public knowledge resources. Here the focus is on creating networks within spatially concentrated centers of excellence, especially around the emerging technologies.[13]

Clearly, these policy models are not mutually exclusive; rather, they can be interpreted as different layers of larger policy packages. The national advantage model, reflecting the policy priorities at the national level, has usually been combined with others that are subnational in nature. The clear distinction between these models can be seen in terms of cluster creation. Whereas the Porterian policy concentrates on supporting existing strong clusters, the goal of the other models is to encourage the formation of new clusters and networks where SMEs play a central role. The Porterian model generally focuses on distinct value chains, whereas for the others the starting point is promoting microlevel networking within and across the traditional value chains and clusters. Furthermore, by encouraging international inward investments, the regional policy model also contributes to formation of cross-national clusters. Despite the absence of explicit cluster policies this has been distinctive to the national policies of the CEECs. Asset privatization by attracting FDIs is believed to stimulate economic growth, technological spillovers, and integration into the EU (Hunya, 2000).

In a way, the differences between the policy models developed during the 1990s reflect the evolutionary change in viewing the clusters and the sources of competitiveness. This change has been a function of global trends, namely, the integration of markets, the liberalization of international trade, and the acceleration of technological change. Implicit in the last three models is the recognition that to understand the functioning of the mesoclusters and to produce more targeted policy recommendations, one should look into the networking patterns within them. In a globalizing world, regional considerations in policy-making become more important and the creation of knowledge, its efficient dissemination, and the ability to translate it into new products constitute the core of competitiveness. This last notion lies at the heart of the fourth policy model, where the cluster is interpreted more as a reduced form of an innovation system based on knowledge value chains.[14]

The above policy models have their potential counterparts at the European level, provided that some kind of cluster policy framework is adopted. From the EU point of view, cluster policies are currently regional, restricted to within national borders. What is quite sure is that these limitations are not Pareto efficient in creating regional clusters and networks, which necessitates cross-border initiatives and agencies. Another

[13] Boekholt and Thuriaux (1999:382) have grouped the activities (tools) in implementing these models into three categories. *Policy programs* are mechanisms for allocating support to collaborative projects. The *framework conditions* for specific clusters can be influenced using traditional policy measures like standards, tax regimes, etc., and by providing specialized facilities like R&D, technology centers, etc., with the objective of altering the competitive conditions of a cluster. The third category is *strategic action* for clusters through the provision of strategic information (market information, benchmarking), through mapping exercises, or by facilitating communication within or outside the cluster.

[14] As noted previously, this does not require geographic proximity.

important policy issue is the trade-off between specialization and sustaining sufficient competition. As for subsidizing the centers of excellence, specialization by country and concentration would increase the productivity of financing, but at the same time it may decrease interregional competition, which is imperative for technical development. A related consideration is whether the EU should take the Porterian stance to promote certain EU-wide clusters, which would inevitably lead to regional specialization and a null-sum game between the member countries.

In addition to the global megatrends, the change in policy orientation has been due to the evolution of the national industrial structures themselves. This evolution is characterized by a long-term transformation through different stages (see, Porter, 1990:685), which has required refinements in economic policy accordingly. At the investment-driven stage of the post-war growth of Western economies, industries with high investment needs dominated and strengthened the clustering around them. It was unanimously agreed that governments should intervene actively and selectively and facilitate investments and exports of key industries.

The innovation-driven stage reached during the 1990s has been mainly the consequence of the maturing of traditional manufacturing industries and the liberalization of international trade, which forced enterprises to invest more resources in R&D. With the acceleration of technological change, innovative high-tech industries and related services have gradually become the drivers of economic growth. For economic policy, this has provided a shift from active intervention and protection to the creation of favorable framework conditions for business activities.

The general change in policy objectives has been accompanied by a gradual shift from the top-down approach—inherent in the national advantage model—to the bottom-up approach. The former is basically market based, with government setting the national priorities and selecting the dialogue groups. In the latter, cluster formation is based primarily on market-induced initiatives and the role of government is to facilitate the networking process by creating an appropriate institutional setting (Roelandt and den Hertog, 1999a).

Furthermore, regardless of the differences between the policy models, they share some general rationales for cluster-based policy-making and the actions that governments may and should take. These rationales ultimately stem from imperfections in the markets caused by externalities (commodities, knowledge, and pollution) and the divergence of public and private objectives.

Table 5: Systemic and market failures and policy responses in selected countries. Roelandt and den Hertog (1999a).

Systemic and market failures	**Policy response**	**Focus of cluster-based policy-making in different countries**
Inefficient functioning of markets	• Competition policy and regulatory reform	• Most countries
Informational failures	• Technology foresight	• Netherlands, Sweden
	• Strategic market information and strategic cluster studies	• Canada, Denmark, Finland, Netherlands, USA
Limited interaction between actors in innovation systems	• Broker and networking agencies and schemes	• Australia, Denmark, Netherlands
	• Provision of platforms for constructive dialogue	• Austria, Denmark, Finland, Germany, Netherlands, Sweden, United Kingdom, USA
	• Facilitating cooperation in networks	• Belgium, Finland, Netherlands, United Kingdom, USA
Institutional mismatches between (public) knowledge infrastructure and market needs	• Joint industry–research centers of excellence	• Belgium, Denmark, Finland, Netherlands, Spain, Sweden, Switzerland
	• Facilitating joint industry–research cooperation	• Finland, Spain, Sweden
	• Human capital development	• Denmark, Sweden
	• Technology transfer programs	• Spain, Switzerland
Absence of demanding customers	• Public procurement policy	• Austria, Netherlands, Sweden, Denmark
Government failure	• Privatization	• Most countries
	• Rationalize business	• Canada
	• Horizontal policy-making	• Canada, Denmark, Finland
	• Public consultancy	• Canada, Netherlands
	• Reduce government interference	• Canada, United Kingdom, USA

Independent of the adopted policy model a second and a third round of cluster research is undertaken in many countries. Multinationals, which dominate production and international trade, decide where to locate their activities based on the total attractiveness of countries, and the borders of national clusters are becoming increasingly blurred. Consequently, the uncertainty concerning the traditional strengths of nations has been increasing. Hence the creation of an innovative business environment and maintenance of sophisticated factors of production have become the backbone of national cluster policies. Compared with the first-round studies, the analysis now more directly serves the needs of policy objectives and there is a more straightforward link between analysis and policy implications.

The shift in the policy toward increased management of NISs can also be justified by the industrial-evolution argument. This is in fact a precondition. Western economies are in transition from the innovation stage of the traditional industrial structures further to a knowledge-based economy where economic growth is strongly dependent on the interplay between knowledge-creating institutions, KIBS, and virtual value chains on the production side. For the current policy rationales, the systemic and market imperfections of the innovation systems, there is basically nothing new, but the focus is shifting more toward technological and science policies and institutional settings. As revealed by the convergence of national policy priorities, this change may also lay the foundation for a common policy at the EU level.

