Upgrading in Clusters and Value Chains in Latin America

The Role of Policies

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Foreword

To benefit from the globalization process, Latin American and Caribbean countries should increase their competitiveness. Micro, small and medium enterprises may play a critical role to trigger the region's competitiveness, and government should support them. This study provides policy lessons and recommendations on how to support SME upgrading in the global market.

The study analyzes the SME upgrading process in the context of clusters and value chains as well as in different economic sectors. The analysis is based on the collection of original data from twelve new clusters in Latin America, and on an extensive literature review of cluster studies. These cases are the largest selection available on which comparative exercises have been carried out. Based on the empirical analysis, the authors explain how small and medium enterprises located in clusters can innovate as a consequence of external economies and joint actions (collective efficiency). They also point out that collective efficiency and upgrading may vary according to patterns of governance within the value chain and the economic sector. Using this findings, the authors propose a menu of policies, some of them whit a general scope and others sector specific.

In the last years the Inter-American Development Bank has been very active promoting competitiveness and SMEs in the region. A competitiveness strategy was approved in 2003 and various loans and technical cooperation were prepared in this area. In addition, it seems that the countries of the region are committed to continue working on competitiveness in the next years. With this document we expect to contribute to the policy debate on competitiveness as well as to provide practical examples of what can be done to promote externalities, joint action and innovation for SMEs located in clusters around the region.

Finally I would like to thank the Italian Trust Fund for MIF project preparation, which made this study possible through its financial support.

Álvaro R. Ramírez
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Executive Summary

Recent empirical evidence shows that small and medium enterprises located in clusters have a competitive advantage with respect to isolated firms because of their higher collective efficiency (namely, external economies and joint actions). In addition, many SME clusters are increasingly participating in value chains. In order to provide policy lessons on how to support SME upgrading in the global market, this study analyzes *the impact of collective efficiency on clusters upgrading*. It also undertakes an investigation of *the impact of different patterns of governance within the chain on the possible forms of upgrading*. Finally, the study analyzes the relevance of sectors to take into account the different learning patterns of the groups of industries considered in the typology proposed; that is, it investigates *how upgrading is sector-specific*.

This three-dimensional analysis is based on the collection of original data from eleven new clusters in Latin America (in Brazil, Chile, Mexico and Nicaragua), and on an extensive review of the literature on clusters. The empirical analysis was carried out from September 2002 to June 2003 by an international team of twelve experts in Italy and in Latin America. The desk and field studies were undertaken following the same methodology, which involved field interviews with local firms, institutions, and observers, as well as interviews with foreign buyers and transnational corporations involved in the local cluster, and secondary sources such as publications and reports.

The study shows that remarkable inter-cluster differences emerge when considering the specific features of learning, innovation, and industrial organization of the different sector groups. Clusters and value chains belonging to different groups of industries tend to follow systematically different patterns of collective efficiency, modes of chain governance, and upgrading. Thus, *collective efficiency reaches different levels in different groups of sectors*. More specifically, it is the number and variety of joint actions that accounts for most of the difference, while passive external economies are more common and easier to achieve in most clusters.

Upgrading has occurred in most of these clusters; however, *process and product upgrading are more common, while functional upgrading is more rarely achieved*. Collective efficiency has a positive effect on the capabilities of local firms to upgrade in all sectors, but the strategic logic of transnational leaders is dominant in complex systems products (COPS). *Intersectoral upgrading was detected only in the Chilean cluster*, with salmon firms venturing into biotechnology and genetics.

Participation in global value chains dominated by large buyers and/or producers from the developed world facilitates the link with the international market by signaling the need (and the modes) of the necessary upgrading. Nevertheless, in many cases, and more *often in complex systems products and natural resources-based clusters, global leaders do not normally foster and support the SME upgrading process*. In contrast, in traditional industries, process and product upgrading are often facilitated by large international buyers, given the crucial role played by the transfer of tacit knowledge and the need for intense buyer-producer interaction.

Finally, favorable macroeconomic conditions are important for all types of clusters. Microeconomic support policies and programs may do little against an unfavorable macroeconomic framework.

The empirical evidence collected and analyzed in this paper offers many strategic policy implications. Most countries have recently undertaken SME support policies with much emphasis on clusters and value chains. However, the tight macroeconomic constraint in Latin America has often produced *a remarkable gap between the statements of principles and the design of SME support policies, and their actual implementation*. Moreover, the major shortcoming of the present policy approach in most countries is the *lack of an integrated and consistent vision of local SME development*

and upgrading. Thus, policy packages tend to address either the issue of technical training or that of local cluster development, or that of the development of value chain providers. Yet, SMEs face *at the same time* the challenge of upgrading (i.e. innovating to increase value added) through the advantages offered by geographical clustering and collective efficiency, *and* through the opportunities offered by participation in global value chains. Any attempt to enhance local SME upgrading should take such an integrated stand.

Given that Latin American countries generally have very limited financial resources that should be used as efficiently as possible, two general principles may be added: *selectivity* and *decentralization*. Clusters to be supported should be selected because of their strong presence in the economy or because they are seen as strategic for future growth. Interventions within clusters should be directed to address few essential priorities. This requires *good tools to map and analyze clusters*, and investing adequate financial resources in the exploratory and diagnostics phase before intervention. Moreover, addressing the specific problems of local SMEs needs specific policies to promote and strengthen decentralized, competent and financially autonomous organizations.

This paper proposes *a menu of actions to support cluster development*. These actions need to target the three main objectives:

- Facilitating development of external economies,
- Promoting linkages between firms, and
- Strengthening the local position within value chains

A major effort to achieve the first objective is to build a specialized cluster-specific labor force, for example with the implementation of "Cluster Skills Centers." Linkages among firms may be promoted in several ways: (i) creating and enhancing trust between firms; (ii) promoting the establishment of collective projects; (iii) creating and strengthening business associations; (iv) strengthening the local supply of financial and nonfinancial services; (v) facilitating the cluster's external connections and (vi) promoting innovation at the cluster level. Finally, strengthening the position of local firms and clusters within the value chains requires efforts to: (i) attract the chain leaders into the clusters; (ii) sustain the upgrading of local suppliers; (iii) facilitate their interactions within value chains; (iv) promote access to new markets and new value chains and (v) assist SMEs in meeting international standards.

Given the remarkable differences emerging across sectors, *cluster support policies need to have a strategic sector dimension*. Thus, policy priorities and policy tools need to differ for the different groups of sectors. This paper argues that in *traditional manufacturing clusters* policies should promote linkages between firms, enhance access to new additional value chains, and ensure consistency between micro support policies and programs and the overall macroeconomic framework. Given that upgrading in *natural resource-based clusters* is fostered by technology improvements and diffusion, as well as by collective efficiency, policies should promote public-private collaboration in research and disseminate research results to SMEs, improve skills and abilities of producers in agriculture, and facilitate the entry of SMEs. Because participation in a global value chain also offers promising opportunities, the adoption of quality and sanitary standards and environmental regulations should be promoted, and quality inspections and controls enforced.

Clusters in *complex product systems* offer the least opportunities for SME upgrading. However, in order to exploit the limited chances for upgrading, policies may support the active and dynamic role of actors working as "network brokers" (*facilitators*) of the cluster, and notably facilitating the relationships between the large anchor firms and small local suppliers. Moreover, an incentive framework aimed at encouraging large firms to source their intermediate inputs and services locally, and support their suppliers' upgrading strategies, should be carefully designed and implemented.

Collective efficiency and joint actions offer powerful opportunities for upgrading in s*oftware (specialized suppliers) clusters*. To this aim, investments in highly skilled professionals may be extremely beneficial, together with efforts to intensify cooperation between indus-

try and research institutions. Cooperation between industry and universities and higher education institutions should orient curriculums in directions that are useful for the industry. Cluster-based technology poles and incubators may provide useful infrastructural support to start-ups in this sector.

1. Introduction

This study focuses on how Latin America's small and medium-sized enterprises (SMEs) can participate in global markets in a way that provides for sustainable growth. This may be defined as the "high road" to competitiveness, in contrast with the "low road" typical of firms from developing countries, that often compete by squeezing wages and profit margins rather than by improving productivity, wages and profits. A case in point is when export prices fall faster than export volumes increase, making the firm and/or the country worse off even though economic activity increases (e.g. wood furniture exports to European Union; Kaplinsky and Readman, 2000). The same applies when increased exports can only be paid for by lower wages (e.g. shoes exports from Sinos Valley; Brazil, Schmitz, 1999a).

A thoroughly different process is one of increasing and improving participation in the global economy, which results in sustained income growth. This is what interests us, and is explicitly the baseline hypothesis of the present study. The difference between the high and the low road to competitiveness is often explained by the different capabilities of firms to *upgrade* (Humphrey and Schmitz, 2002a; Kaplinsky and Readman, 2001; Porter, 1990). This study provides new evidence to show how to provide support to SMEs, which often lack the capabilities to participate effectively and fruitfully in global markets (Peres and Stumpo, 2000 and 2002), in their upgrading efforts on their high road to competitiveness. The following question is central to this study: *What can be done to support SME upgrading in the global market?*

Capitalizing on one of the most productive areas of the recent literature on SMEs, we restrict our field of research to *small enterprises located in clusters*. As a matter of fact, there is now a rich empirical evidence (Humphrey, 1995; Nadvi and Schmitz, 1999; Rabellotti, 1997) showing that small firms located in clusters, both in developed and developing countries, are able to overcome some of the major constraints they usually face: lack of specialized skills, difficult access to technology, inputs, market, information, credit, external services (Schmitz, 1982).The concept of *collective efficiency* (Schmitz, 1995) is central to our study. By *collective efficiency* we mean the combination of incidental external economies and of the effects of joint actions, that helps to explain the efficiency gains of firms located in clusters, and their increased capability to upgrade and grow.

The literature on clusters, which is mainly focused on analyzing local sources of competitiveness from vertical and horizontal intra-cluster relationships that generate collective efficiency, has neglected the increasing importance of external linkages. Due to recent changes in production systems, distribution channels and financial markets, as well as to the spread of information technologies, enterprises and clusters are increasingly integrated in value chains that often operate across many different countries. The literature on global value chains (Gereffi, 1999; Gereffi and Kaplinsky, 2001) calls attention to the opportunities for local producers to learn from global leaders (buyers or producers) of the chains. This study details how the scope for upgrading is affected in an important way by the pattern of governance of the chain. That is, the study addresses the following specific questions:

- Is SME upgrading facilitated by the degree of collective efficiency of clusters?
- How does the introduction of clusters into global value chains affect local upgrading strategies?

Chapter 2 provides an overview of the recent literature on clusters, industrial districts and global value chains. It also introduces a sector dimension that takes into account different technological regimes and learning patterns that apply to different industries.

Chapter 3 presents the main findings of the case studies (a salmon cluster in Chile, four agro-industry clusters and one metalworking cluster in Brazil, a milk and dairy cluster in Nicaragua and a furniture and several software clusters in Mexico). It also presents informa-

tion collected through an extensive literature survey on more than 40 cluster studies in Latin America. In addition, it also draws on a very detailed analysis of the birth and growth of industrial districts in the south of Italy (from a development point of view this is a very interesting case, although it is less internationally celebrated than the now well-known "Third" Italy). The findings of the case studies are also compared to international trade statistics that provide evidence of some upgrading experiences in Latin America in the same sectors as those of the case studies.[1]

Chapter 3 presents and discusses the results, adding a sector dimension to the analysis. Accepting the different learning, innovation and upgrading patterns of different sectors (as long acknowledged by several scholars, including Pavitt, 1984, Bell and Pavitt, 1993), we propose the following categorization of the existing Latin American sectors: (i) *traditional manufacturing industries* (e.g. textile, footwear, tiles and furniture); (ii) *resource-based industries* (e.g. copper, marble, fruit, fish); (iii) *complex product systems industries* (e.g. automobiles, auto parts, aeronautics and consumer electronics); and (iv) *specialized suppliers* (in this study, essentially software). For each group the report analyzes the impact of collective efficiency and of the pattern of value chain governance on upgrading strategies.

The final section (chapter 4) draws the main conclusions and discusses the policy implications from the available empirical evidence, presenting the main instruments that can be adopted to sustain and foster SME upgrading, identifying the main actors, the methodologies of implementation and the potential pitfalls to avoid.

[1] The case studies are summarized in the Annexes 2, 3, 4, 5, 6 and 7.

2. The Theoretical Framework

This paper builds on the theoretical approaches followed by the literature on institutional economics that acknowledges the central role that institutions play in determining the behavior and performance of economic agents,[2] as well as the literature on evolutionary economics that focuses on the evolutionary nature of the process of technological change.[3]

Organizations are consciously created formal structures with an explicit purpose. The organizations with which firms interact may be other firms (suppliers, customers, and competitors) and non-firm organizations such as universities, research institutes, standard-setting agencies, financing organizations, schools, government agencies, policy organizations, etc. (Edquist, 2002). Of particular importance for innovation and upgrading are sustained interactions that go beyond arm's length market transactions and that involve more than the information about prices and volumes. When pursuing technological innovation, learning and upgrading firms interact (more or less closely) with other firms and organizations. Laws, regulations, social rules and norms, technical standards and cultural habits constitute the institutional context within which firms and organizations interact. Such institutions may foster or hinder the interactive learning processes essential for upgrading. Importantly, all these relationships have a fundamental dynamic nature, as firms, market structures and institutions *co-evolve* over time (Nelson, 1998).

Within this general theoretical background, this study aims to develop the hypothesis that *enterprise upgrading is simultaneously affected by firm-specific efforts and activities, and by the environment in which firms operate*. The latter is crucially shaped by three characteristics:

- the collective efficiency of the cluster in which SMEs operate;
- the pattern of governance of the value chain in which SMEs participate, and
- the peculiar features that characterize learning and innovation patterns in specific sectors.

CLUSTERS

During the last decade, a new approach toward small-scale industry in developing countries has been stimulated by the successful performance of industrial districts in the developed world, particularly in Italy. The ability of clustered firms to be economically viable and contribute strongly to the growth process in industrial districts attracted a great deal of interest in development studies.[4] The literature on industrial districts is vast and there are many definitions provided by numerous scholars in various disciplines and regions of the world who have contributed to this debate.[5] In this study, however, the term "industrial district" refers to the Marshallian type as it was first defined by Becattini (1987).

Industrial districts in developing countries are characterized by sector specialization and geographic concentration, as has already been documented in the literature.[6] However, the existence of a critical mass of specialized and clustered activities, in a number of cases even with strong historical roots, does not necessarily imply that the clusters also share other characteristics of a district as defined by Marshall. Nonetheless, clustering can be considered a major facilitating factor for a number of subsequent potential developments, including division of labor and specialization; and the emergence of a wide network of suppliers, of

[2] Among the many authors, see Nelson and Sampat, 2001; Putnam, 1993; and Williamson, 2000.

[3] See for all Nelson and Winter, 1982, and Dosi et al., 1988.

[4] See for instance Schmitz (1995), Rabellotti (1997) and the two special issues of *World Development* edited by Humphrey (1995) and Nadvi and Schmitz (1999).

[5] For a recent review of the literature on industrial districts see Paniccia (2002).

[6] For a review of the empirical cases available in the literature see, on Africa, McCormick (1999) and on Latin America Giuliani et al. (2003) and Albaladejo (2001).

agents who sell to distant national and international markets, of specialized producer services, of a pool of specialized and skilled workers; and the formation of business associations.

To capture the positive impacts of these factors on the competitiveness of firms located in clusters, Schmitz (1995) introduced the concept of *collective efficiency*, which is defined as the competitive advantage derived from local external economies and joint action. Clustering offers opportunities for powerful externalities that may be appropriated by SMEs located in the cluster. Moreover clustering may facilitate the development of joint actions among local actors.

The concept of *external economies* was first introduced by Alfred Marshall in his *Principles of Economics* (1920) when he wrote about economies external to the firm but internal to the district.[7] In industrial districts the most common external economies are (i) the creation of a market for specialized skilled labor; (ii) the creation of a market for inputs, machinery and specialized inputs (increased availability, competition on price, quality and service) allowing for a finer division of labor; (iii) improved market access; and (iv) easy access to specialized knowledge on technologies and market and rapid dissemination of information. While external economies are of importance in explaining the competitiveness of industrial clusters, there is also a deliberate force at work; namely, *consciously pursued joint action* (Schmitz, 1999b). According to Nadvi (1999), joint action can take three different forms.

- Joint action within vertical linkages: including backward ties with suppliers and subcontractors and forward ties with traders and buyers.
- Joint action within bilateral horizontal linkages between two or more local producers. This can include joint marketing of products, joint purchase of inputs, order sharing, common use of specialized equipment, joint product development and exchange of know-how and market information.
- Joint action within multilateral horizontal linkages among a large number of local producers, particularly through cluster-wide institutions. This includes cooperation in business associations and business development service centers.

The combination of incidental external economies and of the effects of active cooperation defines the degree of collective efficiency of a cluster. The foregoing implies that the analysis of industrial clusters is focused on the role of intra-cluster vertical and horizontal relationships that generate collective efficiency by increasing returns from incidental external economies and joint actions. Thus, resources for upgrading stem mainly from within the locality, and result from interactions between firms and with local institutions (Humphrey and Schmitz, 2002a). However, recent changes in production systems, distribution channels and financial markets, which picked up speed as a result of the globalization of product markets and the spread of information technologies, suggest that more attention needs to be paid to external linkages.[8] On this respect, the global value chain (GVC) approach helps to take into account activities occurring outside the cluster and, in particular, to understand the significance of the relationships with key external actors.

VALUE CHAINS

The idea of a value chain is very simply focused on the activities needed to turn raw materials into finished products and sell them, and on the value added at each link (Gereffi, 1999; Kaplinsky and Readman, 2001; UNIDO, 2002). Individual companies rarely undertake alone the full range of activities that is required to bring a product or a service from conception to the market. The design, production and marketing of products involve a chain of activities divided between different enter-

[7] External economies can be defined as positive or negative unpaid, out of the market rules, side-effects of the activity of one economic agent on other agents.

[8] Markusen (1996), broadening the definition of industrial district, discusses four types. In the "satellite platform" type, consisting of a congregation of branch facilities of externally based multi-plant firms, she acknowledges the importance of external linkages. Guerrieri et al. (2001) further develop this approach and apply it to clusters in Italy and Taiwan.

prises often located in different places, sometimes in different countries. Increasingly, firms from several countries are involved in value chains that have a global reach and can be called global value chains.

According to Kaplinsky (2000) and Wood (2001), the value chain perspective is analytically useful for three main reasons. First, the focus moves from manufacturing only to the other stages of activity involved in supplying goods and services to consumers. Particularly, more attention is paid to the "intangibles" phases, such as distribution and marketing, whose cost often accounts for a larger share of the final price of a good than do manufacturing costs. Second, this type of analysis captures the flows of information as well as goods between the stages of activity in the chain, making clear that linkages between firms are often not at arm's length and involve skills and knowledge that are scarce and command large financial rewards. Third, the key to understanding the global appropriation of the returns to production is the ability to identify high return activities along the value chain.

The focus of value chain research is on the nature of relationships among the various actors involved in the chain, and on their implications for development (Humphrey and Schmitz, 2002b).The concept of *governance* is central to the analysis of these relationships. At any point in the chain, some degree of governance or coordination is required in order to make decisions regarding what will be produced (product design), how it will be produced (production process, technology, quality standards), and how much will be produced. Coordination may occur through arm's-length market relations or non-market relationships. In the latter case, following Humphrey and Schmitz (2000), we distinguish between three possible types of governance:

- Networks, implying cooperation between firms of more or less equal power which share their competencies within the chain.
- Quasi-hierarchical relationships between legally independent firms in which one is subordinated to the other, and where a leader establishes the rules for all to follow.
- Hierarchy when a firm is owned by an external firm.