5 The Forest Cluster and Current Trends

Having addressed cluster definitions, the analytical methods, and policy implications, the next logical questions are: what clusters have been identified and what shapes do they take? The focus here is on the forest cluster as a special case. Generally speaking, most of the definitions and analytical tools dealt with here have been applied in studies on forest clusters, and the remarks on the development of policy rationales are also deductible to them. Therefore, instead of going into the findings of the various studies,[15] the objective here is to examine some general trends that are of relevance to cluster research at the European level.

5.1 Forest Clusters Worldwide

According to the OECD report on national cluster studies (OECD, 1999b), countries identified as having a strong forest cluster are, not surprisingly, the USA, Sweden, Finland, and Austria. These countries have an abundance of forest resources and, with the exception of the USA, the forest cluster products account for a significant share in their total production and exports. With respect to the forest clusters, the OECD report reveals other noteworthy commonalities between these countries. With the exception of Austria, the cluster mix consists of a *construction* cluster, the core of which is one of the main customer segments of the forest cluster, and an *energy* cluster, the significant provider of production inputs.[16] Furthermore, these countries all have a strong ICT cluster, which contributes not only to the increase in technical efficiency at all stages of production within the forest industries, but also to their organizational restructuring.

However, there has been a common and deep-rooted belief that some countries, particularly those in Europe, are forest industry countries while some are not. This is not consistent with the facts that emerge, e.g., in a recent study on European forest-based industries and agglomerations (Hazley, 2000). All countries have some elements of a forest cluster within their industrial structure, whether the cluster is important or not.

[15] See the references in OECD (1999b).

[16] The core industries in the energy cluster are energy production and energy technology manufacturing, which belong to the supporting and related industries in the forest cluster. In Finland, the rise and international competitiveness of the energy cluster were strongly supported by the stringent demands on the part of the forest industry (Hernesniemi and Viitamo, 1999).

Moreover, as indicated above, identifying those specific clusters does not preclude the existence of strong forest clusters in other countries, again demonstrating the interdependence of the cluster definitions and the analytical approaches.

For example, the large-scale forest industries in Canada and Japan imply well-developed cluster structures despite the countries' differences in international orientation. In addition to the Nordic countries, Germany, France, and Italy are significant producers and exporters of forest cluster products. However, these and other European countries use a larger share of production for domestic markets and have high import levels relative to total consumption. So instead of classifying countries according to the strength of the forest cluster, it would be more appropriate to characterize them according to specific attributes such as the degree of market orientation, technological intensity, and resource dependency.

5.2 The Structures and Cluster Dynamics

Figure 3 illustrates a standard Porterian cluster chart of a developed national forest cluster including all important activities. The manufacturing of primary products is characterized by strong economies of vertical integration and economies of scope, which, especially in Nordic countries, have been accompanied by economies of ownership concentration. The forest industry in the Nordic countries is also characterized by a high degree of self-sufficiency in energy production, because the pulping process produces considerable energy as a by-product.

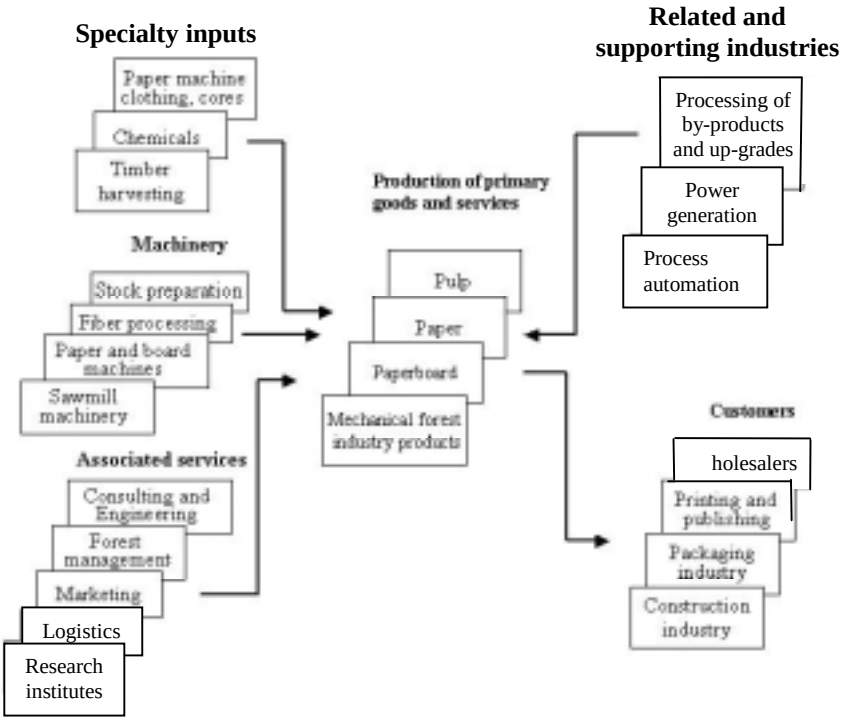

Figure 3: Standard structure of a developed forest cluster.

In Central and Southern Europe, the production of primary goods is less concentrated in terms of ownership and production volumes. Furthermore, cluster activities in those regions are distinctively market oriented and they consist typically of industries, which are customers of those in the Nordic countries. Either way, the cluster chart in Figure 3 can be modified to describe national clusters and a Europe-wide cluster with activities located in different regions. Hence, Porter's diamond can be applied at both levels and to each industry individually.

As suggested by numerous studies, Ricardian comparative advantage in basic factors of production no longer explains the international competitiveness of countries. This is particularly true for technologically sophisticated products and industries, where competitiveness is determined more by the innovation process—from the generation of knowledge to its translation into new products and processes. This suggests that the more decisive determinants of competitiveness are the absolute abundance of sophisticated factors of production and company strategies for locating their production accordingly (Dunning, 1993; 1999).

Porter goes even further, arguing that competitive advantage based on natural resources is unsustainable because it shifts rapidly and because global competitors can easily circumvent it. According to Porter's industry categorization, this explains why resource-based industries cannot be the backbone of advanced economies (Porter, 1990). That notion and the consequent exclusion of forest industries from his empirical studies caused a lot of criticism, and clearly for some countries the opposite has been true. Like industries based purely on highly sophisticated factors of production, the advanced forest clusters provide significant R&D input in the form of high-tech facilities and requirements for developed marketing and managerial skills.

There is no doubt that raw material abundance has traditionally dictated the location and competitive advantage of the forest industry, but the picture is changing. The liberalization of world trade, the diffusion of production and communication technology, and the increased sophistication of demand have shifted the core of competitiveness to the ability to innovate and access technology and markets. Using Porter's classification of clusters in terms of their trajectories, advanced national forest clusters have moved from the phase driven by factors of production to the investment- and innovation-driven phases (Hernesniemi *et al*., 1996).