The literature on value chains stresses the importance of the quasi-hierarchy type of governance, distinguishing between coordination by buyers (buyer-driven chains) and those in which producers play the key role (producer-driven chains) (Gereffi, 1994). Moreover, Gereffi (1999) and Dolan and Humphrey (2000) conclude that the increasing concentration of retailing in developed countries makes buyer-driven chains a growing phenomenon.[9] The literature also stresses the role played by global value chain leaders, and particularly by the buyers, in transmitting knowledge along the chains. For small firms in developing countries, participation in value chains is a way to obtain information about the upgrading necessary to gain access to the global market.

Although there is agreement that the access to information about the standards that need to be met is one of the advantages of being part of a value chain, the role played by the global value chain leaders in fostering and supporting the upgrading process is less clear. Gereffi (1999) assumes a rather optimistic view, emphasizing the role played by the leaders, which almost automatically promotes process, product and functional upgrading among small local producers.[10] In line with the present approach, Humphrey and Schmitz (2000) discuss the prospects of upgrading with respect to the pattern of value chain governance. They take a less optimistic stance and conclude that participation in a quasi-hierarchical chain offers very favorable conditions for process and product upgrading, but hinders functional upgrading. They also conclude that networks offer ideal upgrading conditions but are unlikely to come about for developing country producers.

A more dynamic approach may help clarify these issues. Humphrey and Schmitz (2002b) acknowledge that chain governance is not given forever and may change over time because of three main reasons. First, power is relational; that is, the exercise of power by one

[9] For a critical view on this taxonomy of global value chains see Sverrisson, 2003.

[10] Although his research is mainly focussed on Asia.

party depends on the powerlessness of other parties in the chain. Existing producers, or their spin-offs, may acquire new capabilities and explore new markets, resulting in changes in power relationships. Second, establishing and maintaining quasi-hierarchical governance is costly for the lead firm and reduces flexibility because of transaction specific investments. The main reason that limits are established along the chain is the risk of potential losses arising from a failure to meet commitments or to ensure that the products conform to the required standards. Finally, firms and clusters often operate in several types of chains simultaneously. This implies that skills acquired as a result of participation in one chain may be applied and adapted to supplying other chains. This is crucial from an analytical point of view, requiring an analysis that is not focused solely on the understanding of the governance and the upgrading process within the dominant chain.

Thus, there are two important questions that will be addressed. Do different patterns of value chain governance favor or hinder the different types of upgrading (process, product, functional and intersectoral)? What are the conditions under which chain leaders support the upgrading process of the firms that make up the value chain?

UPGRADING

The concept of *upgrading* (that is, making better products, making them more efficiently, or moving into more skilled activities) has been used often in the literature on competitiveness (Porter, 1990; Kaplinsky, 2000).The macroeconomic dimension of competitiveness is often mixed with the microeconomic definition, embedded in the competitiveness literature. This generated an extensive debate among international trade economists who reject the notion of "competitiveness" as essentially wrong and misleading, particularly when compared with the clear concept of "comparative advantage" (Krugman, 1996). According to the concept of comparative advantage, all economies benefit from international specialization, provided that it is consistent with their pattern of comparative advantage. However, insofar as we admit the possibility of inter-firm (intrasector) differentials (for example, differentials related to market imperfections, information asymmetries, firm-specific learning and capabilities, etc.), that are ruled out by the (macro) theories of comparative advantage, then competitiveness becomes a meaningful, and indeed relevant concept (Lall, 2001). Further, the latter approach allows the consideration of "dynamic" comparative advantage, which refers to comparative advantages acquired through the purposeful efforts of enterprises, and in sectors different from those where they enjoy static comparative advantages (Pietrobelli, 1997). The present discussion of alternative paths to competitiveness refers to the macroeconomic implications of strategies at the level of the enterprise. An individual enterprise could find it optimal to increase (static) competitiveness by squeezing costs (including labor costs), but this would not be desirable from the point of view of the country (or the region/cluster) as a whole (and would imply a "low" road to competitiveness).

Following this approach, we see that upgrading and innovation are intertwined, particularly because we define upgrading as *innovating to increase value added*. Enterprises may achieve this in various ways, as for example by entering higher unit value market niches, by entering new sectors, or by undertaking new productive (or service) functions. In addition, in this context, innovation is clearly *not* defined only as a breakthrough into a product or a process that is *new to the world*. It is, rather, a matter of marginal, evolutionary improvements in products and processes that are *new to the firm*, and that allow it to keep up with an international (moving) standard. This involves a shifting into activities, products and sectors that have a higher value added and higher barriers to market entry. According to Humphrey and Schmitz (2000), enterprises working in a value chain have four types of upgrading options: process, product, functional and intersectoral upgrading.

Process upgrading refers to transforming inputs into outputs more efficiently by reorganizing the production system or introducing superior technology (e.g. footwear producers in the Sinos Valley; see Schmitz, 1999a). *Product upgrading* means moving into more sophisticated product lines in terms of increased unit values (e.g. the apparel commodity chain in Asia upgrading from discount chains to department stores; see Gereffi, 1999). *Functional*

upgrading refers to acquiring new, superior functions in the chain, such as design or marketing, or abandoning existing functions that have a low value added to focus on higher value added activities (e.g. Torreon's blue jeans industry upgrading from *maquila* to "full-package" manufacturing; see Bair and Gereffi, 2001). *Intersectoral upgrading* denotes applying the competence acquired in a particular function to move into a new sector. (For example, Taiwanese TV manufactures used their knowledge and skills to make monitors and move into the computer business; see Humphrey and Schmitz, 2002b, and Guerrieri and Pietrobelli, 2003).

In sum, upgrading within a value chain implies going up the value ladder, moving away from activities in which competition is of the "low road" type and entry barriers are low. But why is the concept of *competitive advantage* gaining increasing importance?

In the theory of *comparative* advantage what matters is *relative* productivity and determining different patterns of inter-industry specialization. However, *competitive advantage* is the relevant concept in the analysis of SME competitiveness because other factors are important, in addition to productivity. The reasons for this are several, including the existence of forms of imperfect competition in domestic and international markets where above average rents are often possible and niches of above average profitability often emerge. A complementary consideration is that different subsectors and stages in the value chain are likely to have different degrees of (dynamic) externalities. For example, in traditional manufacturing this applies to design, product innovation, marketing and distribution, which may all foster success in related activities. For all these reasons, the effort to upgrade functionally (and the policies to support this process) may often be justified in order to reap larger rents and externalities available in some stages of the value chain.

Dynamic considerations also require the concept of competitive advantage. While comparative advantage registers *ex-post* gaps in relative productivity that determine international trade flows, success in upgrading at the firm level enables the dynamic acquisition of competitiveness in new market niches and sectors. Functional upgrading is also likely to reduce *weaknesses* and *vulnerability* in an enterprise product specialization. Competition from new entrants –such as firms from developing countries with lower production costs that crowd out incumbents is stronger in the manufacturing phases of the value chain than in other phase (such as product design and innovation, chain management, distribution and retail, etc.) that are more knowledge and organization intensive. Therefore, functional upgrading may bring about the acquisition of more enduring and solid competitive advantages.

An additional element that has a crucial impact on the upgrading prospects of firms and clusters is the *sector dimension*. Insofar as we have defined upgrading as innovating to increase value added, then all the factors influencing innovation acquire a new relevance. This aspect is often overlooked in studies on clusters, perhaps due to the fact that most of them are not comparative but rather detailed case studies. In order to take into account sector features and their effects on firms' patterns of innovation and learning, we need to introduce the concept of *tacit knowledge*, a notion first introduced by Polanyi (1967) and discussed in the context of evolutionary economics by Nelson and Winter (1982). Some aspects of technological knowledge are well articulated, written down in manuals and papers, and taught at various educational levels, while others are largely tacit, mainly learned through practice and practical example. In essence, this is knowledge that can be freely used but that cannot be expressed and communicated to others. The tacit component of technological knowledge makes its transfer and application costly and difficult. As a result, mastery of a technology may require that an organization be active in the earlier stages of its development, as well as close and continuous interaction between the user and the producer (or transferor) of suck knowledge. Inter-firm relationships are especially needed in this context. Tacit knowledge is essential to establishing a useful grouping of economic activities.

Explicit consideration of sector features is necessary to take into account the different characteristics that the learning process (and thereby the related upgrading processes) may have in different industries. To this aim, we

turn to the seminal work of Keith Pavitt (Pavitt, 1984; Bell and Pavitt, 1993), and adapt it to take into consideration the characteristics of Latin American countries, which tend to be relatively richer in natural resources than in human and technical resources (Wood and Berge, 1997). Economic sectors in Latin America may be grouped into four large categories, depending on the way that learning, innovation and upgrading occur, as well as on the related industrial organization that most frequently prevails. The categories are:

- *Traditional manufacturing*, which refers mainly to labor-intensive and "traditional" technology industries such as textile, footwear, tile and furniture;
- Resource-based industries, which imply the direct exploitation of natural resources (e.g. copper, marble, fruit);
- Complex product systems' industries, which include, among others, the automobile, auto parts and aeronautic industries, ICT and consumer electronics; and
- Specialized suppliers, which essentially refers to software.

Table 1 summarizes the main characteristics of these four categories in terms of their learning and innovation patterns.

Table 1: Patterns of Learning and Innovation in Different Sector Groups

Groups	Industries	Learning Patterns	Description
1. Traditional Manufacturing Industries	Textile and garments, footwear, furniture, ceramic tiles	Mainly supplier dominated, labor intensive firms	• Most new techniques originate from machinery and chemical industries. • Opportunity for technological accumulation is focused on improvements and modifications in production methods and associated inputs, and on product design. • Most technology is transferred internationally, embodied in capital goods. • Low appropriability, low barriers to entry.
2. Resource-based industries	Sugar, tobacco, wine, fruit, dairy, mining	Supplier dominated, Science-based	• Importance of basic and applied research led by public research institutes due to low appropriability conditions (Pineiro, Trigo, 1996). • Most innovation is generated by suppliers (machinery, seeds, chemicals, etc.). Increasing importance of international sanitary and quality standards, and of patents.
3. Complex Product Systems Industries	Automobile and auto parts, aircraft, consumer electronics	Scale intensive firms	• Technological accumulation is generated by the design, building and operation of complex production systems or products. Radical innovation is risky. • Process and product technologies develop incrementally (modular production systems). For consumer electronics, technological accumulation emerges mainly from corporate R&D labs and universities. • Medium appropriability, high barriers to entry.
4. Specialized Suppliers	Software	Specialized suppliers	• Often small firms. Important user-producer interactions. Learning from advanced users. • Low barriers to entry and low appropriability. • High in-house R&D for development of cutting-edge technologies.

SOURCE: Generated by the authors from Pavitt, 1984; Bell and Pavitt, 1993 and Malerba, 2000.

Traditional manufacturing and natural resources-based industries are by far the most numerous in Latin America and, as a result, are especially relevant to assessing the potential of SMEs for upgrading within clusters and value chains.

Traditional manufacturing chains are supplier-dominated because major process innovations are introduced by producers of inputs (e.g. machinery, materials). Indeed, firms have room to upgrade their product and process by developing or imitating new product designs (style). Large buyers are increasingly playing a role in shaping the design of final products and hence the specifics of the production process itself (times, quality standards and costs).

Natural resources-based industries rely on advancements in basic and applied science, which, because they cannot be easily appropriated should be led by public research institutes, possibly in collaboration with producers (farmers, breeders, etc.). Increasingly, this type of basic research is carried out by large firms (i.e. trans-national corporations) that take advantage of economies of scale and appropriate the results of their researches through patents.

Hobday (1998) defines complex product systems as "high cost, engineering intensive products, subsystems or constructs supplied by a unit of production", where the local network is normally anchored to one assembler, which operates as a leading firm characterized by high design and technological capabilities (examples in Brazil are Embraer or foreign transnational corporations such as Fiat, General Motors or Ford). For our aims, relationships with these anchors companies may be crucial to fostering (or hindering) SME upgrading through technology and skills transfers (or its lack).

In the category of specialized suppliers we only consider software, which typically is client-driven. This is an especially promising sector for SMEs in developing countries because the disintegration of some productive cycles (such as, for example, in telecommunications) opens up new market niches with low entry barriers (Torrisi, 2003). At the same time, the proximity of the market and of clients may play a crucially important role in improving the development of design capabilities and, thereby, fostering product/process upgrading. Thus, powerful pressures for clustering and globalization coexist in this sector.

THE METHODOLOGY OF THE STUDY

The aim of this study is to provide *policy lessons on how to support SMEs' upgrading in the global market*. This is attempted on the basis of a qualitative and quantitative exploration of the hypothesis that SMEs' upgrading is affected by the collective efficiency of the cluster in which SMEs operate, by the pattern of governance of the value chain in which SMEs participate, and by the peculiar features that characterize learning and innovation patterns in specific sectors.

This three-dimensional analysis is based on the collection of original data from twelve new clusters in Latin America (Table 2), and on an extensive literature review of cluster studies. The empirical analysis is inevitably affected by some limitations, due to the lack of reliable data. Even when updated firm-level statistics are available, which seldom happens in developing countries, they are usually available at the national or local level, but never gathered at the cluster level or to take into account relationships within the same value chain. This prevents the type of rigorous econometric analyses that would be desirable. Therefore, the analysis relies on the available quantitative evidence and careful qualitative assessments.

The 40 cases selected for this study meet five conditions; namely, agglomeration, upgrading, value chains, sector dimensions and policy lessons. The *agglomeration* condition means that all the cases show some degree of geographical clustering of SMEs. The *upgrading* requirement means that the clusters selected have experienced some degree of upgrading (product, process, functional and/or intersector). The *value chains* condition implies that all clusters are part of a value chain with other firms and organizations. The *sector dimension* refers to a taxonomy proposed following Pavitt and others to assess the current situation in Latin America. Finally, *policy lessons* refer to the fact that all the cases reviewed offer relevant policy lessons. The list of cases studied, while necessarily not com-

plete, is the largest available (to our knowledge) on which comparative exercises have been carried out, and provides a good approximation to the reality of clusters and value chains in Latin America. Thus, the database allows reasonable generalizations.

The following type of information was collected for each cluster:

- The cluster and its degree of collective efficiency;
- The number and mode of governance (market, network, quasi-hierarchy and hierarchy) of the value chains that the clusters supply;
- The upgrading experience of the clusters; that is, the nature of the upgrading achieved, and whether it was positively or negatively affected by being located in a cluster and by being part of a value chain; and
- Information on policy interventions to sustain upgrading in order to determine what kind of instruments were adopted, who took the initiative, at what point in the chain the in tervention began?, who financed the intervention, and if a detailed evaluation of the instruments was carried out.

Attempts to classify clusters following a quantification criterion were also made. The criteria included (i) a quantification of the different types of external economies and joint actions in an ordered scale, ranging from absent (0) to high (3), and the creation of an index of collective efficiency combining external economies and joint action;[11] and (ii) a quantification of the degree of product, process and functional upgrading. As with any study of this kind there may be potential problems with the accuracy of the results that call for cautious interpretations. To overcome some of these problems, the information was cross-referenced and tested by means of interviews with key informants and local experts.

Finally, analysis of the empirical findings is also based on international trade statistics disaggregated at the product-level to assess some upgrading experiences in Latin America, focusing on a particular type of upgrading; namely, vertical product differentiation in the traded goods sector (Amighini, 2003).

[11] On the basis of a thorough assessment by the team of experts and of the available published literature, we quantify the different types of external economies and joint actions in an ordered scale, ranging from absent (0) to high (3), and then compute indexes of external economies and joint action by summing up these figures. The index of collective efficiency is the simple average of the two.

Table 2: Basic Characteristics of Selected Clusters

	Cluster	Country	Date of creation	Number of firms	Production 2002 (US$ mill.)	Production 1995 (US$ mill)	Exports 2002 (US$ mill)	Exports 1996 (US$ mill)	Direct jobs	Indirect Jobs
1	Salmon - Austral Region	Chile	1978	65 + 150	1,005.0	500.0	970.0	480.0	29.000	12.500
2	Milk and dairy - Boaco, Chontales	Nicaragua	mid 1990s	10.605	31.8	25.4	12.7	2.9	15.624	6.544
3	Mangoes -Petrolina-Juazeiro	Brazil	1980s	330	37.0	8.0	51.0	22.0	17.400	11.600
4	Grapes - Petrolina-Juazeiro	Brazil	1980s	250	56.0	45.0	34.0	10.0		
5	Melons - Rio Grande do Norte	Brazil	1980s	120	13.0	19.0	38.0	25.0	19.000	12.500
6	Apples - Santa Catarina	Brazil	1960s	750	51.7	23.3	31.0	6.0	23.500	6.800
7	Furniture - Chipilo, Puebla	Mexico	1987	146	6.7	17.5	7.0	17.1	5.400	..
8	Metalworking, Espírito Santo	Brazil	1988	66	33.3	23.3	1.7	1.1	12.000	48.000
9	Software - Aguascalientes	Mexico	2000s	13	4.3	..	..	..	121	..
10	Software – Mexico, D.F.	Mexico	1980s	130	57.5	..	..	..	2.000	..
11	Software - Guadalajara	Mexico	1990s	152	..	..	..	..	1.040	..
12	Software - Monterrey	Mexico	1982	76	120.0	..	51.1	..	2.000	..

SOURCE and NOTES: Field studies carried out for the present study. … not available
(1.) 65 firms in main value chain, 150 additional local providers. 40 percent of direct jobs are seasonal.
(3. - 6.) For Brazilian fruit clusters sources are: IBGE (www.ibge.gov.br) for production and SECEX (www.aliceweb.desenvolvimento.gov.br) for exports.
(3. and 5.) These figures are incompatible since value of exports exceeds value of production.
(7.) figures for 1996
(8.) Only figures on enterprises associated to CDMEC.
(11.) In Jalisco only 60 firms are formally registered.

3. The Empirical Evidence

This section presents the main empirical findings of the study based on a sector taxonomy. We analyze the impact of collective efficiency and of the pattern of value chain governance on upgrading for each group.

TRADITIONAL MANUFACTURING

Traditional manufacturing refers to labor intensive and light industries such as textiles, garments, footwear, tiles and furniture. In this group, competition is primarily on costs, and predominantly on labor costs, but also increasingly on design, quality of products, fashion content, advertising and branding, mostly depending on the segments of market.

On the Origins of Clustering

The existence of geographic clusters of enterprises specialized by sector is well documented in the literature (Nadvi and Schmitz, 1994). Nevertheless, there are many cases where in spite of clustering, the development of external economies and cooperation remains minimal. One of the necessary, albeit not sufficient, conditions for clustering to generate the development of collective efficiency is time. The Italian literature has drawn attention to the long historical roots of most industrial districts. This aspect has been also emphasized by Cersosimo and Viesti (2003, see box 1) in their analysis of the birth and growth of industrial districts in the Italian *Mezzogiorno*: many of the successful cases are located in areas where there was a long craft tradition in the industry of specialization. Examples are shoes and leather products in Naples, leather in Solofra, embroidery in Central Abruzzo and the textile industry near Teramo, all craft traditions going back to the 19th century. Industry specialization is similarly historically rooted in some of the Latin American cases studied. This is clearly true for the two Mexican shoe clusters in Guadalajara and Leon (Rabellotti, 1997).