What then is the relative importance of the cluster linkages for the innovation activity? This is highlighted in Figure 4, which uses the Finnish pulp and paper industry to illustrate the similarities and differences between the *transaction* cluster and the *innovation* cluster.[17] As pointed out in many innovation studies (OECD, 1999a), large companies with more resources tend to rely more on internal innovation than do SMEs. Knowing the company size in the pulp and paper industry, the high score in internal innovation activity supports this kind of correlation. In that sense, the innovation and

[17] In 1997, Statistic Finland conducted an innovation survey of Finnish industries. Respondents from the companies in the sample were asked to rank alternative sources of innovation by importance (0 = no importance, to 3 = very important). Mean scores are shown in Figure 4. It is interesting to note that although the point of departure of this survey was not explicitly the cluster framework, as seen in the picture, the innovation sources are consistent with Porter's diamond.

transaction clusters seem to be equivalent, because companies are vertically integrated with long internal value chains.

As seen in Figure 4, the greatest divergence between the clusters is in the relative importance of the customers—typically big printing and publishing houses in Central Europe. While the associated transaction volumes are also high and the innovation patterns vary by country, this divergence demonstrates that the NISs are highly interdependent and that the main determinants of competitiveness may lie outside national borders. Furthermore, a look at supporting and related industries indicates that *informal* linkages between cluster companies are of considerable importance.

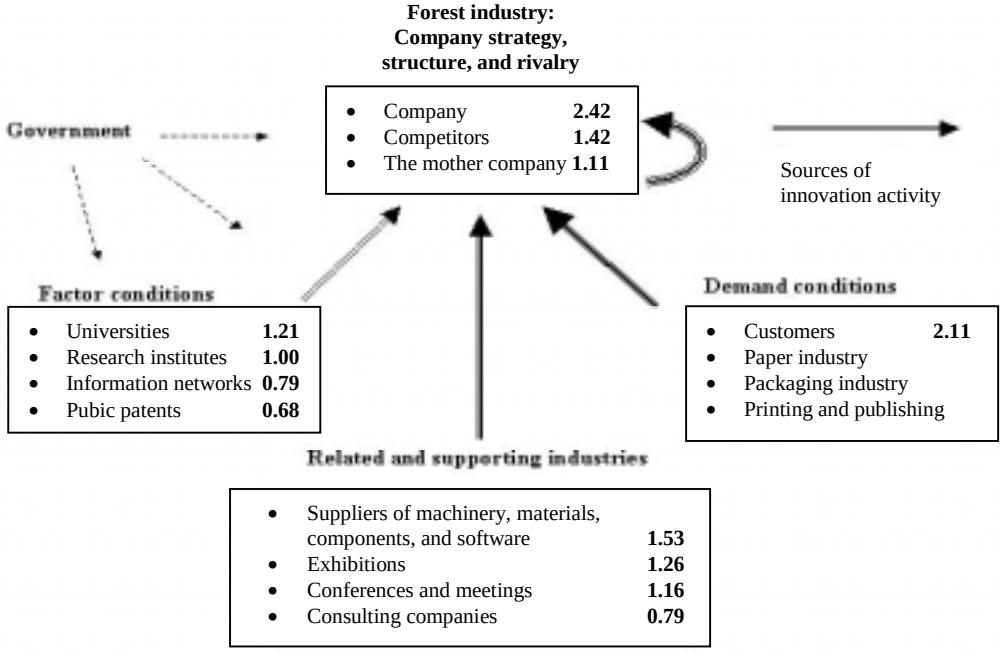

Figure 4: Innovation cluster of the Finnish pulp and paper industry.

Porter notes that, "in the innovation stage the full diamond is in place in a wide range of industries and all the determinants are at work and their interactions are at their strongest." At the cluster level the innovation stage is manifested by the following dynamics of the diamond:

- *Factor conditions*: Advanced and specialized factors are created and upgraded, selective factor disadvantages accelerate the upgrading of competitive advantages.
- *Firm strategy structure and rivalry*: Firms develop global strategies.
- *Demand conditions*: Demand sophistication becomes an advantage, domestic demand becomes more international through a nation's multinationals.
- *Related and supporting industries*: Related and supporting industries are well developed.

These conditions are, in one way or another, met by all European countries with advanced forest clusters, which may anticipate a more general development facilitated by deepening integration. Another essential feature of the innovation stage is the growing importance of services in all parts of the diamond, which is one expression of the growing share of the service sector in Western economies. In the advanced forest cluster, the growing use of business services produced by modern ICT has resulted in increasing service intensity of all value chains. On the input side, this has been due to the outsourcing of service activities and the gradual substitution of intangible inputs for tangible ones, especially wood.[18] In addition to the technological change and the increase in knowledge intensity, the gradually diminishing relative importance of domestic raw material resources for innovative forest clusters is also the result of the liberalization of trade and the increasing global supply of roundwood.

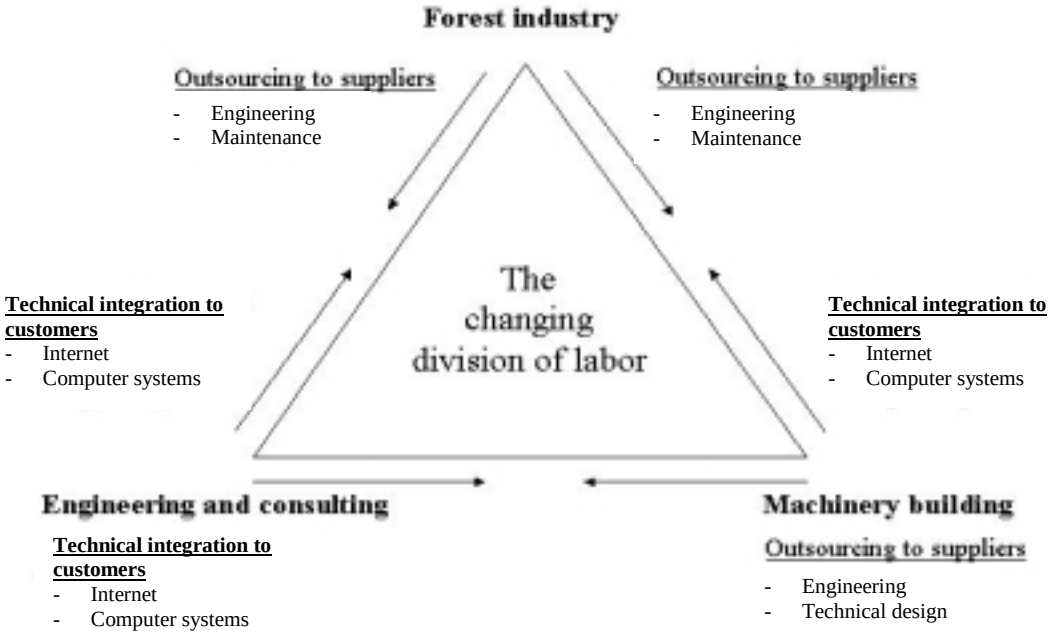

Figure 5: Example of the dynamics between the key industries in the advanced pulp and paper clusters.