However, there are more recent clusters in southern Italy, which were created as the result of the successful development of a leading firm. The most quoted example is the sofa district in Puglia that grew around the company Natuzzi. At the beginning of the 1980s Natuzzi was a small enterprise that succeeded in exporting leather sofas to the United States. Today, it is the largest firm in the Italian furniture industry. Natuzzi has generated an intense spin-off of new firms created by former workers (in most cases) that began work as subcontractors, often imitating Natuzzi's successful organizational model (Cersosimo and Viesti, 2003).

The development of the Mexican furniture cluster located in Chipilo, Puebla, is very similar story to Natuzzi's, although its subsequent development is different. This cluster originated at the end of the 1980s as a result of the success of an individual firm, Segusino, which was established in 1987 with less than 20 workers and two subcontractors. The village of Chipilo, a little community of 5,000 inhabitants who are largely of Italian origins, traditionally specialized in cattle-breeding and artisan dairy industry. There was no previous local experience in the furniture sector. Yet, Segusino's export success (exports increased from few hundred thousand dollars to a record of more than US$30 million in 1998) transformed the local economic structure. In its best years, Segusino employed 1,500 workers and had a network of more than 100 subcontractors. In Chipilo, many cattle sheds were rapidly turned into carpenter's shops. Despite the similarity between Chipilo and the sofa district in Puglia, Segusino closed its plants and declared bankruptcy in January 2003.

Both Segusino and Natuzzi owed their initial growth to exports to the US market. Natuzzi was able to produce leather sofas at US$699, compared to an average price of US$1,999. Segusino identified a specialized market niche: Mexican country-style furniture. In addition, Segusino benefited from a combination of positive elements that boosted furniture exports to the United States. These included a growing demand for this particular style of furniture and improved price competitiveness resulting from the 1994 devaluation of the

Mexican peso. The downfall of Segusino stemmed from a reversal of these conditions; namely the entry of competitors into the Mexican country-style furniture market, a slowdown in demand, and a reversal of macroeconomic conditions, mainly a revaluation of the Mexican peso against the US dollar. Segusino also experienced some microeconomic inefficiencies that contributed to its decline.

In sum, specialized clusters develop in areas with a craft tradition or those where a local leading firm responds to a business opportunity, and where there is access to a market. Cersosimo and Viesti (2003) also stress the importance of the size of the market in explaining the origin and then the growth of the districts in southern Italy. All the successful Italian cases are located close to important urban areas. This is the old Adam Smith argument explaining the extent of the division of labor, recently revamped in economic geography models (Fujita *et al*., 1999).

Box 1
Industrial Clusters in the Italian *Mezzogiorno*:
Different from "Third Italy," Closer to Emerging Countries

In spite of persisting difficulties and unfavorable economic conditions, Southern Italy has undergone a radical transformation during the last decade. Renewed industrial activity in the Mezzogiornio region was spurred by improvements in local governments and local political establishments, the successful fight against organized crime, and a slow but widespread economic recovery. Increased exports of textiles from southern Italy benefited from the unexpected positive differential in price competitiveness after the lira entered the European Monetary System (EMS) as well as from stagnant domestic demand. Like on previous occasions during its very long history, the Mezzogiorno found its future in international trade and integration, on which it had turned its back between 1976 and 1992.

There are currently 25 industrial districts in southern Italy that encompass almost 13,000 firms and employ about 110,000 persons. The average business size is 8.3 employees and varies by each sector and district. In 1998 these districts generated a turnover estimated at US$6.5 billion.

In the second half of the 1990s, Italy enacted policies that favored more economically delayed areas. These policies were radically different from past policies, both in kind and in their aims. The new regional development policy aims to increase territorial competitiveness through highly qualified public investment and a sweeping modernization of the public administration. The Territorial Pact is the most coherent and innovative tool of the new policy. The Pact establishes a program to change the local institutional context by providing incentives to coalitions made up of public and private players that address the need to initiate integrated processes of local development. The Pact is based on two analytic assumptions. The first is that in every socio-institutional context there are factors that can facilitate or obstruct local economic development. The second assumption is that it is possible to have an impact on public policies to change the existing context. Several empirical investigations have proved that, in a significant number of cases, the Pact has contributed to reducing the isolation of the public administration and other local institutions, as well as reinforcing interaction and horizontal relationships.

However, the most obvious criticism to the entire normative apparatus of the Pacts consists in its selection modalities. Specifically, social and institutional cooperation are not assessed. In addition, the modalities with which the Pact has been constructed (that is, its economic dimension, consistency between infrastructure and entrepreneurial projects for local development) have not been assessed or audited. The absence of these types of assessments explains why funding has been granted even to collusive pacts where cooperation has been lacking.

Current information does not permit us to draw firm conclusions. It is wrong to dismiss the Pact because it has not yet been an efficient instrument for financing businesses. But it is equally wrong to uncritically regard it as a successful measure of economic policy in changing local institutional contexts.

SOURCE: Cersosimo and Viesti (2003).

Collective Efficiency

The concept of collective efficiency, first introduced by Hubert Schmitz (1995), defines the competitive advantages enjoyed by firms located in clusters. These advantages stem from local external economies and joint action. The remainder of this section presents empirical evidence on the most common external economies and forms of joint action that can be found in Latin American clusters specialized in traditional manufacturing industries.[12]

External Economics

The existence of a pool of workers with *specialized skills* is the most widespread form of external economy in traditional manufacturing clusters, which is present in many Latin American clusters. The ability to readily find skilled workers is a very important competitive advantage for traditional manufacturing industries because workers' skills have a significant impact on the quality of products. In addition, a degree of rotation of skilled people among firms facilitates the exchange of knowledge within the cluster. A specialized local pool of labor is one of the main sources of collective learning at the cluster level, given that most of the knowledge in these sectors is tacit (Camagni and Capello, 2002).

The creation of a local specialized labor market takes time, explaining this type of external economy is not well developed in Chipilo. Segusino exporting success encouraged many local farmers to become carpenters, but doing so requires time, training, and access to tacit knowledge that does not circulate easily in a cluster lacking a tradition in furniture making. Skilled workers are still rare in Chipilo, and the scarcity of labor resources partly explain the substantial rise in wages without a corresponding increase in labor productivity experienced in the local market.

Clustering of firms also gives rise to a specialized local *supply of inputs and services*. The concentration of firms with similar input needs attracts raw materials and components suppliers and increases competition. Firms located in clusters stand to benefit from lower transaction and transport costs as well as from the ability to maintain lower inventories.

The availability of inputs and services is a more common characteristic in southern Italy (Cersosimo and Viesti, 2003) than in Latin America. Segusino played a crucial role in Chipilo by providing raw materials, components and inputs, and credit to its subcontractors. Clusters in both southern Italy and in Latin America suffer from the lack of local machinery, which prevents the exploitation of the advantages of a close local interaction between technology producers and users. New or used industrial machinery is usually imported from North Italy, other European countries or, increasingly, Taiwan.

Clustering also facilitates the dissemination of specialized *know-how and information* by permitting the easy, informal and rapid flow of information between producers operating near one another, and also among producers, traders, suppliers and providers of specialized services connected to the cluster. This type of external economy is particularly relevant for small firms, which can rarely afford activities like market studies, participation in foreign trade fairs or subscription to expensive databanks.

The dissemination of information takes place through informal channels facilitated by the social cohesion within the cluster. In Chipilo, this happens as a result of the strong family ties within the small local Italian community. The owner of the leading furniture company is not from Chipilo, however, he improved his ties with the locality through his wife whose family emigrated from Segusino, a village near Treviso in Veneto. Bazan and Schmitz (1997) stress the importance of a strong local community spirit in his analysis of the Sinos valley footwear cluster, where community ties are based on common German heritage. This also applies to the furniture cluster of São Bento do Sul.

The grouping of producers in close geographic proximity also facilitates *market access*. The initial export success of the Sinos valley footwear cluster was made possible by the fact that

[12] The tables providing a quantification of the different types of external economies and joint actions in an ordered scale are presented in the Annex 1.

U.S. shoe importers looking for new shoe suppliers in low-wage countries. In the Sinos Valley they found an established cluster, which included shoe producers and some specialized local input suppliers (Schmitz, 1995). Southern Italian clusters also tend to be located near urban centers in order to gain access to larger markets.

Joint Actions

The discussion of joint actions focuses on backward vertical linkages and horizontal multilateral linkages. Forward vertical linkages, mainly with buyers, are discussed in the section on value chains. Horizontal bilateral linkages are not well developed, with rivalry among firms prevailing over cooperation.

Vertical collaboration in Chipilo took the form of cooperation between Segusino and its subcontractors. From the very start, the leading firm made an explicit choice to adopt an organizational model based on strong division of labor. Segusino organized its network of subcontractors favoring their specialization in specific products (i.e. chairs, tables, etc.) and provided technical and financial assistance to many of them. Segusino also helped train the workforce and checked the quality of the products on an ongoing basis. The best subcontractors participated in the quality improvement process and sometimes also contributed to the introduction of new designs.

In some of the Latin American clusters analyzed (e.g. the footwear clusters of Sinos Valley, Guadalajara and Leon and the furniture cluster of São Bento do Sul) external challenges led to an increase in cooperation between producers and local suppliers. Since the opening of the domestic market and concomitant the increase in shoe and components imports, the manufacturer-supplier relationship in Guadalajara has undergone profound change. Suppliers reacted to increased competition from imports by the quality, variety and fashion content of their products. Suppliers also began to visit international trade fairs on a regular basis. As a result, locally available information has increased and the relationship between footwear producers and suppliers has improved. Collaboration in the areas of product development, quality improvement and delivery time has also improved (Rabellotti, 1999). Cooperation between suppliers and shoe producers in the Sinos Valley benefited from the so-called "Chinese shock," which pushed local firms to improve quality and delivery times (Schmitz, 1995).

Different considerations apply to *horizontal cooperation through institutions*. Institutions have played a very important role in the growth strategy of some clusters. A case in point is the Sinos Valley cluster, where, according to Schmitz (1995), self-help institutions played a major role. The organization of a trade fair and a program to bring foreign buyers to the Sinos Valley played an important role early on. Later, as the cluster grew and firms took on different interests, there was a proliferation of institutions and a period characterized by lack of a common purpose at the cluster level. Attempts to create a technological center to assist the furniture industry in Chipilo and to promote an association among local producers were not successful. The reason for this lack of success could be that Segusino backed both initiatives and local producers not belonging to Segusino's network saw it as a way for the leading firm to protect its own interests.

To sum up our discussion about collective efficiency in the traditional manufacturing group, Table 3 presents an index of collective efficiency obtained by combining the external economies and the joint action indexes.[13] The first significant finding is that external economies are more common than joint actions, as the theory would lead us to expect. This argument appears in Nadvi and Schmitz (1999) and is confirmed for a large number of cases in this study. Joint action requires specific investments and firms get involved in cooperation only if they have to face external challenges such as new competitors, innovations that require adapting or a new market.

On average, clusters in the footwear industry develop a fair degree of collective efficiency (the clusters in the Sinos Valley and in Leon are clearly ahead of the others). In three clusters, the degree of collective efficiency can be defined as low. In Chipilo, the lack of collec-

[13] See previous section on the methodology for constructing the indices.

tive efficiency may be explained by a combination of factors, including the very recent origin of the cluster and its main organizational pattern, which is dominated by vertical relationships between the leading firm, and its network of subcontractors). The predominance of these strong vertical relationships interferes with the development of external economies and, especially, joint actions apart from cooperation between the leading firm and its subcontractors. Very similar results are also reported in Torreon's blue jeans cluster where the only significant external economy is the creation of a specialized local labor market and joint action at the horizontal level is almost nonexistent and is characterized by a generalized distrust among firms and the absence of an institutional environment that would help the cluster growth (Bair and Gereffi, 2001).

Table 3: Traditional Manufacturing. Index of Collective Efficiency

Cluster	EE	JA	Index*	Degree**
Textiles				
Medellin (Columbia.)	6.5	6.0	6.25	Medium
Itaji, Santa Catarina (Brazil.)	8.5	5.0	6.75	Medium
Garment Industry				
Bucaramanga (Colombia.)	6.0	5.0	5.50	Medium
Gamarra (Peru)	8.0	3.0	5.50	Medium
Torreon (Mexico.)	2.0	2.0	2.00	Low
Footwear				
Sinos Valley (Brazil.)	12.0	8.0	10.00	High
Leon (Mexico.)	12.0	8.0	10.00	High
Guadalajara (Mexico.)	8.0	7.0	7.50	Medium
Campina Grande (Brazil.)	7.0	6.0	6.50	Medium
Furniture				
Serra Gaucha (Brazil.)	7.0	3.5	5.25	Medium
Uba, Minas Gerais (Brazil.)	4.0	2.0	3.00	Low
Espírito Santo (Brazil.)	6.0	7.0	6.50	Medium
São Bento do Sul (Brazil.)	12.0	4.0	8.00	Medium
Segusino/Chipilo (Mexico.)	6.0	5.0	5.00	Low
Ceramic Tiles				
Santa Catarina (Brazil.)	9.0	7.0	7.00	Medium
Total	114	78.5	94.75	
Average	**7.6**	**5.23**	**6.31**	

NOTE: Evidence on these cases comes from our field studies and published references. *0.5 EEI + 0.5 JAI , **≥9.5 = High; 5.1>Medium<9.5; ≤5 Low

Value Chains

Reading the literature on global value chains (Gereffi, 1999), one would expect the quasi-hierarchy as the dominating pattern of governance in the traditional manufacturing group, with buyers and manufacturers playing a leading role. However, according to our empirical evidence, there are a greater variety of forms of organization and governance in the value chains. In some cases value chains coexist with firms participating in local as well as in global value chains. Seven of the clusters studied participate in more than one value chain with different patterns of governance (Table 4).

An example of a cluster operating simultaneously in different types of chains is the footwear cluster in the Sinos Valley, where in addition to the chain dominated by US buyers, there are other minor chains geared to the Brazilian and the Latin American market. The various chains have different patterns of governance. As mentioned, the US value chain is a typical quasi-hierarchical chain, dominated by US buyers. However, firms that supply the domestic and Latin American markets operate under market conditions. In the quasi-hierarchical chain, US buyers impose their conditions concerning product design, marketing, and branding on Brazilian producers. The buyers are the undisputed leaders in the chain, exerting control over intermediaries, local producers and often input suppliers as well. According to Bazan and Navas-Aleman (2003), this asymmetrical relationship with local producers can be explained by several factors, the most important being the marked concentration of exports by a small number of export agents in the US market and the fact that buyers had numerous sourcing options (such as China, Spain and Portugal) if local producers did not accept their terms. The organization of the domestic value chain is completely different from that of the global chains because the relationships between producers and buyers are market-based.

> *…This is reflected by a number of different indicators such as the low degree of buyer concentration and sales concentration to main clients, the strategic option of selling directly to retailers by using the producer's own sales representatives and, more importantly, the main strategic activities (design, branding and marketing) are carried out by producers instead of buyers. Sales representatives are hired by producers and this sets them apart from exporting agents (who are hired by buyers) in the quasi-hierarchical chains. Therefore, the main differences are that sales representatives are accountable to the producers, buyers (local wholesalers and retailers) do not control any of the strategic activities mentioned above and these conditions, combined with the atomized local footwear demand make market-based relations the main trend in the chain*. (Bazan and Navas-Aleman, 2003)

The two Mexican footwear clusters also operate simultaneously in different chains: in quasi-hierarchical chains dominated by US buyers and in the domestic market in some cases under market conditions and in others in network chains. While in the quasi-hierarchical chains, US buyers control design and product development, in network value chains there is cooperation between firms of more or less equal power, which share their knowledge and experience with the chain. This is an increasingly common pattern in the Mexican footwear clusters, where one of the effects of trade liberalization has been an increase in cooperation between domestic buyers and producers (Rabellotti, 1999).

Table 4: Traditional Manufacturing. The Pattern of Governance in Value Chains

Cluster	Market	Network	Quasi-hierarchy	Hierarchy
Textile:				
Medellín (Col.)	0	0	1	0
Itaji, Santa Catarina (Br.)	3	0	0	0
Garment:				
Bucaramanga (Col.)	2	0	0	0
Gamarra (Peru)	1	0	0	0
Torreón (Mex.)	0	0	2	0
Shoes:				
Sinos Valley (Br.)	3	0	2	0
León (Mex.)	1	1	2	0
Guadalajara (Mex.)	1	1	2	0
Campina Grande (Br.)	n.a.	n.a.	n.a.	n.a.
Furniture:				
Serra Gaucha (Br.)	1	0	0	0
Uba, Minas Gerais (Br.)	1	0	0	0
Espírito Santo (Br.)	1	1	0	0
São Bento do Sul (Br.)	0	1	2	1
Segusino/Chipilo (Mex.)	3	0	1	0
Tiles: Santa Catarina (Br.)	2	0	0	0

Legend: O=absent; 1=domestic chain; 2=global chain; 3=domestic and global chains

Value chains operate differently in the Chipilo furniture cluster, where the leading firm sells its products under market conditions to a large number of foreign buyers, getting directly involved in domestic and international distribution. In the Mexican market, Segusino opened its own stores and set up a franchising retail chain, while in the US market it often preferred joint ventures with local retailers. Although some US buyers maintained a system of quality control in Chipilo, the value chain cannot be defined as a quasi-hierarchical chain because market conditions prevailed and Segusino maintained full control of the types of products that it would manufacture. In this case, the quasi-hierarchical value chain existed between Segusino and the other leading firms and their subcontractors. The small subcontractor workshops operated under conditions defined by the leader of the chain, which held all the strategic design and marketing functions for itself.

In sum, different types of value chains often coexist in the clusters analyzed. In most cases, global value chains dominated by large buyers from the developed world are characterized by a quasi-hierarchical system of governance where the chain leaders generally control the highest value added phases such as design, marketing and branding, and producers from the developing world are often dependent on a few buyers. However, many of the clusters do not participate exclusively in quasi-

hierarchical chains. They may also participate in chains where market conditions dominate. The latter has important implications in terms of upgrading opportunities for clusters and firms.

Upgrading

In traditional manufacturing clusters, process and product upgrading are widely diffused, especially if compared with functional upgrading (which is only just beginning to take place in a smaller number of cases) and intersector upgrading (which never happens in the clusters analyzed) (Table 5) Because these industries are supplier-dominated major process innovations (upgrading) are introduced by producers of inputs (i.e. machinery, raw materials).

Product upgrading usually occurs incrementally through the introduction of new product designs and improvements in the quality of products and components. In some of the cases studied, *process and product upgrading were facilitated by large international buyers*. This confirms Gereffi's view (1999) that producers entering a quasi-hierarchical chain have good prospects for upgrading their processes and products. Along the same lines, Humphrey and Schmitz (2003) agree that "local producers learn a great deal from global buyers about how to improve their production processes, attain consistency and high quality, and increase their speed of response to customer orders."