The current restructuring of activities between industries can be illustrated by the change in the division of labor in the advanced pulp and paper clusters. The forest industry is outsourcing technical design and production services to engineering companies and machinery manufacturers. These companies have online connections to the information systems of their customers, enabling the supply of services regardless of geographical location. In outsourcing manufacturing and concentrating more on

[18] The most important service inputs for future competitive advantages are consulting and data processing services, but logistics and maintenance services are also important. Knowledge intensity is increasing as a result of the application of ICT.

technical design and engineering services, the business activities of machinery builders increasingly resemble those of traditional engineering companies. While this results in intensified competition, machinery builders are outsourcing general design activities to consulting companies demonstrating the dynamics of rivalry and cooperation.

5.3 New Challenges for Modeling

There is an interesting historical analogy between the current world of fast-developing ICT and the development of communication and transportation technology and infrastructure at the time of the emergence of modern capitalism in the end of the 1990s. As for the latter, Chandler (1990) has concluded that by reducing the overall transaction costs, it totally changed the structure of markets, intensified international rivalry, and, most important, forced entrepreneurs to turn operational management over to professional business managers, who were encouraged to further organizational innovations within the corporations. To demonstrate, the substitution of steamships for sailing ships in overseas transportation accompanied by the development of icebreaker technology led to a considerable change in the competitive situation in the European forest industry. This favored the Nordic countries and especially Finland having the biggest geographical disadvantage.

Notwithstanding the accelerating technological progress since that time, industries—including the forest industry—are facing equivalent pressures for institutional reorganization, and for the same reasons. In addition to the rapid development of the ICT there is also a general convergence of technologies, not only between communication and information technology, but also between ICT and the process technology of the forest industry.[19] In terms of market relations, this has resulted in a deepening integration of information networks between the forest industry and its customers and suppliers, contributing to a further reduction of transaction costs within the national and international clusters.

Another facet of this change is the simultaneous increase in the standardization and complexity of technologies, which is transferring the competitive advantage in knowledge and production of services to specialized suppliers, leading to a growing pressure for forest industries to outsource their supporting activities. In the first place, this concerns services like logistics, maintenance, and engineering, but in the future it will also apply to larger complex entities of functions, that is, operation of the production processes at different stages of the value chain. As the company specificity of technology decreases, the core competence in the industry is shifting to production design, customer relations, and marketing. Because of the economies of scale and scope in the supplier and customer industries, the comparative advantages of institutional changes correlate positively with the concentration of the industries.

Because of industrial evolution and changes in the relative importance of determinants of competitive advantage, modifications in modeling are also called for. An alternative approach to capturing the dynamics of the forest cluster—or, more generally, the innovative clusters—is to look into the elementary subcategories of competitiveness,

[19] This has lead to the increased use of embedded software.

which may be called *technological* and *institutional* competitiveness and the competitiveness arising from *market behavior*. Hence, the total competitiveness of a cluster will be determined by the existence and interplay of these elements.

The technological dimension embraces available production machinery; supporting technology, especially automation and ICT (used to operate, control, and maintain the production facilities); and the know-how required to exploit tangible assets. In terms of Porter's diamond, these determinants are located in factor conditions and in supporting and related industries. Market behavior consists not only of firm strategy, structure, and rivalry—the horizontal dimension of competitive behavior—but also the strategies connected to vertical cooperation and control within the value chains. Thus, this category takes into account the comprehensive market behavior of the actors in the cluster covering all factors in the diamond accordingly. The institutional competitiveness refers to the efficiency determined by make-or-buy decisions, that is, organizing transactions and information flows between markets and hierarchies (Williamson, 1985; Menard, 1997). Although partly included in company strategies of Porter's diamond, institutional changes also cover actions taken by non-market organizations.[20]

In reality, the interplay and mutual dependence of these categories is complex, but it can realistically be assumed that there exists a certain pattern of causality between them. Technological change in the cluster may be regarded as an exogenous variable—although for leading countries it is also endogenous—especially in terms of the European forest cluster, because of the concentration of the supply of state-of-art technology and the easening access to it.[21] Technological changes in turn induce changes in market behavior, rivalry forms, and the structure of industries. This is especially true for the development of ICT, which encourages new market entries and differentiated services. Equally important is the cluster's ability to respond in the form of institutional changes required to fully exploit the impacts of competitiveness created by the other factors.

With respect to competitive advantage, the importance of institutional effects has been largely ignored in the mainstream literature. But it is an important factor, especially for clusters with mature key industries and long-lasting inflexible structures, such as those of the forest sector. The large differences in company size across Europe suggest that institutional aspects matter. They also indicate that, regardless of barriers to trade, in countries where companies tend to be small, it has been possible to compensate, at least partly, for insufficiencies in other determinants through institutional flexibility.

There are also some interesting implications for the potential competitive advantages of East European countries that are in a relatively undeveloped technological and institutional setting. The rapid technological development in information technology in Western Europe will sooner or later transform the rigid organizational structures of the forest industry into more flexible ones, while the application of these technologies

[20] In reality, the distinction between the change in vertical relations and institutional structures is often difficult to make. In cases where the outcome is transformation of liabilities, like outsourcing, they are equal.

[21] This has ultimately been the function of market behavior.

facilitates the incremental increase in production efficiency. The East European countries have the potential to catch up quickly by adopting best practice technologies and the respective institutions simultaneously, which may encourage industries in Western Europe to undertake a similar restructuring. The massive greenfield investments in the Asian and South American paper and pulp industries demonstrate that this kind of technological and organizational "leap" is possible and profitable.[22]

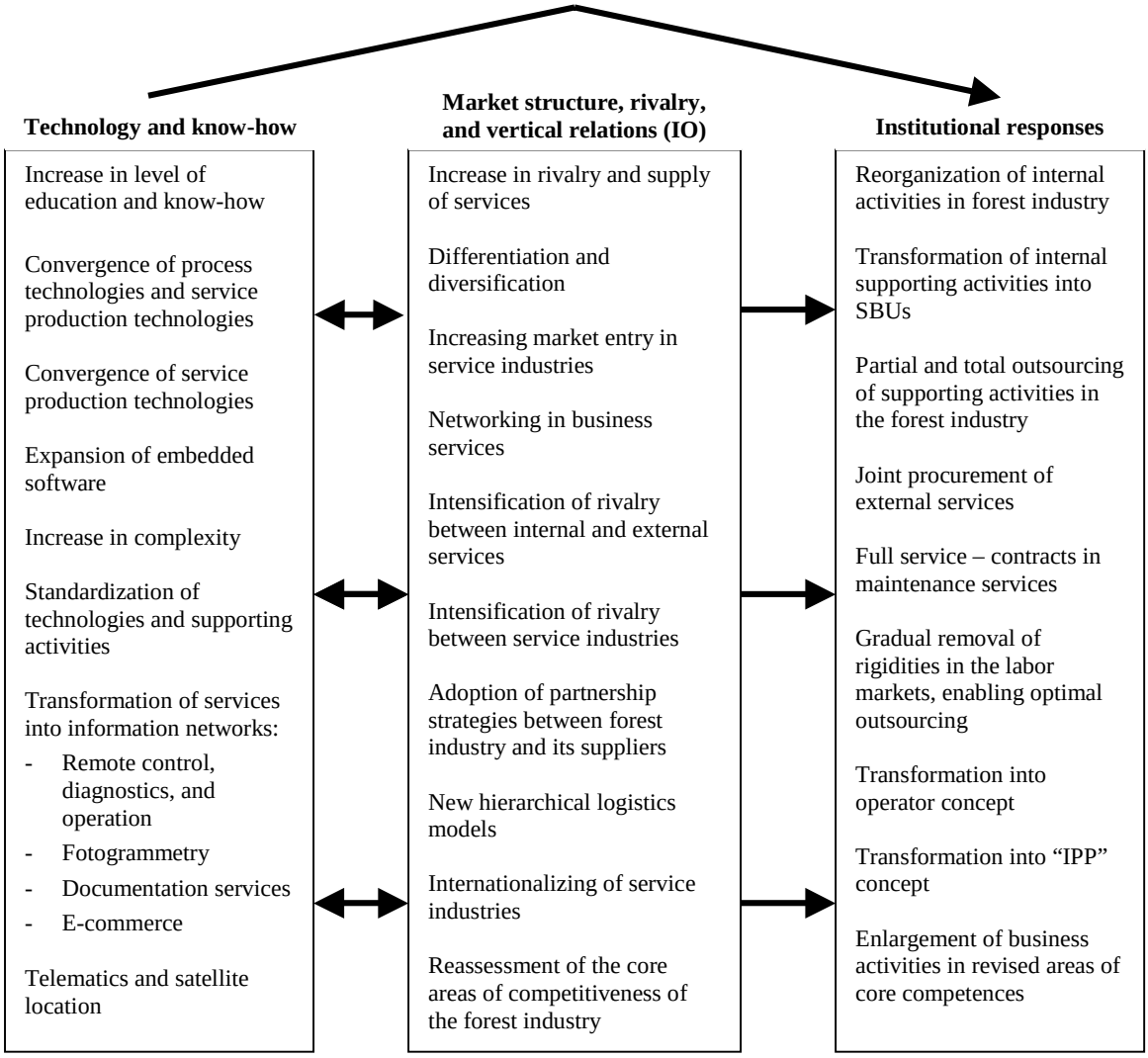

Figure 6: Dynamics and relations of the key determinants of competitiveness for the forest cluster.

5.4 Toward Common Policy Principles

While it is too early to draw detailed policy conclusions here, some general remarks, based on the previous discussion, can be made. First, it should be noted that although it

[22] These investments are often carried out close to the Independent Power Production (IIP) concept, in which several stakeholders are involved in the investments and the operations of the production units.

appears in the national advantage policy model as a viable option, explicit policies favoring certain clusters are becoming the exception rather than the rule in developed countries. In countries where the share of the forest cluster in industrial activity has been significant, the formulation of industrial policy has logically been affected by the needs of the forest industry. This was especially true for the investment-driven stage during post-war industrial development. For example, in the Nordic countries the technological development and investment cycles in the post-war period were facilitated by the policy of high inflation and recurrent devaluations of the national currencies.[23]

European integration and the establishment of the monetary union have restricted the possibilities for direct subsidizes from national governments. In line with the general change in the role of the government to that of a facilitator of framework conditions, and with the transition to market-induced cluster formation, national policy strategies are separating from cluster-specific policies to more general ones. The rationales behind them are those summarized in Table 5.

As for the policy implementation activities grouped by Boekholt and Thuriaux (see footnote 13), many of them can be targeted explicitly to specific clusters like the forest cluster. However, because of the generalization of the policy rationales, the impacts of policy actions have increasingly cumulative effects on other clusters sharing common resources like R&D, training, technology centers, etc. Another factor contributing to these externalities is the convergence and standardization of technologies of different industries as a result of the intensified application of automation and embedded ICT. Thus, even if the policy design were intentionally cluster specific and selective, implementing it would be impossible.

An example of actual policy recommendations for the forest cluster is the conclusions of a recent Finnish case study (Viitamo, 2000).[24] The general objective of the study was to investigate the competitive impacts of services on the forest industry, and conversely, the impacts of the forest industry, as a *demanding* customer, on the competitiveness of service industries. The focus here was restricted to the most important services from the forest industry point of view. As seen in Table 6, the recommendations to increase the two-way competitive impacts are consistent with the modern policy rationales and, given the remarks above, there is no cluster specificity as such. Another factor strengthening the externalities of the policy implementation is the existence of economies of scope in these particular service industries. By serving several industries, they form links transmitting the policy impacts from one cluster to another.

A starting point for policy outlines at the EU level is the recent resolution by the European Parliament regarding the Commission communication on the competitiveness of EU forest-based and related industries (European Parliament, 2000).[25] The key question—and one to which a complete answer is impossible to give at this stage—is the applicability of the national policy strategies at the EU level. Do the general

[23] Macroeconomic factors have been largely ignored by Porter.

[24] This study was carried out as a sub-project in the national forest cluster research program Wood Wisdom.

[25] The forest-based and related industries consist of the primary industries of the forest cluster and some of their customer industries.

liberalization and convergence of national policy regimes toward a more laissez-faire type of framework reflect a suitable strategy for the community level too? Or is this impossible because of the EU's very nature as a customs union whose objective is to protect its industries against outside competition?[26] In grasping these and other fundamental questions, it is important to note that the decisive factor shaping the future of the European forest cluster is not so much the EU enlargement itself but the policy principles adopted ex ante and ex post. This is reinforced by the fact that most exports of forest cluster commodities from CEECs are already being directed to EU markets.

Table 6: Policy recommendations derived from a Finnish case study.

Factor of competitiveness / **Service industry**	**Technology and know-how**	**Institutional innovations**	**Market structure, rivalry, and vertical relations**
Logistics	Investing in education, maintaining efficiency of infrastructure, initiatives for research programs	Fostering functioning of labor markets, allowing organizational innovations	Better control of state-owned monopolies, creation of equal competitive conditions
Maintenance services	Investing in education, initiatives for research programs	Fostering functioning of labor markets	
Consulting and engineering	Investing in education, financing R&D		Export promotion
ICT services	Investing in education		

At the moment there are some signs of opposing developments in national and EU policy rationales that stem basically from regional differences of economic development within the EU. While the governments of the current member countries are liberalizing their policies—a logical consequence of the shift from decentralized to centralized decision-making structures—the EU is increasingly basing its policy on subsidies for less developed regions. The impacts of implementing this kind of policy, characteristic of the aforementioned investment-driven phase of industrial development, are valid more for the woodworking industry than for the chemical forest industry. Because of the relatively low barriers to entry, the changes in competitive conditions caused by subsidies can be dramatic. There have already been some signals of sharply increased capacity caused by new setups, especially in former East Germany.[27]

Instead of sticking to certain objectives (e.g., regional equity), policy design should start from more general considerations. For example, what are the real rationales for having a vital and competitive forest cluster in the EU? Is it simply because the European forest

[26] In principle the formation of an integrated customs union is always sub-optimal, having positive and negative welfare effects. The positive ones are those following from the removal of trade barriers, while the negative ones are due to the artificial redirection of trade within the union, which may lead to inefficient production and allocation of resources (e.g., Fidrmuc, 1997).