Table 5: Traditional Manufacturing: Upgrading*

Cluster	CE Degree	Product Upgrading	Process Upgrading	Functional Upgrading
Textile:				
Medellin (Col.)	Medium	2.0	2.0	1.0
Itaji, Santa Catarina (Br.)	Medium	3.0	3.0	1.0
Garment:				
Bucaramanga (Col.)	Médium	1.5	1.5	n.a.
Gamarra (Peru)	Médium	1.0	1.0	0.0
Torreón (Mex.)	Low	1.0	3.0	1.0
Shoes:				
Sinos Valley (Br.)	High	3.0	3.0	1.5
León (Mex.)	High	2.0	2.0	1.0
Guadalajara (Mex.)	Medium	2.0	2.0	1.0
Campina Grande (Br.)	Medium	1.5	1.5	0.0
Furniture:				
Serra Gaucha (Br.)	Medium	2.5	2.5	0.0
Uba, Minas Gerais (Br.)	Low	1.0	1.5	0.0
Espírito Santo (Br.)	Medium	1.5	1.5	1.0
São Bento do Sul (Br.)	Medium	1.0	2.0	1.0
Chipilo (Mex.)	Low	2.0	2.0	1.0
Tiles: Santa Catarina (Br.)	Medium	3,0	3,0	1,0
Total		**28,0**	**31,5**	**10,5**
Average		**1,86**	**2,1**	**0,7**

*3=High; 2=Medium; 1=Low; 0=absent

However, although inclusion in global value chains generally represents an open window on the global market, foreign buyers do not always provide support for upgrading (Humphrey and Schmitz, 2003). On the basis of our sector approach, we can conclude that *in traditional industries buyers usually provide support*. This depends on the characteristics of products that are not customized. In these industries information on products and processes cannot be easily codified in technical norms and the quality of products depends on the specialized skills of local producers (or alternatively, even though the processes could be codified, local firms lack the capability to adapt those instructions to their production systems). As a result, global buyers have no choice but to assist local suppliers in improving products and processes. This support is crucial in the first stages of a local producers' integration into the global value chain. In fact, in traditional industries global buyers look constantly for lower-cost production sites and this implies that when they integrate new producers into a global value chain, they have to assist them in meeting requirements that frequently do not apply to the domestic market. Thus, we may expect that in these cases, quasi-hierarchical governance is needed because new suppliers lack knowledge of international markets and buyers need to be involved in product design. This is also the case because close monitoring and control are required to ensure that products meet international standards (Humphrey and Schmitz, 2003).

This upgrading effect is well documented in the Sinos valley where, according to Bazan and Navas-Aleman (2003), rapid process and product upgrading have been facilitated by inclusion in the US value chain. A similar effect is also apparent in Leon, one of the two Mexican footwear clusters, where after the 1994 devaluation of the peso US buyers began to play a very significant role in upgrading. Again, US buyers have contributed in an important way to process and product upgrading in the blue jeans cluster of Torreón (Jalisco, Mexico) (Bair and Gereffi, 2001). In all those cases, integration in global value chains has led to the adoption and rapid improvement of product and process capabilities. In addition, there is a *positive relationship between product upgrading and the degree of collective efficiency* in this group of industries (Table 6), which can be explained by several factors.

- The sharing of information and knowledge and the rotation of workers among the various firms facilitate the transmission of upgrading within the clusters.
- Product upgrading is also facilitated by joint action. Vertical joint action with suppliers is crucial to improving products because components and inputs obviously contribute to their quality. This also applies to relationships with buyers.
- Multilateral horizontal cooperation can also play an important role in product upgrading through various actions such as participation in international trade fairs, collection of information about international fashion trends, and connections with international buyers.

The footwear clusters in Mexico and the Sinos Valley are good examples of the positive relation between collective efficiency and product upgrading. Rabellotti (1999) shows how the efforts by some manufacturers and their suppliers to improve the quality and fashion content of components permeated throughout the Guadalajara cluster. Moreover, the author stresses the importance of a program undertaken in León, aimed at promoting the standardization of components, in product upgrading at the cluster level.

Schmitz (1995) underlines the importance of various cluster programs in the Sinos Valley that are aimed at supporting the participation of local producers in international trade fairs and at bringing international buyers in the cluster, at an early stage of development.

However, based on the available empirical evidence, it does not appear that there is a clear link between collective efficiency and process upgrading. The reason for this is that technology suppliers drive process innovations in traditional industries and there is no local technology in any of the clusters analyzed. In other words, the close relationship between users and producers of technology that it is so important in explaining process upgrading in Italy's industrial districts is missing in Latin American clusters.

Table 6: Traditional Manufacturing:
Correlation Between Collective Efficiency and Upgrading*

Collective Efficiency	Product Upgrading	Process Upgrading	Functional Upgrading
High	2.5	2.5	1.25
Medium	2.0	2.5	1.00
Low	1.5	2.5	1.00

*The table presents the average level of each form of upgrading for each groups of cluster classified on the basis of the degree of collective efficiency.

The literature on *functional upgrading* (Bazan and Navas-Aleman, 2003; Humphrey and Schmitz, 2003; Rabellotti, 2001) shows that although inclusion into global value chains facilitates product and process upgrading, it also means that firms become tied into relationships that often prevent functional upgrading and leave them dependent on a small number of powerful customers. In the Sinos valley, local suppliers were discouraged from functional upgrading by their main US buyers who did not want to share their core competencies in design, marketing and sale with them (Bazan and Navas-Aleman, 2003). In a well-developed and strongly export-oriented Italian footwear district (Brenta), Rabellotti (2001) found that with the entry of the luxury fashion companies into the market, local enterprises began to move out of design and sales. In fact, it appears that Brenta has been undergoing a process of functional *downgrading*. While the design and acquisition of inputs were traditionally controlled locally and carried out by the firms themselves or inside the district, the introduction of luxury fashion companies has pushed local enterprises out of design and sale. There are also signs that the luxury fashion companies are extending their control backwards along the chain.

Amighini (2003) also describes a process of functional downgrading in Mexico's furniture industry. The analysis of market shares and export unit values for the furniture industry in Mexico shows a modest market share for all of the products considered and that the share is decreasing in 3 out of 4 products,[14] suggesting a loss of international competitiveness. Mexico has experienced a downgrading in the office furniture market (a slight decrease in market share combined with a sharp decrease in export unit value relative to competitors). In addition, Mexico is withdrawing from other segments of the market (with decreasing shares and decreasing export unit value).

Functional upgrading can more easily take place in market-based value chains (Humphrey and Schmitz, 2003). As already mentioned, Sinos Valley firms selling in the domestic and Latin American markets have successfully undertaken functional upgrading in design, branding and marketing. According to Bazan and Navas-Aleman (2003) the reason for this success in functional upgrading lies in the fact that smaller buyers have less market power. A similar process of functional upgrading is also apparent in the Mexican footwear industry among firms selling in the domestic and Latin American markets (Rabellotti, 1999). The same is true in the Brazilian textile cluster in the Itaji valley (Santa Catarina) (Campos et al., 2000).

Table 6 shows a positive (albeit weak) relationship between functional upgrading and collective efficiency. This information and the available qualitative evidence show that the factors that account for this positive relationship are the transmission of information and

[14] The disaggregation of products considered is taken from the UN Comtrade (HS, Rev. 00) and is the following: Office Furniture, Kitchen Furniture, Bedroom Furniture and Other Wooden Furniture.

the rotation of a skilled labor force among the firms (i.e. external economies) and initiatives such as participation in international trade fairs, collection of information about fashion trends, training programs for designers, and collective promotion of local brands (i.e. joint actions). That is, in order to upgrade functionally firms need to invest in design, branding and marketing and given that the sums involved are often large, SMEs may take advantage of clusters to collectively improve access to information, know-how and knowledge about markets.

Conclusions

In traditional manufacturing, process and product upgrading are a rather common phenomenon among the clusters analyzed. In some of them, the upgrading process has been supported by the leaders of the global value chain dominating the cluster. However, collective efficiency also plays a role in supporting both product and functional upgrading. Above all, SMEs rely on the effect of external economies and joint actions to reduce the cost of investments required to undertake upgrading. Given the coexistence of several value chains with different types of governance, the evidence reveals that those with market-based governance offer the best opportunities for local SMEs to functionally upgrade. To conclude, it is important to keep in mind that favorable macroeconomic conditions are particularly important for this group of industries (indeed, unfavorable macro conditions may rapidly turn current successes into failures). The recent collapse of Segusino, the leading firm in the Chipilo furniture cluster, reveals that in a favorable macroeconomic context a cluster may be able to successfully upgrade products and processes, often by integrating into a global value chain. But changes in these conditions may put the cluster at risk.

NATURAL ROURCE-BASED CLUSTERS

For our purposes, industries based on natural resources include agroindustrial activities (e.g. fruit, sugar, wine, salmon, milk) and some mining industries. Together with traditional manufacturing, they are the sectors in which the countries of Latin America enjoy a comparative advantage (Amighini, 2003). Although these activities have some characteristics of the "supplier dominated" industries (Pavitt, 1984), they also share some features of the "science-based" industries because they evolve, change and innovate on the basis of scientific discoveries and their subsequent technological upgrading. The bulk of research is carried out by universities and in the research labs of biotech, chemical and food firms (e.g. Tobacco TNCs). Local farmers, breeders and producers often make incremental improvements in the production process and in product differentiation. In mining and other extracting industries (e.g. marble and copper), innovation is carried out mainly by suppliers of machinery and inputs.

This sector, in spite of being essentially based on natural resources, is increasingly affected by structural changes resulting from globalization. This means that static comparative advantage is no longer sufficient for achieving long-term competitiveness (Perez-Aleman, 2000). The global market for fresh fruits and other natural and animal products has become increasingly demanding, both in terms of better quality and of socially and environmentally sustainable production processes. In other words, the imperative of continuous scientific and managerial innovations to attain these demanding standards is clear and dominating for small growers as well as larger ones (Dolan, et al., 1999; Farina, 2002; Gibbon, 2001; Reardon et al., 2002). In turn, this also requires collective action to spur constant innovation, enhance the appropriation of its results, and reduce risks and uncertainties.

The empirical evidence for this section derives from detailed and original field studies on the salmon cluster in Southern Chile (Maggi, 2003), the milk and dairy cluster in Boaco and Chontales, Nicaragua (Artola and Parrilli, 2003), the mango and grape cluster in Petrolina-Juazeiro, the melon cluster in Rio Grande do Norte, and the apple cluster in Santa Catarina, all in Brazil (Gomez, 2003). An extensive literature survey was also conducted.

On the Origins of Clustering

As with the traditional manufacturing sector, agroindustrial clusters also originated in very different and varied ways.

The salmon cluster in Chile began through a process of public-private cooperation and collective learning that come together as a result of increased external demand and an export support and promotion policy (Maggi, 2003).

The first attempts to explore the fish farming potential of Chile's Southern region (Tenth Region) took place in the 1960s, and generated a significant amount of specialized technical knowledge, but open sea "ranching" technique did not prove successful. In 1981, Fundación Chile bought the Domsea Farms (a Chilean subsidiary of Union Carbide) plants and founded Salmones Antártica, which produced more than 1,000 tons of salmon in 1988 (Pietrobelli, 1998). Other initiatives were carried out in lake Llanquihue with support from CORFO, the Japanese company Nishiro and the fishing company Mytilus (now Mares Australes). An additional indicator of growing success was the creation of a producers' association, Asociación de Productores de Salmón y Trucha de Chile (APSTC, today Salmon Chile), which grouped 17 national producers in 1986. APSTC managed to coordinate the process of commercialization urging producers to respect export quality standards through a voluntary trademark that helped set a minimum quality level for all producers (members and non-members alike). Thus, *the interaction of public and private initiatives in a new and risky business was fundamental to establish success models and provide the essential public goods for this sector*.

The transformation of the local economy of Petrolina-Juazeiro (Brazil) into a dynamic mango and grape cluster was *the result of centralized government planning* (Gomes, 2003). In 1948, the federal government created the San Francisco River Valley Development Agency (CODEVASF), a parastatal targeting the promotion of navigation, irrigation, agricultural and industrial development in the San Francisco river valley. In the 1960s and 1970s, CODEVASF expropriated land in order to implement public irrigation projects; enlisted different size growers and agricultural processing firms in each project; provided incentives for agricultural industries to establish in the region; and supported the creation of a growers association (VALEXPORT) that was key to promoting exports.

By providing different sized lots, CODEVASF explicitly established a structure of production consisting of both large and small growers. Hundreds of small growers received irrigation-ready lots (with on-farm pumps, canals, and drainage system installed and ready for use), guidance on what to produce and technical assistance, and also facilitated access to credit and buyers. Initially, growers paid a nominal fee for the lots and received most of the support at no cost. Later, in the late 1980s, CODEVASF began charging water fees and drastically reduced its technical assistance. There was also a noteworthy technological dimension to this strategy. CODEVASF promoted a sequence of crops that facilitated the learning process of small growers, most of whom had never previously worked with irrigated agriculture. Thus, growers first produced a combination of annual crops, including beans, corn, and melon, followed by the widespread adoption of industrial tomato crops, and subsequently higher-value fruit crops, including mangoes and grapes. The transition from phase to phase involved a combination of conventional and more innovative support policies to help growers in each, consecutively more difficult, phase.[15]

The establishment of the apple cluster in Santa Catarina (Brazil) was somewhat different. This cluster resulted from *the initiatives of pioneering entrepreneurs with public support and extension policies*. Apple production in Santa Catarina is spread across two main growing regions centered on the cities of Fraiburgo and São Joaquim, which share the title of "Brazilian apple capital." Apples have been the region's main source of income and employment since the 1970s.

Commercial apple production in Santa Catarina dates back to the 1960s when private en-

[15] The adoption of industrial tomatos crops, for example, involved an unusual level of coordination between CODEVASF, the Bank of the Northeast, processing firms, and growers. Likewise, the transition from tomato to perennial fruit crops involved coordination between CODEVASF and the Bank of Northeast, where the Bank "unintentionally" served as a conduit of technology between firms and small growers. It did so through its loan application process which required bank professionals (who were familiar with irrigated agriculture) to visit each farm to assess the proposed project, including its choice of technology (Gomes, 2003:8).

trepreneurs began experimenting with different varieties. German and French immigrants led the efforts in Fraiburgo, while Japanese immigrants led those in São Joaquim. These pioneers were instrumental in experimenting with different apple varieties and in establishing a market for domestically produced apples at a time when Brazil imported 90 percent of its apples.[16] Following their example, many other apple growers settled in the area. A great variety of firms and growers are now established in Santa Catarina. Public policies and institution-building efforts also played an important role in the establishment of this cluster. Fiscal incentives enabled the original firms in Fraiburgo to expand their production of apples and take risks that they otherwise might not have taken. Advancements in technical know-how began to take place with the creation of the Project for Temperate Fruits (PROFIT), which was aimed at establishing an apple growing area in the state and provided all the necessary support, including agricultural credit, extension, training, and research, through the Agricultural Credit and Extension Agency (which subsequently became the State Agricultural Research Agency, EPAGRI). Government outreach efforts were instrumental during the initial stages. The state government established extension offices in each of the regions considered favorable for apple production. Each local EPAGRI office had at least one agronomist specializing in temperate fruit production for every 20 growers. The extension workers visited growers at least once a week at home and in the field. EPAGRI also offered training courses and seminars for growers at its training centers throughout the state, paying for growers' travel and participation. The state invested heavily in training its cadre of researchers and sought technical expertise and financial resources in several developed countries that had extensive experience with apple production. This led to collaboration with Israeli, German, and British institutions, as well as with Cornell University in the United States.

[16] In addition, pioneers in each area established the very different structures of production that persist to this day, with large firms in Fraiburgo and small growers in São Joaquim. This is consistent with the natural environment, which is one of rolling hills in Fraiburgo (favoring large landholdings), and rocky mountainous terrain in São Joaquim (favoring smaller holdings) (Gomes, 2003).

Melon production in Mossoró, Rio Grande do Norte (Brazil) got its start as a result of initiatives undertaken by two entrepreneurs who correctly identified a business opportunity (Gomes, 2003). Agricultural production in the area was originally dominated by cotton, corn and beans. In the late 1980s, a large commercial firm began growing melons, hiring an experienced grower from São Paulo. By the mid-1990s, this firm was the single largest melon grower in Brazil. Its success inspired another entrepreneur from São Paulo to establish what turned out to be the second largest firm in the sector. Together, they accounted for about 70 percent of the melons produced in the region.

The availability of highly subsidized venture and investment capital in the mid-1970s enabled these pioneering firms to test new varieties of melon and experiment with production practices in order to adapt them to local conditions. It also allowed them to establish domestic and foreign export channels and build a recognized name for locally produced melons. Tightening credit markets and the economic repercussions of the Real Plan in the mid-1990s plunged these two firms into a financial crisis that resulted in the closure of one of them closed and drastic cutbacks in production at the other. Despite the outcome for these firms, their venture into melon production was crucial to boost the emergence and growth of a cluster. They proved that the environment in Rio Grande do Norte is favorable for growing melons, identified suitable varieties, established domestic and export marketing channels, and trained hundreds of field workers and agronomists who subsequently spread their know-how throughout the cluster. The participation of small and medium enterprises in the production of melons increased from 9 percent in 1990 to 27 percent in 1997, and it is likely to be as high as 30-40 percent today. The emergence of clusters in Mossoró is similar to the experiences of the Mexican furniture cluster (Zepeda, 2003) and of other examples in southern Italy (Cersosimo and Viesti, 2003). Although agroindustrial clusters may have very different origins, the presence of an entrepreneurial project is pivotal and common to all.

Table 7: Natural Resources-based Clusters: Index of Collective Efficiency

Product	Location	EEI	JAI	Index*	Degree**
Tobacco	Rio Pardo, RGS (Br)	8.0	6.0	7.0	Medium
Wine	Colchagua (Ch)	11.0	5.0	8.0	Medium
Wine	Serra Gaucha, RGS (Br)	9.0	7.0	8.0	Medium
Sugar	Valle del Cauca (Co)	9.0	10.0	9.5	High
Marble	Espírito Santo (Br)	9.0	4.5	6.8	Medium
Copper	Cuajone-Toquepala (Pe)	5.0	1.5	3.3	Low
Salmon	Region Austral (Ch)	10.0	11.0	10.5	High
Milk -Dairy	Boaco, Chontales (Nic)	8.0	8.0	8.0	Medium
Mangoes and Grapes	Petrolina Juazeiro (Br)	10.5	10.5	10.5	High
Melons	Rio Grande do Norte (Br)	9.0	7.0	8.0	Medium
Apples	Santa Catarina (Br)	10.5	10.5	10.5	High
	Average	**9.00**	**7.36**	**8.2**	

*0.5 EEI + 0.5 JAI **≥9.5 = High; 5.1>Medium<9.5; ≤5 Low

Collective Efficiency

External Economies

There is substantial evidence to suggest that in spite of the existence of many productive clusters in Latin America, the development of external economies and cooperation remains minimal (Albaladejo, 2001).

Table 7 presents an index of collective efficiency obtained by combining the external economies (EEI) and the joint action indexes (JAI). It shows that overall clusters in this group appear to have *more sources of external economies that joint actions*. The former occur as a spontaneous, often unintentional effect of agglomeration. The latter require an active attitude, widespread consciousness of the benefits of cooperation, longer time, and often never take place without outside influence (or public initiative).