[27] While these investments are based mostly on subsidies by national governments, the approach on national subsidies adopted by the European Commission will indirectly reflect its policy orientation. Given the subsidies policy and the fact that the forest clusters in the CEECs more or less deal with the woodworking industry, enlargement may have even more profound changes on competitive conditions.

cluster is currently an important employer and its shares of the EU's total value added and exports are significant (Hazley, 2000)? For policy issues, this line of justification implies the maintenance of the competitive advantage in relation to the rest of the world or to substituting products. While similar to the national advantage model, this policy strategy is not necessarily a purely defensive one. A market-based counterargument is that the forest cluster is not necessary in the first place if it is more economical to let the EU's demand for forest products be met through imports. This view acknowledges that there is no excess value inherent in the forest cluster other than its current market value.

The appropriate point of departure may be somewhere in between, giving rationales for certain policy actions. To combine opposing views, it is important to see the actual role the forest cluster plays in supranational integrated regions like the EU. The forest cluster is a supplier of necessary intermediate goods for many downstream industries and of goods for final consumption, and this forms the main argument for its existence and policies. The recognition that the forest cluster's efficiency dictates, both directly and indirectly, the efficiency in many sectors of the EU's economy and its general well-being implies the need for a free division of labor within the EU and between EU and non-EU countries. In the long run, policies should aim at creating favorable framework conditions for developing strengths, that is, the knowledge base and technology, which form the basis not only for securing efficiency, but also for future export opportunities.

6 Conclusions and Discussion

Since the publication of Porter's pioneering studies on the competitiveness of nations, the cluster approach has been adopted as a general framework in formulating industrial policy in the majority of industrialized countries in the West. While the reasons for this have been numerous and partly country specific, the factors explaining the implementation of the approach are the general slowdown of economic growth at the beginning of the 1990s and the consequent need for structural changes and new policies.

This report summarizes the essence of the cluster approach and its development over the past 10 years, with a special focus on the forest sector. It is an account of the past experience of cluster research, leading to general guidelines for future cluster studies. More specifically, this report illustrates how the cluster approach can be used to investigate the competitiveness of the forest industries at the EU level, taking into account the impacts of future EU enlargement.

In addition to international assessments, there has been a growing need for retrospective evaluations in countries with pronounced cluster-based policies. One recent example is the historical account of the cluster approach in Finland (Jääskeläinen, 2001) published simultaneously with this report. Like the mainstream Finnish cluster studies, this qualitative case study yields in-depth information on the developments of importing the diamond to Finland.[28]

[28] Jääskeläinen's central argument is that cluster models as such did not change the policy guidelines at the beginning of the 1990s. They simply facilitated carrying out the predetermined change in policy strategies (Jääskeläinen, 2001:217).

6.1 Guidelines for Future Cluster Research

Since the cluster concept was introduced into economic research, there have been numerous *definitions* of clusters. These have depended on the different analytical approaches used, the research questions asked, and the data available. This diversity primarily shows the flexibility of the approach and there has been a general striving for a more systematic classification of the different concepts used.

However, what has been missing so far is an identification of the basic determinants of clustering, which are independent of its actual forms. Economies of scale and scope within the value chain are the dominating mechanistic factors that encourage the pooling of resources, and the transaction costs of alternative governance structures determine the degree of integration of different activities. Changes in the structure of clusters are deducible from the dynamics of these determinants.[29]

Having their origins in the NIS research, clusters are increasingly viewed as reduced-scale NISs stemming from the need to identify the real sources of cluster competitiveness. Thus, in addition to the transaction relations, the linkages within clusters are based on information and innovation flows, leading to a broadened cluster concept. The basic determinants—mentioned above—explaining mechanistic clustering are also applicable to the innovation activity.

Porter's diamond model and *methodology* were adopted as standard tools in cluster analysis. Porter's methodology explains competitiveness based mainly on qualitative analysis, which provides in-depth information but also at least partially incomparable results. At the same time there have also been parallel lines of research based on I/O analysis and innovation surveys, which have been used to quantitatively map the clusters and their innovation patterns, but not explicitly to explain competitiveness.

Despite their drawbacks and the need for refinements, quantitative and qualitative analyses are appropriate methodologies for cluster research. What is needed is improved communication and consistency between case studies and I/O analysis in order to link them more efficiently. Case studies should be carried out in a more structured and systematic way, and the compilation of data for I/O and innovation matrices should be coordinated and based on common principles that better meet the needs of empirical research and policy-making. This applies to both national and international research.

All lines of cluster analysis are characterized by a new focus on innovation activity and on the institutional setting of the economy as a whole. This extends the set of analytical tools to those applied in contract law and in different branches of the social sciences, especially in institutional economics. While the current economic problems in the East European countries are fundamentally institutional, the link between the change in the cluster interpretation and the potential for new areas of application of cluster analysis becomes obvious.

Publicly financed cluster research can be interpreted as a form of the cluster dynamics, reflecting the process nature of *policy-making*. Although the cluster approach has been

[29] The principal factor explaining the dynamics is technological change (see Figure 6).

adopted for industrial policy-making, it is viable only if policy implementation is based on the specific policy-research process and if policymakers comprehend that. This is also a prerequisite for policy actions to increase competitiveness in the long run.

Policy rationales should be sensitive to the exogenous changes in the economic environment and industrial evolution. This can be observed in the development of different policy models and their gradual convergence as a consequence of intensified globalization and technological change. The role of government is increasingly seen as one of providing favorable framework conditions for innovative business activity; that is, policy actions should only correct market imperfections. The accompanied shift to bottom-up policy principles has meant a gradual departure from a selective to a more general cluster policy, which may also anticipate policy formulation at the EU level.

The mechanisms and institutional structure of the policy-research process are as important as the ability to refine the policy to meet the needs of the changing environment. The first requirement for an efficient mechanism is codification of the procedure through the clarification of the roles of government and research institutes. The second is not to commit a priori to a specific cluster definition or analytical tool (see, Bergman and Feser, 1999), but to let these variables be determined by the general policy targets and rationales set by the central or local governments. In Figure 7, the shaded area indicates the proper proceedings for the beginning of a policy-research process. Once they have the policy objectives, research institutions will choose the appropriate definitions and tools in order to derive policy recommendations from the findings. After combining the recommendations with other societal objectives,[30] policymakers will then decide which of the available policy instruments to use.

The process does not end there; the information on the impacts of the policy measures should be transmitted back to policymakers through control studies conducted by research institutions. If there is no reason to change the basic policy rationale, these studies provide the policymaker with the information on whether there is a need for fine-tuning the use of policy instruments. These control studies may also provide more in-depth information on specific areas of the clustering processes. In the case of dramatic changes in the state variables (megatrends) or in the growth and performance of industries, it may be appropriate to revise the general policy lines and to launch a new round of policy-research processes. The initiative to revise the policy may also come from the government based on the feedback (dashed lines in Figure 7) from different target groups.

[30] In terms of the division of labor, this is perhaps the most critical issue. The key question concerns the level of detail of the recommendations given by researchers, which depends on, among other things, the policymakers' ability to understand the cluster mechanisms.

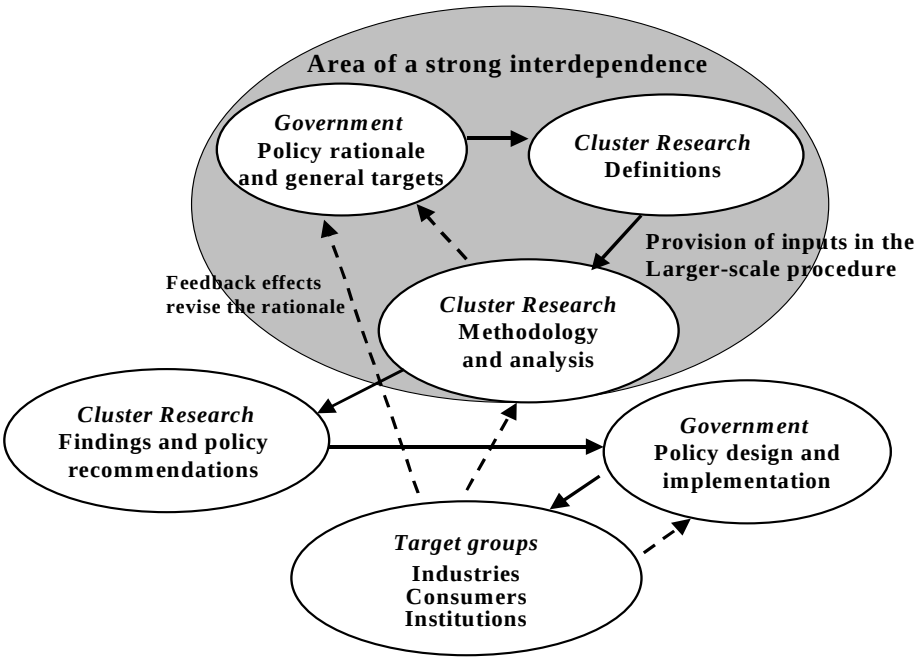

Figure 7: An efficient cluster policy procedure. Modified from Bergman and Feser (1999).

6.2 Broadening the Scope

Before analyzing Europe- or EU-wide clusters, one should have a clear understanding of what these concepts really mean. Irrespective of the existence of the EU, there would still be a European forest cluster with its markets, actors, and other institutions that have arisen through the common history. As a consequence of the EU, part of that cluster (albeit a very large part) has been submitted to a more centrally administered and coordinated governance structure with fewer trade barriers. While the EU forms a geographically coherent entity, it need not necessarily be so. So in this light, the change caused by the enlargement to date may have been less dramatic for the forest sector than has been stressed in some instances.[31] Nevertheless, the formal integration of the European economy has reinforced the merging of national industrial clusters—especially forest clusters—so there are logical grounds for broadening the focus of research from the national to the EU level.

There are many other rationales for such an undertaking. As a provider of essential inputs for the EU, the forest cluster has a prominent role in affecting the efficiency of

[31]For example the inclusion of Sweden, Finland, and Austria in the EU in 1995 increased the employment, production, and export of the EU's forest cluster dramatically. However, excluding the increased efficiency in the form of reduced transaction costs, the changes for the European forest cluster were less dramatic.

many downstream industrial sectors and, ultimately, the well-being of EU citizens. Given the current industrial policy regimes at different administrative levels, EU enlargement will unavoidably change the competitive situation within the forest cluster. To reap the potential benefits of the enlargement—stemming from the coordination and optimization of an enlarged economic entity—common policy actions will be needed. Furthermore, the European forest cluster is a significant net exporter, indicating global competitiveness, which should be ensured in the future, too. And finally, independent of the outcome of the enlargement, the restructuring of the forest cluster has a direct impact on the use of European forest resources that is connected to the balance between environmental and economic issues.

Although the primary level of focus here is Europe, the forest cluster cannot be separated from its global environment for at least two reasons. First, European companies are becoming increasingly global in their market orientation, which links the EU's forest cluster to those on other continents. So, the global trends, like changes in the growth rates of consumption in different parts of the world, will influence the strategies of European companies. Second, international treaties like the World Trade Organization are formally integrating the world economy as a whole. To derive any policy recommendations for the EU level, the constraints set by globalization should be recognized.

The top-down approach is also appropriate for analyzing competitiveness. General macroeconomic conditions combined with other indicators of the competitiveness of national economies indicate the general economic setting and opportunities for the development of different cluster activities (EBRD, 1999). In general, the extent to which different member states meet the Maastricht requirements implies not only the relative geographical attractiveness of the member states themselves, but also the convergence of the national economies (see, e.g., Landesmann, 2000; Stehrer and Landesmann, 1999).

A uniform and stable macroeconomic environment can be interpreted as a form of Porterian factor conditions, which reduces uncertainty and enables the exploitation of real competitive advantages within the community. Macroeconomic benchmarking is also important for the candidate countries, allowing them to see their relative positions and development through the transition period. The revealed performance in meeting the macroeconomic criteria may then be explained by the general determinants of competitiveness illustrated in Figure 6.

Since the primary objective—i.e., the general policy target—here is to study the competitiveness of the EU forest cluster(s), according to the policy-research procedure presented in Figure 7, an appropriate cluster concept and analytical tools must be chosen. In general, the competitiveness of the European forest cluster is a function of the competitiveness of its industries located in different countries, which necessitates a dual approach. The measurement of competitiveness should be based on multiple indicators, such as productivity, relative efficiency, and the relative market shares in domestic and export markets. Benchmarking of the indicators across countries and across forest product groups will yield an overall picture of competitiveness.

The objective of explaining competitiveness inevitably leads to the use of the Porterian line of reasoning based on the determinants of the diamond model, their derivatives, or the basic elements presented in Figure 6. However, considering the extent of the focus, descriptive and qualitative analyses are insufficient (and impossible). What is needed is a holistic and systematic methodology based on more quantifiable variables. Another justification for applying the Porterian framework is that, by broadening the scope to the EU level and looking at competitiveness from the European perspective, much of the shortcomings of Porter's methodology vanishes.

References

Bergman, E.M. and E.J. Feser (1999). Industry Clusters: A Methodology and Framework for Regional Development Policy in the United States. In: *Boosting Innovation: The Cluster Approach*, OECD Proceedings. ISBN 92-64-17080-4.

Boekholt, P. and B. Thuriaux (1999). Public Policies to Facilitate Clusters; Background, Rationale and Policy Practices in International Perspective. In: *Boosting Innovation: The Cluster Approach*, OECD Proceedings. ISBN 92-64-17080-4.