Most clusters tend to benefit from external economies derived from local labor markets and the local availability of inputs. This is less true for access to information and markets, where inter-cluster differences are more marked. The sector and geographic concentration of productive activities in natural resources-based clusters tends to create a pool of specialized skills that benefit both workers and firms. This appears to be their major source of external economies (see annex 1). The creation of a local specialized labor market takes time, but most of these clusters have been in existence for quite some time, often several decades. Perhaps in some relatively more backward areas labor skills are not very advanced, but tend to match relatively backward technologies, and this does not appear to negatively affect production efficiency. This appears to be the case of the dairy cluster in Nicaragua. Furthermore, in a dynamic cluster the endowments of skilled labor tend to rise over time as a result of training activities undertaken by individual firms, or of joint actions in training, or the intervention of the public sector. The Chilean salmon cluster is a good example of powerful efforts to create related specializations in local universities, and to promote training at the firm level (Maggi, 2003). The wine cluster in Colchagua, Chile, also benefits from local expertise that usefully complements foreign expertise (Giuliani, 2003).

With some exceptions, natural resources-based clusters enjoy the advantage of locally available inputs. The exceptions are the copper cluster in Peru and, to some extent, the marble cluster in Espírito Santo, which suffer from the local lack of some crucial intermediate inputs. In addition, milk producers in Nicaragua do not enjoy easy access to specialized machinery.

Most of the available literature stresses the idea that clustering enhances the easy, informal and rapid flow of information and knowledge among local producers, traders, and institutions. Knowledge is shared and created though a process of "collective learning" in the cluster. In some cases, the cluster is even considered a locus of localized learning, with substantial spillovers in the air (Maskell, 2001).[17] However, this hypothesis is questioned by the empirical evidence of knowledge flows in the Colchagua valley wine cluster in Chile. In this case, knowledge does not flow freely by virtue of geographical proximity, but rather flows within cliques of actors and firms, with similar absorptive capacity that belong to the same knowledge community (Giuliani, 2003). Thus, tacit and codified knowledge is held by specific persons (professionals). This means that firms' capacity to transfer and absorb knowledge is not evenly spread, but is the result of specific skills and capabilities available only to a few firms.

Drawing from Allen's (1977) terminology, Giuliani (2003) isolates three different types of firms in Colchagua; namely, technological gatekeepers, external stars and isolated firms.

Technological gatekeepers are firms with a high level of knowledge that have broad connections with other local firms and with sources of knowledge outside the cluster. They are often locally owned firms or foreign-owned wineries that are strongly related to their parent companies. These firms bring new knowledge into the cluster and disseminate it locally. *External stars* are firms highly connected with external sources of knowledge, but with little or no interaction with other local firms and, therefore, do not disseminate their knowledge locally. Finally, *isolated firms* are scarcely connected either within or outside of the cluster.

In Colchagua, the strongest links that firms have with networks of knowledge are the so-called "flying winemakers." These are consulting oenologists who advise firms and keep them informed of the latest technology. The consultants are often (56 percent) foreign experts who visit the wineries not less than 4 times a year. They often serve more than one local firm, thereby further spreading knowledge within the cluster. National experts constitute what has been called an epistemic or knowledge community, which represents a local highway for learning and technical improvements. Endowed with a common technical knowledge base, they easily connect national and foreign professionals, and facilitate knowledge flows inside and outside the cluster. Foreign advisors play a similarly important role in the Brazilian wine cluster (Vargas, 2001).

In other cases however, information flows informally across the agents, often facilitated by extension initiatives of the international development agencies (as is the case of Nicaragua). In other cases it benefits from public and private education and research programs (such as the local universities in the Chilean salmon cluster).

In principle, geographical clustering by producers may attract customers and improve market access for local firms. However, this is not the case in any of these clusters, where agglomeration *per se* does not result in better market access. In Nicaragua, the access to market resulting from the clustering of milk and dairy activities is good but not great. The cluster lacks adequate transportation infrastructure and has difficulty gaining access to the Central American market because of its higher health standards and regulations.

Joint Action

The three fresh fruit cluster in Brazil provide particularly useful information about the role of external economies versus joint actions (Gomes, 2003). All three clusters enjoy similar levels of external economies. Given that they

[17] In Marshall's "industrial atmosphere," "…the mysteries of the trade become no mysteries, but are as it were in the air, and children learn many of them, unconsciously." (Marshall, 1920)

all similarly long production experience, all of them also have access to a qualified labor pool, they purchase nearly all inputs locally, and they enjoy easy access to information about markets and technology (which is spread through formal (associations, cooperatives, input suppliers-growers) and informal (social) networks. Yet, remarkably, they differ in terms of joint actions and of the institutions that growers and the public sector have created to aid in the process of upgrading. Further differences are also related to the role and the governance model of the value chains to which they belong.

At one extreme of the joint action spectrum are mango and grape growers in Petrolina-Jauzeiro, is the result of concerted planning by a federal parastatal. At the other extreme are melon growers in Rio Grande do Norte, where joint action is mostly the result of private entrepreneurship and only minimal public support. Somewhere in between is apple production in Santa Catarina, where the public sector was very active with research and extension, but did *not* carry out a broad range of interventions like that in Petrolina-Jauzeiro. Moreover, interventions in Santa Catarina were mostly in the hands of the state rather than the federal government.

What can explain such strikingly different levels of joint action in the three cases? A possible explanation lies in the structure of production. The empirical evidence suggests that less concentrated structures of production are associated with a greater level of joint action among growers (Gomes, 2003). In Rio Grande do Norte two leading firms historically accounted for over 70 percent of total production, while production is less concentrated in Petrolina-Jauzeiro and Santa Catarina, where 5 and 10 growers, respectively, accounted for 35 and 50 percent of production, respectively. Thus, scale economies in production and rising sector concentration would not help to explain the advantages of collaboration and joint action.

In Santa Catarina, firms and small growers also interact through vertical coordination, which ranges from outsourcing production through long-term contracts to on-the-spot negotiations at harvest time. In Petrolina-Jauzeiro mango and grape exporters sometimes visit growers weekly, providing technical assistance, performing soil analyses to schedule fertilizing, making suggestions regarding the harvest calendar, harvesting and transporting mangoes to packing houses, and advancing credit to purchase inputs.

Forward and backward linkages in the melon cluster of Rio Grande do Norte are radically different. The two leading firms were never able to collaborate beyond the few activities undertaken by the melon growers association, PROFRUTAS, which itself was created only in response to demands from the US Department of Agriculture, but remained a weak and disorganized association, with limited reach and limited voice. Thus, *the Rio Grande do Norte cluster stands out for its comparatively low level of joint action.*

This is in stark contrast with the experience of the salmon cluster in southern Chile where policy requirements evolved with the development of the local system. In the case of this cluster, public policies and private initiatives generated several remarkable joint actions, which took place in three distinct phases. The first phase involved initial learning and went from 1978 to 1985. The central challenge during this period was to learn to produce a new good under new conditions. This required investments in research and development and pioneering initiatives, and benefited from private and public investments in the new venture. This would later create a demonstration effect that drew additional investors. Investments during this phase were largely undertaken by Fundación Chile, the Instituto de Fomento Pesquero (IFOP, Fisheries Promotion Institute), and international development agencies. Activities were largely directed to building the basic physical and research infrastructure, developing the knowledge and technology to breed salmon under the conditions prevailing in Chile, and generating successful models that could be imitated by entrants into the market.

The imperative during the second (or maturing) phase, which lasted from 1986 to 1995, was to improve competitiveness by standardizing the quality of the product and increasing production. This phase required better infrastructure, better local providers of inputs such as cages, nets, and feed (local clusters of input

providers gained importance during this phase). Efforts to upgrade functionally by promoting and marketing Chilean salmon abroad emerged during this period. Policies also differ during this period. Public agencies such as CORFO and ProChile offered subsidies to help develop the needed technical skills. INTESAL (*Instituto Tecnológico del Salmón*), was created as a public/private (70/30) initiative to strengthen local technical skills and improve technology transfer. SalmoFood, a public/private (20/80) venture involving 13 local salmon producers was founded to enter the strategic segment of food production, which until then was dominated by foreign producers. Salmocorp brought together 13 national producers (who together represented 30 percent of total production) to sell abroad. And ProChile, in cooperation with Canadian producers, promoted Chilean salmon in the United States to develop new markets.

The third phase involved globalization and has been going on since 1996. Its aim is to raise productivity through technology transfer (foreign missions) and biotechnology (genetic improvements and remedies for illnesses that affect fish). Several efforts were also made to improve the regulatory environment for the sector. Thus, for example, public policies introduced environmental controls, and a collective agreement on clean production was reached among the firms participating in the cluster, the salmon producers' association and regulatory (CONAMA) and support (CORFO) agencies. New environmental regulation (RAMA) was also introduced. Interestingly, the technical mechanism to allocate resources shifted from that of direct subsidies, utilized in the early stages of the cluster, toward public funding allocated through competitive tenders. This was only possible because the cluster had evolved and matured.

In sum, the experience of this cluster has been characterized by remarkable joint actions involving a variety of private and public firms and institutions throughout all the phases (Maggi, 2003, Table 9). These cooperative actions were first mainly directed to promoting access to export markets and later, in the globalization phase, to addressing second order priorities, typical of a mature cluster, such as science and technology, and environmental and regulatory issues.

Useful lessons may also be drawn from *failures in carrying out joint actions*. Thus, for example, the melon cluster in Rio Grande do Norte experienced a puzzling disconnect between growers and public sector researchers. Yet, the damage was much less than could have been the case because of the nature of the market for melons. In addition, the production cycle for this fruit makes upgrading much easier. Moreover, the cluster was dominated by two large growers who could do much of the upgrading themselves and did not require public support. In principle, two public sector institutions could have potentially supported melon growers: the local (federal) agricultural school (ESAM), and the EMBRAPA center in the neighboring state of Ceará. However, both of these institutions remained distant from the growers since the very beginning of the cluster. The capabilities for carrying out research on melons was very limited in both agencies, and the two larger growers had no interest in the widespread dissemination of technologies that could facilitate the entrance of other growers into the market.

Another interesting example of joint action stems from the apple cluster in Santa Catarina. Apple growers in Santa Catarina formed an association (ABPM, Brazilian Apple Growers Association) to represent their interests before government agencies. Although only large apple growers were members of the group in the initial stages, the ABPM is now a forum for both large and small growers. Its members now account for 80 percent of Brazilian apple production and ABPM is especially active through marketing campaigns, pest monitoring programs, lobbying of federal officials to ensure protection from imports, and disseminating research findings for improved production practices.

Bilateral and multilateral horizontal relationships in Nicaragua's dairy cluster improved in the past few years thanks to the creation of several cooperatives for processing cheese as well as the establishment of lobbying and service organization (Chamber CANISLAC, Alianza Amerrisque). The creation of cooperatives benefited from international cooperation, which helped revert existing negative attitudes toward the concept of cooperatives (that was the result of experiences during the Sandinista period). An example of a successful coopera-

tive is *Cantores*, which brings together 37 cheese manufacturers in the province of Boaco. The cooperative is planning rely on advise from UNIDO and CIDA to set up its own pasteurizing plant (Artola and Parrilli, 2003). Another interesting example of joint action is the Alianza Amerrisque, which involves nine milk producers' cooperatives in Chontales and together with Unión Nacional de Agricultores y Ganaderos (UNAG) is seeking financing to build its own milk processing plant.

Another example of joint action in the Nicaraguan cluster is the creation of the milk producers' association (CANISLAC) in 2000, which was established with advice from UNIDO and PRODEGA (a Finnish cooperation project that has operated in the sector for several years). This group plays a lobbying role on issues such as international trade negotiations (following the closing of the Salvadorian market to Nicaraguan milk) and government subsidies (for providing a glass of milk per schoolchild per day throughout the country). Large foreign companies, such as Parmalat and Nestlé-Prolacsa, are also members of this association. This has its pros and cons because of the diversity of the interests being represented.

An interesting example of joint action is the creation of the Brazilian Wine Institute (IBRAVIN) by the wine cluster of Serra Gaúcha (Rio Grande do Sul, Brazil) during the 1990s. IBRAVIN was originally created to manage a series of projects approved through the so-called Fund for Support to the Wine Sector (Fundovitis), which was financed through the state government. Initially, the institute attempted to bring together efforts being carried out by the main wine associations in order to upgrade the whole wine production chain. This process involved development projects in several areas, including market information, improved viticulture practices, cooperation between growers and wineries, improvements in wine and grape quality, creation of a viticulture directory in the region, and a new legislative proposal for the sector. As a result, the institute became a potential regulatory body, emulating a model that had been successful in Uruguay in the 1980s. The institute was also able to bring together the needs of the sector with research carried out by regional research centers and universities (Vargas, 2001).

Several field studies highlight the importance of *collective actions to promote scientific and technological research and development*. For example, EMBRAPA's National Center for Research on Grape and Wine (CNPUV) and the JK Agro technical federal school (both located in Bento Gonçalves) carry out research and training programs for the cluster. The CNPUV, which was created in 1975, is a national clearinghouse for wine research. Its main purpose is the development of agroindustrial product and process technologies for the wine industry. The center performs most viticulture R&D activities for the cluster. The JK Agrotechnical federal school, which was created in 1959, is the only teaching institution in Brazil that offers training for oenology technicians at the intermediate degree level. In 1995, the school began to offer a graduate course in viticulture and oenology technology, and collaborates with the French National School for Agronomic Formation in Toulose and with the Federal University of Rio Grande do Sul.

The Brazilian Apple Growers Association in the Santa Catarina apple cluster also focuses on research and development. In 1992, in cooperation with the Ministry of Agriculture and state secretary of agriculture, the association established a warning system for plant diseases and a control system to reduce the impact of hailstorms on the region's apple orchards. The relationship between public sector research and the growers was strengthened in 1988 when ABPM developed a research program funded through member contributions (about US$8/ha/year), formed a technical council and invited a leading EPAGRI researcher to coordinate its activities. Through this process, ABPM has funded almost 50 percent of the annual research costs of EPAGRI's local station

In contrast to the foregoing examples, the tobacco cluster in Brazil's Rio Pardo valley (Rio Grande do Sul) lacks teaching and research organizations to meet the specific technological demands of the firms of the sector. Linkages are confined to lab analyses and certification, and all research is takes place within subsidiaries of the transnational corporations operating in the sector.

Table 8: Natural Resources-based Clusters: The Pattern Of Governance of the Value chains

Main Product	Location	Market	Net-work	Quasi-hierarchy	Hierar-chy
Tobacco	Rio Pardo, RGS (Br)	0	0	2	0
Wine	Colchagua (Ch)	3	0	2	0
Wine	Serra Gaucha, RGS (Br)	3	0	0	0
Sugar	Valle del Cauca (Co)	3	0	0	0
Marble	ES (Br)	1	0	2	0
Copper	Cuajone-Toquepala (Pe)	2	0	2	0
Salmon	Region Austral (Ch)	0	2	2	0
Milk – and Dairy	Boaco, Chontales (Nic)	1	1	2	2
Mangoes and Grapes	Petrolina Juazeiro (Br)	1	0	3	0
Melons	Rio Grande do Norte (Br)	1	0	3	0
Apples	Santa Catarina (Br)	1	0	3	0

Notes: O=absent; 1=domestic chain; 2=global chain; 3=both domestic and global chains.

Value Chains

According to the literature, the quasi-hierarchy form of governance tends to prevail in natural resources-based clusters with international buyers playing a leading role. However, our evidence reveals a greater variety of forms of organization and governance prevails for value chains (Table8). In addition to many quasi-hierarchy forms of governance, market-based relationships also occur, and often multiple value chains coexist in the same cluster.

For example, multiple value chains emerged in Nicaragua's dairy cluster as the sector developed. Each value chain offers a different scope for upgrading by local firms, and each enjoys a different degree of external economies. Artola and Parrilli (2003) have identified five main types of value chains.

- *Semi-urban cattle breeders produce* raw unprocessed milk and sell it to small retail shops and craft food producers near the urban areas in the regions of Boaco and Juigalpa-Chontales.
- *National "manteros"* buy milk from areas that lack easy access and process it (in a craft rather than an industrialized fashion) to produce cheese, *cuajada*, cream, butter, and other dairy products. *Manteros* mainly supply popular, low-income markets. They also buy milk from isolated producers and sell it to intermediaries or directly to retails shops in urban centers.
- *Small investors from El Salvador* who invested in production plants in the main milk producing areas during the 1990s and produce *morolique* cheese to export to El Salvador and hard cheese for the ethnic markets in the United States. They buy milk from the producers and cheese from other plants. Their main competitive asset is the knowledge of the export market, its requirements, and the retail networks therein.
- *Semi-industrial cooperatives of small and medium-sized milk producers* that have grouped to share facilities (i.e. milk collecting stations, processing plants, commercial outlets) and other services (credit, technical assistance, machinery). Twelve

of them group over 2,000 small breeders. They sell refrigerated milk to processing plants and cheese to traders from El Salvador. They are also approaching the US export market, with some increasing success (i.e. functional upgrading).

- *The transnational corporation, Parmalat* entered the national market in 1999, mainly targeting the national and the regional (Central American) markets. Parmalat buys milk from a variety of sources, including its own milk collecting stations in Boaco and Chontales as well as other stations owned by cooperatives. Parmalat's main markets are higher-income shops and supermarkets in Managua and in the main urban centers.

The last three value chains are the most relevant for this analysis. There are different types of relationships between large transnational corporations and local SMEs; sometimes the relationships are of a cooperative nature, while other times they are more at odds. The third value chain noted above has made an important contribution to increasing Nicaragua's dairy exports. The value chain led by the cooperatives is substantially upgrading its processes and functions.

Thus, upgrading is occurring under the quasi-hierarchy of the value chain led by the main transnational corporation present in the sector (Parmalat), as well as within local networks of cooperative producers and those led by foreign buyers and investors. Since its entry into the market (1999), Parmalat has urged local producers to improve milk quality standards and helped develop a new "culture" of milk consumption in Nicaragua. At the same time, local cooperatives have often been pushed to upgrade in order to improve the quality of the milk that they sell to Parmalat and, indirectly, to find other outlets for their products. As already mentioned, following the lead of the Salvadorian investors, some cooperatives are attempting to venture into the US ethnic market. Clearly, *the value chains interact among themselves*, providing incentives for each other and even supporting each other in the upgrading process (Artola and Parrilli, 2003).

In sum, upgrading in different value chains is possible, even when they have different types of governance (as shown by Bazan and Navas-Aleman, 2003, for the Sinos valley). However, *upgrading tends to be confined to products and processes in quasi-hierarchical chains*, such as the one led by Parmalat. In contrast, *functional upgrading is easier in value chains with a network-based governance*, which is more equal and cooperative. This is the case of the value chains led by the local semi-industrial cooperatives. Value chains led by foreign buyers, such the ones led by investors from El Salvador have also led to some upgrading, enhancing the product and functional upgrading of the better organized cooperatives. However, not all the cheese that they have so far exported would pass the sanitary tests of more demanding international markets.

Fresh-fruit value chains show a clear tendency toward the dominance of quasi-hierarchical forms of governance that are associated with the restructuring of food retailers (who are increasingly shifting away from middlemen and wholesalers to alternative, more direct forms of procurement). In practice, however, there remains a surprisingly wide range of possible relationships between buyers and suppliers, from arm's length to a few cases of hierarchy (Del Monte in Rio Grande do Norte, Alpine in Petrolina-Jauzeiro, and the French dominated Agricola in Santa Catarina).

In Brazil, the consolidation of food retail has been especially rapid since the stabilization plan of 1994 which attracted increased foreign direct investment by multinational supermarket chains, such as Carrefour, Ahold, and Walmart (Farina, 2002). The greater power of importers and buyers has meant mounting pressures for growers to make the necessary changes in their products and production processes to meet buyers' demands (in particular, this has implied a shift from product to process standards) (Reardon et al., 2002). As a result, retailers are not concerned with backward or forward integration and prefer to reallocate the risks in food procurement and quality maintenance with other actors in the chain. That is, they relay market information on to their suppliers, but seldom engage in actual upgrading support (Humphrey and Schmitz, 2000).

There are, however, a host of activities that by their very nature demand public sector ac-

tion.[18] Contrary to melon growers in Rio Grande do Norte, fruit growers in Petrolina-Jauzeiro and Santa Catarina have turned to the public sector for support in their upgrading efforts. This difference can be explained by the different technological requirements for growing other fresh fruits and by the different structure of the fresh fruit industry in these two areas.

A few large conglomerates, including British American Tobacco, Philip Morris, and Dimon, dominate the tobacco cluster of the Rio Pardo valley in Brazil. By buying tobacco leaves from local SMEs, these corporations transmit international standards and specifications without providing business and technical support. The governance of these relationships is eminently hierarchical, where large the transnational corporations set the requirements and signal the standards demanded by the market, and retain the core capabilities that, in this sector, are related to basic research and marketing. These are especially noteworthy in biotechnology R&D for the development of new hybrid or genetically modified varieties of tobacco, as well as to ensure a rigid control of the tobacco leaf production system. Local actors provide a negligible contribution to the process of technological innovation in the cluster (Vargas, 2001).

Subsidiaries of transnational corporations also entered the wine cluster of Serra Gaúcha, Brazil, but they entertain a less hierarchical relationship with local grape producers and small wineries. In this cluster, the small family-owned wineries that produce premium wines play a prominent role. Although they make up a small group, the wineries are at the very center of the upgrading process (Vargas, 2001).[19] This differs from the early 1970s when the scale of production mattered more than quality and the largest national wineries (in association with the transnational corporations) were the key actors.

Upgrading

Most of the natural resources-based clusters studied underwent product and process upgrading. Local external economies and, sometimes, joint cooperative actions help to bring about constant improvements in products and process. The results are summarized in table 9.

A perhaps surprising result is the very limited product and process upgrading recorded in the melon cluster in Rio Grande do Norte. In fact, for about 15 years, melon exporters enjoyed an exclusive 4-month window to the European market. During these months, only melons from Rio Grande do Norte were reaching Europe and, as a result, growers had reduced

Table 9: Natural Resources-based Clusters: Upgrading *

Main product	Location	CE Degree	Product Upgrading	Process Upgrading	Functional Upgrading	Intersect. Upgrading	Sum of Upgrading
Tobacco	Rio Pardo, RGS (Br)	Medium	3	3	0	0	**6**
Wine	Colchagua (Ch)	Medium	3	3	0	0	**6**
Wine	Serra Gaucha, RGS (Br)	Medium	3	3	0	0	**6**
Sugar	Valle del Cauca (Co)	High	3	3	2	1	**9**
Marble	ES (Br)	Medium	2	2	0	0	**4**
Copper	Cuajone-Toquepala (Pe)	Low	2	2	0	1	**5**
Salmon	Region Austral (Ch)	High	3	3	2	2	**10**
Milk – and Dairy	Boaco,Chontales (Nic)	Medium	2	2	2	0	**6**
Mangoes and Grapes	Petrolina-Juazeiro (Br)	High	3	3	0	0	**6**
Melons	Rio Grande Norte (Br)	Medium	2	1	0	0	**3**
Apples	Santa Catarina (Br)	High	3	3	0	0	**6**
	Total		29	28	6	4	
	Average		**2.64**	**2.55**	**0.55**	**0.36**	**6.09**

*3=High; 2=Medium; 1=Low; 0=absent

In fresh ... des, ... le, ... aptive re... ol of ... bests ... atho... gens, and particular ... ments in fa... ing practices and management.

[19] The wineries benefited from increased demand resulting from ... eases in income and sophistication of Brazil's urb... dle class.

incentives to upgrade their products. Despite a single variety, and its low sugar content, importers bought all the melons that reached their shores, since the off-season fruit was considered an exclusive and exotic tropical product that earned high margins for retailers (Gomes, 2003). However, the lack of upgrading had its price, as importers began to look elsewhere for melons (Peru, Sudan, Costa Rica and South Africa).

Nevertheless, over time melon growers have improved their production and post-harvesting practices and are today successfully growing and exporting a greater variety of melons. Why was melon production in Rio Grande do Norte able to follow the "high road" to improved competitiveness (i.e. product and process upgrading allowing export increases), despite relatively weak local institutions and the absence of public sector agencies, which were central to the upgrading efforts in Petrolina-Jauzeiro and Santa Catarina? The answer lies in the very nature of this tropical fruit; that is, growers were able to upgrade in spite of the absence of supporting institutions because melons are an annual crop, which can be harvested in as little as 60 days. This means that growers have a relatively low opportunity cost and are thus able to experiment with different varieties and planting techniques (i.e. spacing, irrigation regimes, choice of fertilizers).[20] Therefore *upgrading is occurring despite collective inaction and the virtual absence of most business support systems.*

Functional upgrading has been experienced by only a few of the clusters analyzed (Table 10).

Upgrading in the Chilean cluster has taken different forms over time. Product and process upgrading were achieved early on through joint actions that implied the partnership of public firms and institutions with private firms. Functional and intersectoral upgrading occurred only later as a result of individual initiatives, which often involved the private sector. These private initiatives were possible because of the complex system of institutions and policies that had been put in place. An example of *functional upgrading* is offered by the integration of different stages in the value chain following initiative undertaken by the largest companies (in some cases transnational corporations) to achieve economies of scale in logistics as well as in production. An example of *inter-sectoral upgrading* (which is very rare across all the cases studied here) are biotechnology and genetics improvements and the development of vaccines, which are often carried out by private firms, generally in some sort of collaboration with universities, *Instituto Tecnológico del Salmón SA* (Intesal), large foreign companies, and publicly-subsidized projects (Maggi, 2003; Maggi et al., 2002).

The functional upgrading experienced in the Nicaraguan cluster is explained by the efforts of the more advanced local cooperatives to: (i) diversify their production and enter the cheese processing stage, and (ii) export to ethnic markets in the United States or to El Salvador and enter the local higher-income urban market. Such efforts reflect the desire of semi-industrial cooperatives to reduce their reliance on Parmalat and find alternative outlets for their milk. As was the case for the traditional manufacturing clusters, there is some preliminary evidence to suggest that collective efficiency enhances not only product and process upgrading, but (to a lesser extent) functional upgrading, as well (Table 10).

[20] Growers of permanent crops such as apples, mangoes, and grapes must wait anywhere between 1 and 4 years to see any results when they make changes in varieties or production practices, thus their opportunity costs are much higher.

Table 10: Natural Resources-based Clusters: Correlation Between Collective Efficiency and Upgrading*

Collective Efficiency	Product Upgrading	Process Upgrading	Functional Upgrading	Intersectoral Upgrading
High	3.00	3.00	1.00	0.75
Medium	2.50	2.33	0.33	0.00
Low	2.00	2.00	0.00	1.00

*The table presents the average level of each form of upgrading for each group of clusters classified on the basis of the degree of collective efficiency.

Conclusions

Process and product upgrading are necessary for natural resource-based sectors. These upgrading processes are a function of scientific improvements and their dissemination. Constant innovation is crucial to remain competitive in this sector, but often has the characteristics of public goods. All this calls for two possible avenues for SME upgrading. Given that, in these clusters, collective efficiency has a positive impact on upgrading, the one option for SME upgrading are the joint technology development and dissemination actions of institutional networks of business associations, universities, and services, training and research centers. Another alternative is linking up with large global chain leaders that have the financial strength and resources to support investments in innovation. The evidence reveals however that hierarchically governed value chains only offer potential for product and process upgrading, while functional upgrading is easier in value chains with a network-based governance.

In principle, foreign buyers facilitate linkages with international markets by signaling the need and the modes of the necessary upgrading. Nevertheless, given that the requirements of the international market are often codified by standards (e.g. HACCP), imposing them on producers carries few transactions costs. Buyers simply relay information on the standards that need to be met, but do not normally support the upgrading process. As a result, SMEs are especially disadvantaged, and policies need to address their specific weaknesses. In particular three crucial policy elements may be singled out: (i) the creation of the conditions necessary for early entry of SMEs into the activity (e.g. allocation of lots to smallholders, technical extension services, training through interactions with other firms, state and research and extension agencies); (ii) the dissemination of research to SMEs; and (iii) the promotion of public-private collaboration in research and, in particular, SME involvement.

COMPLEX PRODUCT SYSTEMS

The recent evolution of the model of industrial organization of complex product systems (COPS) is shrinking the space and the options for producers from developing countries (Humphrey, 1995). In these industries, the local enterprise network is normally anchored to one assembler or "anchor" that operates as a leading firm. The relationships with these anchors may be crucial to foster SME upgrading through technology and skills transfers.

These types of products rely on *modular design* that is based on breaking the design into several modules that are connected by standardized interfaces (Ulrich, 1995). Once assembled, the modules form a *complex system*. The leading firm normally controls the design of the complex product, while modules are left to evolve, improve and change over time through the actions of their suppliers. Over time, the use of common platforms and models in all countries has standardized production. As a consequence, the assemblers (leaders) demand a worldwide service from their suppliers that needs to follow them in their internationalization strategy. To respond to this demand, a first tier of suppliers has developed

that complies with highly sophisticated quality and technological standards, which require an extraordinary internal effort in enhancing production and design capabilities. In many cases, the specificity of such components or subsystem implies a process of co-design and partnership with first-tier suppliers, based on network relationships. This generates incentives for upgrading because first-tier suppliers are contracted by the leading firm in accordance with their capabilities to comply with these design standards. In most cases, first-tier suppliers are owned by foreign companies and there are strategically important. Locally owned firms operate as second or third-tier suppliers in low value added activities with lesser opportunities for upgrading (Giuliani et al., 2003).

This has important implications because the leading firm/assembler of the producer-driven chain controls the design of the overall complex system. In addition, first tier suppliers are cutting-edge firms with very high technological capabilities that design and/or produce subsystems and components for the assembler and are often global suppliers. Moreover, local firms normally engage in low value added activities (such as packaging and transportation) that offer few opportunities for upgrading. The presence of the local assembler, however, creates room for upgrading in very specific niches. Finally, acknowledging the limited upgrading possibilities of local SMEs in these sectors, is not clear that governments in developing countries should actively promote them (Humphrey, 1995).

This group includes complex sectors whose presence in Latin America is a function of the *maquila* operations of transnational corporations in industries such as cars and consumer electronics. The study of the complexities of these strategic relationships goes beyond the aims of this paper. Instead, we focus our discussion on the metalworking cluster in Espírito Santo, Brazil (Cassiolato et al., 2003), which shows how local SMEs may engage in fruitful collaboration with large companies, exploiting their high levels of collective efficiency, and upgrading in very specific niches.

Table 11: Complex Product Systems: Index of Collective Efficiency

Product	Location	EEI	JAI	Index*	Degree**
Aeronautics	SJC, São Paulo, (Br)	10.00	8.00	9.00	Medium
Automotive	Nova Serrana (Br)	6.00	6.00	6.00	Medium
Automotive	Caixa do Sul, RGS (Br)	8.00	6.00	7.00	Medium
Automotive	Juárez, Delphi (Mex)	7.50	3.00	5.25	Medium
Metalworking	Espírito Santo (Br)	9.00	8.00	8.50	Medium
Electronics	Jalisco (Mex)	6.00	3.38	4.69	Low
Audiovisual Equipment	Baja California (Mex)	4.00	1.50	2.75	Low
Intel ICT	San José (Costa Rica)	8.00	1.00	4.50	Low
High Tech	Campinas, São Paulo (Br)	10.00	6.00	8.00	Medium
	Average	**9.00**	**7.36**	**6.19**	

*0.5 EEI + 0.5 JAI **≥9.5 = High; 5.1>Medium<9.5; ≤5 Low

Table 12: Complex Product Systems: The Pattern of Governance of Value Chains

Product	Location	Market	Network	Quasi-hierarchy	Hierar-chy
Aeronautics	SJC, São Paulo, (Br)	0	0	2	0
Automotive	Nova Serrana (Br)	0	0	2	0
Automotive	Caixa do Sul, RGS (Br)	0	2	2	0
Automotive	Juárez, Delphi (Mex)	2	0	2	0
Metalworking	Espírito Santo (Br)	0	0	1	0
Electronics	Jalisco (Mex)	0	0	2	0
Audio visual Equipment	Baja California, (Mex)	0	0	0	2
Intel ICT	San José, (Costa Rica)	2	0	0	0
High Tech	Campinas, São Paulo (Br)	2	2	2	0

Legend: O=absent; 1=domestic chain; 2=global chain; 3=domestic and global chains.

Collective Efficiency

External economies are not high in most of these clusters (Table 11). Although, in most cases, there is a specialized labor market, it developed differently compared to other sectors. In addition, local inputs are often not provided locally because transnational corporations generally follow a worldwide sourcing strategy. The metalworking cluster in Espírito Santo is an exception. Local SMEs are beginning to supply local anchor firms with local inputs and services. Access to information and markets is facilitated by clustering to some degree, reflecting the dominant role of the quasi-hierarchical value chains leaders (see Annex 1).

Joint actions are also limited, except for the aeronautics cluster established around Embraer in São João do Campo and the metalworking cluster in Espírito Santo. In the latter, forward vertical linkages with the large anchor firms have improved notably. Moreover, the local Center for the Development of the Capixaba Metalworking Industry (CDMEC) has taken an active role in fostering networking within the cluster as well as the relationships between the large anchor firms and small local providers of parts and services. The CDMEC was created in 1988 with backing and leadership of the Development Bank of the State of Espírito Santo (BANDES), the anchor companies, and a few local SMEs. Also important to the success of CDMEC are the persons chosen to fill the job of director.

The aeronautics cluster in São João do Campo developed around the operations of Embraer. There is a fair degree of inter-firm cooperation among subcontractors and frequent spin-offs, and upgrading of second and third-tier subcontractors.

Thus, the summary index of collective efficiency records lower values than for other groups. The low index values for the electronics and consumer electronics clusters in Mexico and Costa Rica are explained by the almost complete absence of joint actions (Annex 1). In contrast, joint actions is what gives the Brazilian clusters in São João do Campo and Espírito Santo their higher index values.

Some examples of vertical cooperation and relatively poor horizontal linkages are apparent at the cluster level. In the automobile cluster of Nova Serrana, the chain leader (Fiat) has succeeded in developing a network of local suppliers, but the suppliers do not engage in exchanges of knowledge and information (Lemos et al., 2000). It is more common for local suppliers to establish vertical links with the leading firm rather than horizontal links

with other suppliers. This reduces the possibilities of joint actions at the cluster level.

Firms in the electronic cluster in Jalisco tend to engage in (backward and forward) *vertical cooperation* in the few cases in which the buyer (e.g. IBM) promotes the local acquisition of goods and services. *Horizontal cooperation* also appears low, with fierce competition among small producers (Dussel, 1999). In Costa Rica, vertical cooperation with Intel is limited, linkages with local suppliers are very weak and 85 percent of inputs were imported by Intel in 1999. Production linkages mainly regard global suppliers coming to Costa Rica to follow Intel's globalization strategy (Vargas and Lindegaard, 2002).

Upgrading

Table 13 shows an especially interesting pattern of upgrading. *Process (and to a lower extent product) upgrading are remarkable, but intersectoral upgrading is totally absent*, *and functional upgrading was only achieved in a few cases.* One of these is the Delphi automotive cluster in Juarez, Mexico, which has undergone a functional upgrading at the local level, due to the development of the design and engineering center of Delphi. Local second and third-tier suppliers have started producing higher value added products and services, mainly in electronics and informatics (Dutrénit et al., 2002). A similar example is the cluster in São João do Campo (Bernardes and Pinho, 2002; Carrillo and Hualde, 1996).

In most cases, the leading firms play a very limited role. For instance, there is no new local design development by the local subsidiaries Nova Serrana (Brazil). What takes place locally is the adaptation of design to local conditions (*tropicalizaçao*) (Lemos et al., 2000; Santos et al., 2002). In the case of the TV industry in Baja California (Mexico), upgrading predominantly concerns foreign first tier suppliers (Gerber and Carrillo, 2002). In Costa Rica (Intel), there has been a very limited upgrading of local firms into more value added activities (e.g. software). Vargas and Lindegaard (2002) note that "… With the reorganization of the plant after 1999, the process attracts some other suppliers of and local interaction with the software industry…. major services are in low-tech low-value added activities, except for some recent software contracts."

Table 13: Complex Product Systems Clusters: Upgrading *

Main Product	Location	CE Degree	Product Upgrading	Process Upgrading	Functional Upgrading	IntersectUpgrad.	Sum of Upgrad.
Aeronautics	SJC, São Paulo, (Br)	Medium	2.0	2	2	0	6
Automotive	Nova Serrana (Br)	Medium	3.0	3	1	0	7
Automotive	Caixa do Sul, RGS (Br)	Medium	1.5	2.5	0	0	4
Automotive	Juárez, Delphi (Mex)	Medium	3.0	3	2	0	8
Metalworking	Espírito Santo (Br)	Medium	2.0	3	0	0	5
Electronics	Jalisco (Mex)	Low	2.5	2.5	0	0	5
Audiovisual Equipment	Baja California, (Mex)	Low	2.5	2.5	1.5	0	6.5
Intel ICT	San José (Costa Rica)	Low	3	3	1	0	7
High Tech	Campinas, São Paulo (Br)	Medium	2.5	2.5	1	0	6
	Total		22	24	8.5	0	54.5
	Average		**2.44**	**2.67**	**0.94**	**0.0**	**6.06**

*3=High; 2=Medium; 1=Low; 0=absent

Table 14: Complex Products Systems: Correlation Between Collective Efficiency and Upgrading*

Collective Efficiency	Product Upgrading	Process Upgrading	Functional Upgrading	Intersector Upgrading
High	-	-	-	-
Medium	2.33	2.66	1.00	0.00
Low	2.66	2.66	0.83	0.00

*The table presents the average level of each form of upgrading for each group of cluster classified on the basis of the degree of collective efficiency.

Collective efficiency does not appear to affect upgrading in any way in most of these clusters (Table 14). In his study of industrial policies in the plastics and auto sectors in the Regional Chamber of ABC, São Paulo, Quadros (2002) concludes that technical collaboration from customers to achieve certification is limited and rarely systematic, and that assistance has rather come from private consultants. Moreover, the assemblers did not reduce their controls also over those suppliers holding an official certification, due to their little trust of the institutions granting the certificates.

Certification has not improved collaboration within the value chain. The design of light components is carried out entirely by the customers, who provide the suppliers with detailed designs. Coordination of activities in the value chain appears predominantly based on arm's length market relations, with customers still directly monitoring and supervising suppliers (Quadros, 2002). However, in our terminology, a quasi-hierarchy governs inter-firm relations and the lead firms in the value chain have little understanding of and sensitivity to the upgrading concerns of local firms. Most technical information is codified and the tacit knowledge that needs to be exchanged through continuous interactions is negligible. Lead firms can easily select their market counterparts (or leave the selection to their first-tier suppliers) without providing upgrading resources and support. In other words, in this case as well as in other examples in this group, *upgrading is left to the market*, that is, to the private individual initiatives of small firms.