Buzzell, D.R. and B.T. Gale (1987). *The PIMS Principles—Linking Strategy to Performance*. The Free Press, New York, London.

Chandler, A. (1990). *Scale and Scope: The Dynamics of Industrial Capitalism*. The Belknap Press of Cambridge, Massachusetts, USA and London, United Kingdom.

Clarysse, B. and U. Muldur (2001). Regional Cohesion in Europe? An Analysis of How EU Public RTD Support Influences the Techno-Economic Regional Landscape. *Research Policy*, 30, 275–296.

Coase, R. (1937). The Nature of the Firm. *Economica*, 4.

DeBresson, C. and X. Hu (1999). Identifying Clusters of Innovative Activity: A New Approach and a Toolbox. In: *Boosting Innovation: The Cluster Approach*, OECD Proceedings. ISBN 92-64-17080-4.

Dunning, J.H. (1991). Dunning on Porter: Reshaping the Diamond of Competitive Advantage. Business and Economic Studies on European Integration, An International Research Program, Working Paper 6/91, Copenhagen.

Dunning, J.H (1993). Internationalizing Porter's Diamond. *Management International Review*, Special Issue, Volume 33:2.

Dunning, J.H (1999). *Regions, Globalization, and the Knowledge-Based Economy*. Oxford University Press, Oxford, New York.

EBRD (1999). Transition Report—Ten Years of Transition. European Bank for Reconstruction and Development (EBRD), London, United Kingdom.

Eichengreen, B. and R. Kohl (1998). The External Sector, the State and Development in Eastern Europe. BRIE Working Paper 125, March. The Center for German and European Studies, University of California, Berkeley.

European Parliament (2000). Report on the Commission Communication on the State of the Competitiveness of the EU Forest-based and Related Industries COM(1999) 457-C5-0306/2000-2000/2159 (COS0).

Fidrmuc, J. (1997). Strength and Advantages of Eastern Europe—EU's Net Gains from Accession. Interim Report IR-97-019, International Institute for Applied Systems Analysis, Laxenburg, Austria.

Hazley, C.J. (2000). Forest Based and Related Industries of the European Union—Industrial Districts Clusters and Agglomerations. B160, The Research Institute of the Finnish Economy (ETLA), Helsinki, Finland.

Heikkinen, S. (2000). Paperia maailmalle. Suomen Paperitehtaitten Yhdistys Finnpap, 1918–1996 (Paper for the World. The Association of Finnish Paper Producers Finnpap 1918–1996). Kustannusosakeyhtiö Otava, Helsinki (in Finnish).

Hernesniemi, H. and E. Viitamo (1999). Suomen energiaklusterin kilpailuetu (The Competitive Edge of Finnish Energy Cluster). B154, The Research Institute of the Finnish Economy (ETLA), Helsinki (in Finnish).

Hernesniemi, H., M. Lammi and P. Ylä-Anttila (1996). Advantage Finland—The Future of Finnish Industries. B113, The Research Institute of the Finnish Economy (ETLA), Helsinki.

Hunya, G. (2000). International Competitiveness Impacts of FDI in CEECs. The Vienna Institute for International Economic Studies (WIIW), Research Paper No. 268, August.

Jacobs, D. and A. De Man (1996). Clusters, Industrial Policy and Firm Strategy: A Menu Approach. *Technology Analysis and Strategic Management*, Vol. 8, No. 4.

Jääskeläinen, J. (2001). Cluster—Between Science and Policy. From Industrial Policy to Social Policy. A33 Series, The Research Institute of the Finnish Economy (ETLA), Helsinki.

Krugman, P. (1991). *Geography and Trade*. Gaston Eyskens Lecture Series. Leuven University Press, Belgium, MIT Press, Cambridge, Massachusetts, London United Kingdom.

Krugman, P. (1995). *Development, Geography and Economic Theory*. MIT, Cambridge, Massachusetts. ISBN 0-262-11203-5.

Landesmann, M. (2000). Structural Change in the Transition Economics, 1989 to 1999. The Vienna Institute for International Economic Studies (WIIW), Research Paper No. 269, September.

Leiponen, A. (2000). Innovation in Services and Manufacturing, A Comparative Study of the Finnish Manufacturing Industries. B165 Series, The Research Institute of the Finnish Economy (ETLA), Helsinki.

Menard, C. (1997). *Transaction Cost Economics, Recent Developments*. Edward Elgar, Cheltenham, United Kingdom.

Metcalfe, S. (1995). The Economic Foundations of Technology Policy: Equilibrium and Evolutionary Perspectives. In: P. Stoneman (ed.), *Handbook of the Economics of Innovation and Technical Change*, Blackwell, London.

Miles, I. (1998). Services in National Innovation Systems: From Traditional Services to Knowledge Intensive Business Services. Paper prepared for the international seminar “Challenges of the Finnish Innovation System”, Helsinki, November 1998.

OECD (1999a). *Managing National Innovation Systems*, OECD. ISBN 92-64-17038-3.

OECD (1999b). *Boosting Innovation: The Cluster Approach*, OECD Proceedings. ISBN 92-64-17080-4.

Penttinen, R. (1994). Summary of the Critique on Porter’s Diamond Model. Discussion Paper 462, The Research Institute of the Finnish Economy (ETLA), Helsinki.

Porter, M.E. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*. The Free Press, New York. ISBN 0-02-925090-0.

Porter, M.E. (1990). *The Competitive Advantage of Nations*. Macmillan Press Ltd., London.

Roelandt, T. and P. den Hertog (1999a). Cluster Analysis and Cluster-Based Policy Making: The State of the Art. In: *Boosting Innovation: The Cluster Approach*, OECD Proceedings. ISBN 92-64-17080-4.

Roelandt, T. and P. den Hertog (1999b). Cluster Analysis and Cluster-Based Policy Making in OECD Countries: Introduction to the Theme. In: *Boosting Innovation: The Cluster Approach*, OECD Proceedings. ISBN 92-64-17080-4.

Roelandt, T., P. den Hertog, J. van Sinderen and N. van den Hove (1999). Cluster Analysis and Cluster Policy in the Netherlands. In: *Boosting Innovation: The Cluster Approach*, OECD Proceedings. ISBN 92-64-17080-4.

Stehrer, R. and M. Landesmann (1999). Convergence Patterns at the Industrial Level: The Dynamics of Comparative Advantage. The Vienna Institute for International Economic Studies (WIIW), Working Paper No. 11, October.

Tirole, J. (1988). *The Theory of Industrial Organization*. MIT Press, Cambridge, Massachusetts. ISBN 0-262-20071-6.

Viitamo, E. (2000). Metsäklusterin palvelut—kilpailukykyanalyysi (Services in the Forest Cluster—Competitiveness Analysis). Discussion Paper 727, The Research Institute of the Finnish Economy (ETLA), Helsinki (in Finnish).

Williamson, O. (1985). *The Economic Institutions of Capitalism*. Free Press, New York.