Value Chains

The strategic alternative to upgrade in very specific niches created by the presence of a local large firm is best illustrated by the metal-working cluster in the State of Espírito Santo, Brazil (Cassiolato et al., 2003). This is an atypical SME cluster, as large commodity exporters (steel, iron-ore pellets, paper pulp) act as *anchors* of the local system, and the cluster SMEs manufacture parts, components and machinery that service industrial maintenance as well as assembly lines.[21] So, strictly speaking, these firms should not be considered as part of a COPS cluster, but they still provide a useful example of how small local firms may collaborate with large (transnational) firms that act according to their own global strategy. Although they do not follow the rationale of modular systems to manufacture complex products, the extent of tacit uncodified knowledge they employ is limited. Thus, the ensuing need of continuous interactions with local suppliers is reduced, as is their interest for learning and upgrading by local providers. This case offers valuable suggestions for the more general study of SME upgrading in complex products systems clusters and value chains.

Although local SMEs sell on the internal market, they are in fact indirectly part of global commodity chains. These firms have experienced a remarkable upgrading, illustrated by the recent increase in local purchases by the large anchor firms (from 1 percent in the 1980s, to 10 percent in 1990, and 35 percent in 2002). In addition, local cluster firms are proving increasingly able to compete with firms from larger and more industrialized states (e.g.

[21] These large firms have acted as promoters of industrial development based on an import-substituting strategy since the 1940s, when state-owned enterprises were set up to exploit abundant local natural resources (iron mines, forests and lumber).

São Paulo and Minas Gerais) in servicing anchor firms out of Espírito Santo.

Several factors play a role in explaining this successful upgrading process. One explanation lies in the combination of customers committed to export commodities in highly competitive international markets, and local SMEs' willingness to improve their industrial capabilities and become suppliers of the anchor companies. Another explanation is the pragmatic collaboration that gradually grew between some of the anchor firms and a group of local SMEs. This has taken time to develop, and has not been equally successful with all anchor companies. It has also been helped along by the personal trust that was generated by the local small entrepreneurs whose businesses were mostly spin-offs of the large companies. Small firms started by selling only to one large firm, and later diversified their portfolio, to reduce the weight of any individual client to a maximum of 35 percent. A final factor that explains successful upgrading is the active and dynamic role played by a local institution, the Center for the Development of the Capixaba Metalworking Industry (CDMEC), which has been acting as an effective network broker or facilitator for the cluster.

The role played by the local government and support institutions should not be underestimated. Local support institutions, such as for example BANDES, provided varying support, but contributed usefully in at least two major ways: (i) by providing financial support to CDMEC during its early years; by funding studies that helped raise awareness of the local small metalworking sector, of the role and usefulness of inter-firm cooperation, and of the potential of local providers of large commodity producers; and (ii) by using all formal and informal political tools to encourage large firms to source their intermediate inputs and services locally. The latter occurred, for example, through the active involvement of the state Environment Ministry, which was able to require investors to, among other things, conserve the local environment and improve local working conditions (which implied more local sourcing).

Encouraging large transnational corporations and assemblers to cooperate with local producers is a very complex task. However, this case shows that some options are available and that they should be actively pursued by local governments. Therefore, provided that some conditions are met (institutions able to facilitate the relationship between SMEs and large firms, local government negotiations that enhance collaboration, an active interest in upgrading on the part of local SMEs), local SMEs may seek a niche to grow and upgrade by servicing large firms active in complex productive systems.

Conclusions

In complex product systems industries the opportunities for available for local SMEs to upgrade are limited. Technological accumulation and upgrading result from the design and development of parts and components of a complex product, and global value chains are dominated by large assemblers and their first-tier suppliers. Local suppliers (who are second or third-tier suppliers) must reach high quality standards and obtain certifications to be part of the subcontracting network, but the lead firms have little interest and understanding of the upgrading concerns of local firms. Moreover, insufficient levels of collective efficiency do not help, and no evidence of a link between upgrading and collective efficiency has been observed. Local enterprise upgrading is imposed by the chain leaders (buyers or producers alike), and is left to the market with often no explicit support offered.

In sum, the overall perspectives for locally owned second or third-tier suppliers in COPS are meager. A viable option may be to find a profitable niche by servicing large leading firms in the chain, as in the successful case of the metalworking cluster in Espírito Santo, Brazil.

SPECIALIZED SUPPLIERS (SOFTWARE)

This study only includes software development clusters in the group of specialized suppliers. The firms belonging to these clusters are typically client driven as they develop or adapt software packages to the specific requirements of their, mainly, local clients. The growth of this sector in Latin America is important for two main reasons: its contribution

to the economic modernization and its high intensity of highly skilled labor force.

On the Origins of Clustering

The existence of a critical mass of local demand, a favorable local environment and an educated labor force are among the basic conditions for the development of a software cluster. Barriers to entry are normally low, encouraging start-ups near major clients and the clustering of potential customers.

All the software clusters studied in this report are demand-driven and are located in areas with a concentration of economic activities. The Mexican clusters are placed in Mexico City, Monterrey, Guadalajara, and Aguascalientes (Ruiz Duran, 2003 and Annex 5). In addition, some of the clusters have also benefited from an intense spin-off of skilled personnel from local plants of high-tech transnational corporations. This is the case with IBM and Hewlett Packard in Guadalajara, and Xerox and Texas Instruments in Aguascalientes. Similarly, in the Brazilian cluster of Blumenau, many of the existing software firms are spin-offs of a large data processing center, which was initially created in 1969 to satisfy the needs of local textile firms and then turned into the largest Brazilian enterprise in this field (Bercovich and Swanke, 2003).

Collective Efficiency

External economies

Generally, local labor markets are characterized by a concentration of highly skilled people who move from one firm to another and thus become an important channel for learning and exchanging knowledge and information within clusters. This helps improve the access to information, which is another important external economy common to the clusters analyzed. The proximity of firms in a cluster is also facilitates the exchange of information. Informal learning requires the face-to-face contacts that occur through social, professional or business situations. This explains the interest in projects to create science parks or technology poles in Mexico City and Aguascalientes. These would provide a place for software firms to relocate, improving the exchange of information and collaboration among firms. Moreover, the transfer of knowledge and information is also facilitated by the common social and cultural background of many entrepreneurs who share past work experience in large transnational corporations such as IBM and Hewlett Packard or are alumni of the same local university.

The division of labor is not very well developed in these clusters, and outsourcing of services is limited. According to Bercovich and Swanke (2003), the reason for this, in Blumenau, lies in the existence of very high coordination cost resulting from strong competition for skilled labor. The study of Blumenau also highlights the positive impact of the cluster's nationally recognized image. The recognition of Blumenau as a high-tech pole initially come from the growth of a center for data processing, created to cater to local needs, but it rapidly extended to the rest of the country. Moreover, some local firms have also contributed to this image by receiving several national awards.

Joint Action

Horizontal cooperation between firms is common in all these clusters. It mainly consists of agreements to integrate different types of software to meet the demand for complete systems. In some cases, these agreements may also imply technological cooperation in order to match the different software programs. The most prevalent type of cooperation is horizontal joint action through institutions. Active business associations in the Mexican clusters promote various initiatives, including training courses, joint promotion and collective directories of products and locally available expertise.

The Aguascalientes business association was created within the framework of a state cluster program aimed at the development of clusters in various industries (i.e. automobile, furniture, garments). The program promotes the establishment of a local business association in each cluster that also includes representatives of the state government and other relevant local institutions. In the case of the software cluster, the association includes 34 enterprises, the Secretary of the State for the Economy, three local universities and the national insti-

tute of statistics (INEGI). Among the activities of this recently created association are several training courses, meetings among entrepreneurs to establish a cooperative atmosphere and collaboration with local universities to adapt the curriculum to the needs local firms. Among the association's future projects are the creation of a technological institute, the development of a technology pole (where many of the enterprises could relocate), and participation of cluster firms in a certification program aimed at collectively obtaining the CMM (Capability Maturity Model) certificate. Obtaining CMM certification is also among the main future projects of the business associations in Mexico and Guadalajara. In both cases, the associations are working to create a program for assisting small software firms in the quite expensive and time consuming process of acquiring this internationally recognized certification (Ruiz Duran, 2003).

Another interesting collective initiative recently launched in Blumenau is a joint project of the local business association and the city government (*Programando o Futuro*) to increase the local availability of skilled labor. The program consists of organizing training courses for mid-level technicians, financed jointly by the local firms and the municipality. The active involvement of the municipality in the development of the software cluster in Blumenau is also reflected in the recent joint participation of many local software firms in a national specialized trade fair that was organized and financed by the local government. This type of initiative, which is new in Brazil, shows the local government's support in an important direct as well as symbolic manner.

The sustainability of the local cluster has been improved by the establishment of Blusoft, an incubator of new software businesses, which was created in 1992 by an agreement between the city government, the local university and the business association. Blusoft is a very successful incubator and also plays an important role in promoting the image of "made in Blumenau" software. This has helped firms to gain access to financing, and organize training courses and visits by foreign experts to the cluster, as well as foreign trips by local entrepreneurs to study other successful software clusters (Bercovich and Swanke, 2003).

All the clusters analyzed show very strong collaboration between firms (through their business associations) and local universities. In many cases, as in Blumenau and Aguascalientes, collaboration is leading to a reorganization of the curriculum to more effectively satisfy the needs of local firms. In both cases, the process of updating the curriculum has been managed by a committee made up of professors as well as staff of local software firms. People are moving from one group to the other in all these clusters, thus promoting an intense flow of knowledge and information. For example, many academics are working as consultants or setting up their own enterprises, students are entering work-study and internship programs in local firms, and the private sector employees are returning to university to take training courses.

Table 15 summarizes the degree of collective efficiency in software clusters. From the empirical evidence presented above, there appears to be a surprisingly high degree of joint action through collective institutions. We have documented various successful collective initiatives involving the private sector and various local public institutions. The plethora of collective initiatives is particularly surprising because most of these clusters are quite recent and institutions and associations normally take some time to flourish. This could be explained by the attractiveness of the high-tech sector, with its highly skilled labor force, which gives the idea of a highly developed area.

Value Chains

In the software clusters the relationship with clients is mainly of a market/network type and the main market is local. In some cases, the relationship that could be defined as network type because it involves a lot of feedback and information exchanges between the software firms and the users. This form of cooperation plays a very important role in product upgrading.

There are only a very few cases in Mexico of local enterprises integrated in quasi-hierarchical global value chains. The best known case is Softtek, a leader software developer that also provides implementation, maintenance, and support services throughout Latin America. Softtek has 2,000 employees

Table 15: Software Clusters. Index of Collective Efficiency

Clusters	External economies index** (EEI)	Joint Action index** (JAI)	Collective Efficiency Index*	Degree of CE**
Blumenau (Brazil)	10	9	9.5	High
Aguascalientes (Mexico)	8	7	7.5	Medium
Distrito Federal (Mexico)	10	8	9	Medium
Guadalajara (Mexico)	10	8	9	Medium
Monterrey (Mexico)	10	7	8.5	Medium
Total	48	39	43.5	
Average	**9.6**	**7.8**	**8.7**	

*0.5 EEI + 0.5 JAI , **≥9.5 = High; 5.1>Medium<9.5; ≤5 Low

and offices in Argentina, Brazil, Colombia, Mexico, Peru, Spain, and Venezuela. Softtek offices in Mexico are located in Monterrey and Mexico City. Softtek's clients include a number of important Mexican and US companies in the financial, manufacturing, telecommunications, and pharmaceutical industries. Its most important US client is General Electric. The types of near shore services that Softtek offers to its US clients are applications development (AD), applications maintenance and support (AMS), Latin America localization, enterprise application integration, and testing.

Upgrading

Product and process upgrading are generally high in all the software clusters studied. Referring to product upgrading, Ruiz Duran (2003) presents five different types of products characterized by increasing value added: data processing, outsourcing (offshore and near shore), ad hoc software development, development of software packages, and development of registered packages. Some of the oldest enterprises in the clusters studied began by supplying data processing services and upgraded to provide ad hoc software packages. In these cases, most of the product upgrading consists of incremental improvements, which are favored by the existence of network relationships with users.

Another form of product upgrading, increasingly common in Blumenau, is the supply of full systems (instead of specific systems) for bookkeeping, human resource management, and other such functions. The market for full and integrated systems has expanded as SMEs increasingly adopt Enterprise Resource Planning solutions. This has allowed small software firms to become competitive in these systems (Bercovich and Swanke, 2003).

There are a few firms in all the clusters studied that have been able to evolve from producing ad hoc solutions to developing standardized systems for a large number of customers. A case in point is a small enterprise located in Aguascalientes that has developed software for ophthalmologists, translating existing packages into Spanish and adapting them to the needs of Mexican doctors. The software is now sold in other Latin American countries.

According to the empirical evidence available, the degree of collective efficiency in all these clusters is positively influencing product upgrading. This is confirmed by most of the entrepreneurs interviewed both in Mexico and Brazil who consider the exchange of information and the movement of skilled people within the clusters as very important determinants of their product upgrading strategies. In addition, the collective initiatives undertaken in most of these clusters also enhance firms' knowledge and access to information and to skilled resources.

Table 16: Software Clusters. Upgrading

Clusters	CE Degree	Product Upgrading	Process Upgrading	Functional Upgrading
Blumenau (Brazil)	High	3	3	2
Aguascalientes (Mexico)	Medium	3	3	2
Distrito Federal (México)	Medium	3	3	2
Guadalajara (México)	Medium	3	3	2
Monterrey (México)	Medium	3	3	2
Total		15	15	10
Average		**3**	**3**	**2**

*3=High; 2=Medium; 1=Low; 0=Absent

In the Mexican clusters, process upgrading is very strongly related to the process of obtaining CMM certification. The Capability Maturity Model is aimed at improving the process of software development. This is a very time-consuming and expensive process for SMEs. As a result, the existing collective initiatives aimed at obtaining the certification would likely play a crucial supporting role. The linkages between software enterprises and local universities are also very important in supporting process upgrading.

Finally, functional upgrading is probably more common in this sector than in others. In all these clusters, there are examples of firms making efforts to improve their marketing activity. Collective initiatives may help SMEs to undertake the investments required. Examples are the joint participation in trade fairs in Blumenau and the creation of a cluster directory in Aguascalientes, where the business association is also starting to develop a marketing policy at the cluster level.

Conclusions

In the group of specialized suppliers we concentrate only on software clusters. All the clusters analyzed record incremental product and process improvements. Functional upgrading is also more likely to occur than in other sectors because it is facilitated by the ease with which software firms are able to engage in design and commercialization of their activities.

Network type relationships with customers, who are mainly local users, play an important role in supporting product upgrading strategies. In addition, the degree of collective efficiency is an important factor explaining the capability of software firms to upgrade. Moreover, the variety of collective initiatives involving firms' associations, local public institutions and local universities is notable, contributing to the high level of collective efficiency.

4. Conclusions and Lessons Learned

CONCLUSIONS FROM THE FIELD STUDIES

The original empirical evidence presented in this report enables several important conclusions that bear strategic implications for the design and management of support policies. However, the empirical analysis does have some limitations owing to the lack of reliable microeconomic data at the cluster level, which prevents us from undertaking more rigorous quantitative analyses. To make up for this shortcoming, we supplement the empirical evidence with careful qualitative assessments. Although the cases selected do not represent the universe of clusters in Latin America, they are the largest selection available on which comparative exercises have been carried out.

Collective Efficiency Enhances SME Upgrading

On average, *collective efficiency appears to be higher in natural resources-based and software clusters*. As expected, clusters in complex products systems have lower levels of collective efficiency, in large part due to the unusual joint actions. All clusters share the advantages of a local labor market, which sometimes is a by-product of geographic clustering. Inputs are also locally sourced (with the exception of for complex products systems clusters where global sourcing is the norm).

Moreover, *passive external economies are more common than the various forms of joint action* in all the groups considered. This confirms our theoretical hypothesis. Joint actions require specific investments, and firms get involved in cooperation only if they have to face some external challenges like, for example, new competitors, an innovation to adopt or a new market to enter.

In some cases, the poor degree of collective efficiency may seriously hinder upgrading. This has been a factor in the development of the Chipilo cluster and helps provide some important general lessons.

- A cluster takes time to develop. Passive external economies may exist, but cooperative attitudes and joint actions take much longer to develop. The Chilean salmon cluster has taken nearly a decade to develop. The metalworking cluster in Espírito Santo made efforts to promote joint actions for almost a decade before getting successful results.
- The predominance of strong vertical relationships interferes with the development of external economies and hinders joint actions. This occurred in the Chipilo cluster, which is dominated by vertical relationships between Segusino, the leading firm, and its network of subcontractors. Very similar results are also reported in Torreón's blue jeans cluster. In Nicaragua, foreign aid projects helped develop a cooperative attitude in the dairy sector, that later enhanced joint actions and the upgrading efforts of small breeders and producers.

Upgrading has occurred in most clusters analyzed. However, *process and product upgrading are more common while functional upgrading is more rarely achieved*. Collective efficiency has a positive impact on the ability of local firms to upgrade. *Intersectoral upgrading only occurred in the Chilean cluster*, with salmon firms venturing into biotechnology and genetics. Evidence of a positive effect of collective efficiency on product and process upgrading is only evident in COPS clusters. An interesting lesson is provided by the metalworking cluster in Espírito Santo where collaboration between the leading anchor firm and local SMEs was enhanced by a local institution acting as a network broker.

The influence of collective efficiency on upgrading may follow several channels including the local institutional network, the public support to local joint actions, research centers, universities, international cooperation (e.g. the salmon cluster in Chile, the mango cluster in Petolina-Jauzeiro, and the apple cluster in Santa Catarina).

Table 17: Index of Collective Efficiency (Averages)

Group	EE	JA	Index*
Traditional Manufacturing	7.60	5.23	6.31
Natural Resources-based	8.91	7.36	8.20
Complex Products Systems	7.61	4.80	6.19
Specialized Suppliers	9.10	7.80	8.70

Table 18: External Economies and Joint Actions (averages)

External Economies: Average					
Group	**Specialized labor market (a)**	**Availability of inputs (b)**	**Easy access to information (c)**	**Market access (d)**	**External economies index** (EEI)**
Traditional Manufacturing	2.36	1.76	1.7	1.83	7.6
Natural Resources-based	2.55	2.45	2.09	1.82	8.91
Complex Products Systems	2.56	0.94	2.11	1.56	7.61
Specialized suppliers	2.8	1.5	2	2.8	9.1
Joint Action: Average					
Group	Backward vertical linkages (a)	Forward vertical linkages (b)	Horizontal bilateral linkages (c)	Horizontal multilateral linkages (d)	Joint Action index** (JAI)
Traditional Manufacturing	1.43	1.36	0.73	1.63	5.23
Natural Resources-based	1.86	1.82	1.50	2.18	7.36
Complex Products Systems	1.5	1.2	0.7	1.3	4.8
Specialized suppliers	1.2	2	2	2.8	7.8

Source: Authors' database.

Table 19: Collective efficiency and upgrading (averages)

Group	Product Upgrading	Process Upgrading	Functional Upgrading	Inter-sectoral Upgrading
Traditional Manufacturing	1.86	2.1	0.7	0
Natural Resources-based	2.64	2.55	0.55	0.36
COPS	2.44	2.67	0.94	0
Specialized suppliers	3	3	2	0

Source: Authors' database.

Many Value Chains Coexist in the Same Cluster and their Strategic Governance Affects SME Upgrading

Participation in global value chains dominated by large buyers and/or producers from the developed world facilitates linkages with international market by signaling the need for upgrading and the type of upgrading necessary. Nevertheless, in many cases, and more often in COPS and natural resources-based clusters, global leaders do not normally foster and support the SMEs' upgrading processes.

In contrast, process and product upgrading in traditional industries are often facilitated by large international buyers. This results from the fact that knowledge about products and processes in traditional industries cannot be easily codified into technical norms and is largely tacit; that is, the quality of the products depends on the specialized skills of local producers. Therefore, foreign buyers and chain leaders have an incentive to help local providers to upgrade products and processes in order to avoid the risk of noncompliance and late delivery of poor quality products, which is high and very costly. Thus constant monitoring and supervision of local producers is an imperative.

Functional upgrading is rarely achieved in the clusters analyzed, and this is also the result of the strategic governance of the value chain leaders. In traditional manufacturing, COPS and natural resources-based clusters local suppliers are discouraged from functional upgrading by their main buyers who do not want to share their core competencies in design, marketing and sale with local suppliers. In most cases, global value chains are characterized by a quasi-hierarchical governance in which the chain leaders control the phases with the highest value added, such as design, marketing and branding, and producers from developing countries often rely on a few buyers. However, *different types of chains often coexist in the same cluster*. Many of the clusters participate in quasi-hierarchical chains and also in chains where market conditions dominate. These offer the largest opportunities to functionally upgrade (e.g. Nicaragua dairy cluster and Brazil shoe cluster in Sinos Valley). Moreover, chain governance is a dynamic process. Given that power is relational, the exercise of power by one party depends on the powerlessness of other parties in the chain. Therefore, existing producers, or their spin-offs, may acquire new capabilities and explore new markets, and this changes power relationships. Secondly, establishing and maintaining quasi-hierarchical governance is costly for the leader firm, and leads to inflexibility because of transaction specific investments. In sum, the governance of the value chains may change and evolve in ways that are more favorable to SMEs in developing countries (Humphrey and Schmitz, 2003).

Sectors Matter

Empirical evidence shows that significant inter-cluster differences emerge when considering the specific features of learning, innovation, and industrial organization of the different sector groups. Clusters and value chains belonging to different groups of industries tend to follow systematically different patterns of collective efficiency, modes of chain governance, and upgrading.

In natural resources-based clusters, process and product upgrading are often related to the scientific base of the activity. Successful clusters of upgrading SMEs in these sectors have often received support from public-private joint actions, chiefly research and technology extension services (e.g. fresh fruit in the Santa Catarina and Petrolina-Jauzeiro clusters in Brazil, the salmon cluster in Chile, sugar in Colombia's Cauca valley). Nevertheless, there are major risks, which are related to protectionist pressures in several countries, to worldwide environmental concerns that may impose further complex requirements, and to the rising control over intellectual property, that may limit access to some industries.

Traditional manufacturing clusters may be considered supplier-dominated because major process innovations are introduced by machinery and materials producers. Upgrading may occur by incremental developments and by imitating new product designs, sometimes helped by large buyers, who have to rely on the specialized competencies of their local suppliers. However, integration into value chains is a two-edged sword because, on the one hand, it facilitates inclusion and rapid enhancement of product and process capabilities,

but, on the other hand, SMEs become tied into relationships that prevent functional upgrading and leave them dependent on a small number of powerful customers (e.g. the Sinos valley footwear cluster in Brazil). Access to alternative value chains, with a less hierarchical governance structure and targeting a different market, may offer powerful opportunities to upgrade functionally and enter higher value-added segments of the chain. This has occurred in the dairy cluster in Nicaragua where local producers' cooperatives joined chains other than the one led by Parmalat (Artola and Parrilli, 2003). Moreover, collective efficiency helps in interacting with global players and in gaining access to alternative market outlets (e.g. national value chains in Brazil for Sinos Valley producers) that offer higher rewards in terms of functional upgrading.

In complex product systems (COPS), technological accumulation and upgrading are generated by the design and development of parts and components of a complex product, and global value chains are dominated by large assemblers and by their first-tier suppliers. Local suppliers (which are second or third-tier suppliers) are required to attain high quality standards and certifications to be part of the subcontracting network, but the lead firms have little understanding of and interest in the upgrading concerns of local firms. This set-up offers very few alternatives to local SMEs. The Espírito Santo metalworking cluster in Brazil, in spite of the fact that it is anchored to large commodity exporters, shows how a local SME cluster may benefit from collective efficiency and follow a collaborative strategy with the anchor, with support from the local government.

In specialized suppliers, we focus on software clusters in Brazil and Mexico. Software firms are usually demand-driven as they develop or adapt software packages to the specific requirements of their local clients. Barriers to entry are low. Proximity to demand encourages start-ups near major clients and may offer the opportunity to develop several market niches (e.g. in Mexico software for tourism applications in the south and for the oil industry on the Pacific coast). Software houses perform incremental product and process improvements. Functional upgrading is more likely to occur than in other sectors because it is favored by the ease with which software firms can engage in design and commercialization of their activities. The relationship with clients is usually of a market/network type, and the leading firms facilitate access to markets and promote the formation of a skilled labor force. However, leaders do not provide direct knowledge transfer to locally owned firms that often perform low value added activities.

Collective efficiency plays a clear role through various means. The relationships with higher education institutions, resulting in a good endowment of cheap and qualified technical workforce and engineers, are essential. Spin-offs seem to be a way of diffusing capabilities locally. In some cases, the subcontracting firms are founded by previous employees of the leading firm and this, in turn, fosters smooth collaborative relations with the leaders.

The Power of the Macroeconomic Framework

Favorable macroeconomic conditions are important for all types of clusters, but are particularly essential in traditional manufacturing. Similarly, unfavorable macro conditions may rapidly revert success into failure. These are sectors where comparative advantage is based on low labor costs, with new entrants constantly coming from developing countries and crowding out higher-wage and lower-productivity producers. *Local potential competitive advantages (e.g. external economies and joint actions) cannot revert unfavorable macroeconomic conditions*, such as, for example, an exchange rate regime that discriminates against exports.

However, international macro conditions may offer unexpected opportunities for upgrading that local SMEs and clusters should exploit. For example, the establishment of tobacco transnational corporations in the Rio Pardo valley was the result of the 1970s trade embargo against Zimbabwe, which was the major tobacco supplier to the European market (Vargas, 2001). This allowed a significant increase in Brazil's share of world exports and sparked the consolidation and international success of the cluster. Similarly, the growth of the wine cluster in Rio Grande do Sul was associated with the entry of transnational corporations,

which was made possible by the macroeconomic conditions and the widespread privatizations prevailing in Brazil during the nineties.

In addition, *competitive factors are not given forever* because market niches are likely to attract competitors and macro conditions can rapidly change. Thus, innovation and the local dissemination of knowledge could be restricted by the strategy of a large firm. This was the case of the melon cluster of Rio Grande do Norte, Brazil, where market conditions allowed the two largest firms to avoid upgrading for many years and hindered the dissemination of new technology and innovations (Gomes, 2003). Similarly, among reasons why the export success of Segusino, the leading firm in the Chipilo furniture cluster, did not last was its failure to undertake local joint actions (e.g. a technology center), errors and miscalculations at the firm level, and the real appreciation of the Mexican exchange rate (Zepeda, 2003).

LESSONS FOR THE DESIGN AND IMPLEMENTATION OF POLICIES AND PROGRAMS TO SUPPORT SME UPGRADING IN CLUSTERS AND VALUE CHAINS

Prevailing wisdom in the 1990s was that effective business support policies should be based on the principles of neutrality, horizontality, and demand orientation (Dini, 2003a). Neutrality implied the ex-ante definition of universal rules, to separate support institutions from potential pressures from private or public lobbies. Horizontality referred the application of policies and rules to all businesses independently on their size, location or industrial sector. Finally, support initiatives should respond to an explicit demand from the enterprise sector that, in turn, was required to provide cofinancing.[22]

Within this general framework, most countries have been recently enacting SME support policies with much emphasis on clusters and value chains, sometimes without a clear understanding of what these concepts mean and imply. However, macroeconomic constraints in Latin America have often implied *a remarkable gap between statements of principle and the design of SME support policies and their actual implementation* that is hardly of the size and outreach foreseen. In stark contrast with what is occurring in more industrialized countries (see Pietrobelli and Rabellotti, 2002, on Italy), the private sector is still insufficiently involved in the design and management of policy initiatives and policy evaluations. Evaluations, although increasingly necessary to get access to public funds, are often weak and lack independence.

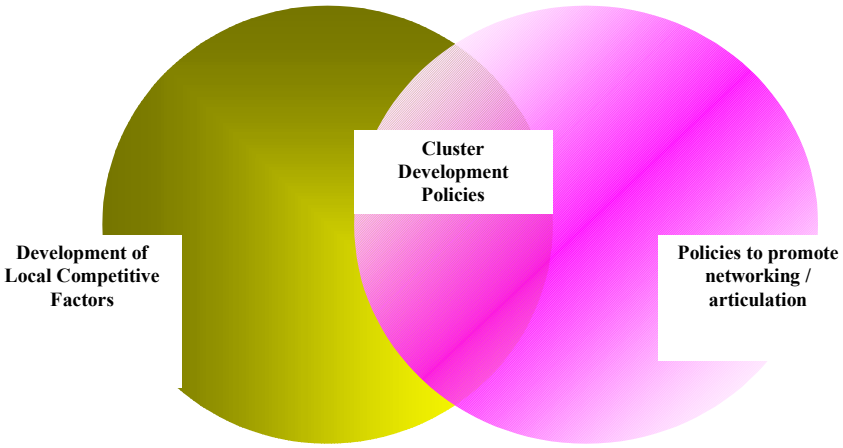
However, the major shortcoming of the present policy approach in most Latin American countries appears the *lack of a comprehensive and consistent vision of local SME development and upgrading*. Thus, policy packages tend to address either the issue of technical training, or of local cluster development, or of the development of value chain providers. Yet, SMEs face *at the same time* the challenge of upgrading (i.e. innovating to increase value added) through the advantages offered by geographical clustering and collective efficiency, *and* through the opportunities and the pressures offered by participation in global value chains and collaboration with foreign buyers. Any attempt to enhance local SME upgrading should, therefore, take such a comprehensive approach.

Cluster Development Policies

In order to design and then manage a policy to support a cluster, the two main dimensions that characterize a cluster must be explicitly taken into account. They are: the territorial factor (i.e. the social and cultural identity as well as the geographical concentration and specialization) and the linkage factor (i.e. the richness of vertical and horizontal linkages undergoing within a cluster).

[22] This is consistent with what is being advocated by the Committee of Donor Agencies for Small Enterprise Development, whose guiding principles are based on a private sector-led, market economy framework that reflects: (i) a fundamental belief in the principles of a market economy, where the State has a role in providing an enabling environment, in correcting market failures, and in the provision of public goods; (ii) the assumption that the majority of business services are private goods, so market rules apply; and (iii) the expectation that with appropriate product design, delivery and payment mechanisms, business support services can always be provided on a commercial basis (Committee of Donor Agencies, 1997 and 2001).

Diagram 1: Cluster Development Policies



Thus, in principle, cluster development policies correspond to the *intersection* between these two policy areas (Diagram 1). A proper cluster development policy, aimed at fostering collective efficiency, should explicitly consider both dimensions at the same time. Thus, policies aimed at enhancing collective efficiency are defined in the overlap of instruments targeting the development of local competitive factors (i.e. tangible factors such as infrastructures and intangible factors such as local know-how) and policies aimed at the promotion of linkages among economic actors in the cluster (e.g. programs to upgrade subcontractors, establishment of consortia or business associations, etc.) (Dini, 2003). As seen, external economies are much more frequent than joint actions in most Latin American clusters. This is due to the complex and lengthy process of building up trust and developing social capital locally. *Human capital and time* are the two essential resources for such policies. This point has been clearly stated by the OECD (Boekholt and Thuriaux, 1999).

Notwithstanding a coherent theoretical vision, in practice, cluster development policies may be remarkably different. Recent evidence on cluster support policies implemented in European countries reveals that each country adopts different policy instruments. However, national policies share a number of key objectives and characteristics (Observatory of European SMEs, 2002). Not all these objectives and actions are appropriate in the Latin American context, but they may usefully serve as terms of reference for cluster policies.

- Cluster policies are seen as a means to promote economic development and structural changes, often through enhancing (regional) innovation capacity.
- Policies are based on improved business cooperation and networking, which may demand the stimulation of social processes.
- Policies also emphasize the linking of firms to the (regional) technological infrastructure of education and R&D institutions and, in particular, try to bring new technology to regional networks of SMEs. In the end, they mean fostering "regional innovation systems."
- Public or semi-public organizations have a role as mediators in encouraging inter-firm networks and joint projects. Especially in the early stage of cluster building, a third party often needs to take care of the flow of information, of the building of mutual trust between cluster members, of supporting the organization of business networks, etc. Policies underline the need to improve innovation capability and knowledge management in firms.

- Underlying these policies there is a focus on the need to stimulate the creation of specialized factors and, in particular, specialized knowledge.

Finally, given that Latin American countries generally have very limited financial resources, which should be used as efficiently as possible, two general principles may be added: selectivity and decentralization and local financial autonomy.

Selectivity. Clusters to be supported should be selected because of their strong presence in the economy or because they are seen as strategic for future growth. In addition, interventions should address *few essential priorities*. A strong element of selection in the rationales of cluster policy initiatives has also been stressed in OECD countries (Boekholt and Thuriaux, 1999). Nevertheless, selectivity is a very difficult task, reminiscent of the old argument of "picking the winners." This calls for the *need to develop good tools to map and analyze clusters*, investing adequate financial resources in the exploratory and diagnostics phase before interventions. The information available is often insufficient, collected for different purposes, and following a different logic. All policy design and implementation should be preceded by well-directed and purposeful analyses of the local circumstances. Several techniques are available and could be usefully employed. Thus, for example, in a different context, methods for rapid rural appraisal of local competitiveness have been applied successfully.[23]

Decentralization and Local Financial Autonomy. Most Latin American countries lack the financial autonomy needed to promote bottom-up initiatives deriving from local actors. Addressing the specific problems of local SMEs needs specific policies and interventions to promote and strengthen decentralized, competent and financially autonomous organizations.

In sum, the following points should be stressed:

- Cluster policies are not the panacea to all economic development problems. In recent times, local and national policymakers have often labeled generic initiatives to support SMEs, sectors, and localities as "cluster policies," creating confusion, false expectations and a lot of disillusionment and reluctance among firms to spend time and efforts on such projects.
- Policies need to evolve over time and consider the evolution of clusters and value chains. To this aim, a noteworthy example comes from the Chilean salmon cluster, where policy requirements and accomplishments have evolved over time with the development of the local system (Maggi, 2003). Initially, pre-competitive investments in R&D and pioneer risky initiatives, both private and public, were favored. This produced a remarkable demonstration effect. Later, the imperative was to standardize production quality and increase production scale, and the cluster was helped with better infrastructure and promotion and marketing abroad. Finally, in the current globalization phase, public policies are enhancing technology transfer (foreign missions), biotechnology research and the introduction of environmental controls (Table 20).

[23] See http://www.paca-online.de/ on PACA – Participatory Appraisal of Competitive Advantage -.

Table 20: Stages in the Life Cycle of the Salmon Cluster and Evolution of a Policy Framework

Cluster Stage	Initial Learing 1978-85 from 50 tons to 900 t. price: US$ 9-10/kg	Maturing 1986-1995 from 1.350 t. to 143.000 t. price: US$ 4-5/kg	Globalization 1996-2003 from 150.000 t. to 400.000 t. price: US$ 2.8-4.5/kg
Main Objective	Survival of the fish	Increase volume of production	Increase productivity
Market Destination	Product: fresh Pacific coho (elite market)	Pacific coho, frozen, mainly to Japan	Fillets and portions to the US market diversification: Japan, US, niches in Europe and emerging markets
Commercialization Channels	Direct sale and cooperatives	Brokers, associative channel of national production (Salmoexport)	Wholesalers (supermarkets) Strategic alliances or integration with final retailers
Technological Challenge	Experimental fish-farming Know-how in fattening	Backward linkages (fish farming) Quality certification Increased production scale	National eggs production, Forward linkages (process), Salmon development cycle, systems of automated control of water, light, etc., vaccines and food, Sustainability of the whole system
Public Policies	• regulation • transfer of technology • investment and pre-competitive research	• Physical infrastructure • promotion and marketing (missions) • innovation and technology development of suppliers (cages, nets, food)	• environmental handling • increase of productivity and transfer of technology (technology missions) • biotechnology (diseases and genetic handling)
Type of company within the cluster	SMEs	SMEs with Presence of foreign groups	Large enterprises (integration and concentration), some TNCs.
Type of supplying company	Few and precarious. Companies seek self-sufficiency	Major outsourcing, local companies gain professionalism	Specialized local SMEs Large presence of highly specialized TNCs
Externalities	"Demonstration effect"	Access to suppliers Critical mass achieved	Dissemination of good practices
Social capital – setting	Pioneering public and private efforts	Associative will between producers	Productive system inserted in a global production chain – commercialization

Source: Adapted and updated from Maggi, Montero y Parra (2000) and Maggi (2003).

A Menu of Actions

In what follows we present a menu of actions aimed at supporting clusters (Box 2). These proposals are not based on abstract theorizing but on the detailed scrutiny of our original case studies, and on international comparisons and best practices available from the specialized literature. The approach suggested here is not normative, and does suggest general principles to apply in all circumstances. It advocates a *context-specific approach* to policy design and implementation. Which action (or combination of actions) a cluster should choose depends on its characteristics, its actual degree of collective efficiency, its main sector of specialization, the characteristics of the value chains in which it operates and, most importantly, its mode of governance. In addition, it also depends on the stage of its life cycle, given that policies need to evolve over time to take into account cluster evolution.

Box 2
A Menu of Actions to Support Cluster Development

Facilitate the development of external economies
- Build a specialized labor force – Cluster Skill Centers

Promote linkages between firms:
- Create and enhance trust between firms
- Promote the establishment of collective projects
- Create and strengthen business associations
- Strengthen local supply of financial and non-financial services
- Facilitate external connections of the cluster
- Promote innovation

Strengthen the local position within value chains
- Attract the chain leaders into the clusters
- Sustain the upgrading of suppliers
- Facilitate the interaction within value chains
- Promote access to new markets and value chains
- Assist SMEs in meeting international standards

Source: Based on authors' field studies.

Facilitate the Development of External Economies

Build a Specialized Labor Force. General basic education and human resource development policies are necessary conditions for local development and to improve the local factor endowment (i.e. the left hand-side circle in Diagram 1). However, they cannot be defined as proper cluster development policies. To our present aims, more specific, cluster-oriented interventions need to be designed and implemented. An example would be the design of technical school curriculums that introduce real-life examples and context into education and adapt training programs to real workplace needs. Even the most basic programs, such as vocational English, can be taught more effectively if the vocabulary is related to that used in the cluster (Rosenfeld, 2002). The same applies to university curricula, as shown by the Chilean cluster, which have noteworthy and strong linkages with local universities (Maggi, 2003). Moreover, the direct involvement of students in local firms for a short period of their school curriculum is usually a very effective means to encourage learners to follow career paths in the cluster.

The notion of a *cluster skill center* associated with an existing institution may help in this regard. This does not necessarily need to be a physical center. It could be a *virtual center* that, for example, organizes teams from various colleges to work on particular problems, conducts R&D, or develop curricula, and disseminates these results throughout the cluster (Rosenfeld, 2002). It should aim at surveying industry labor needs, developing new curricula, updating skill standards, benchmarking practices in other places and collecting information about cluster labor market (Box 3). Moreover, cluster skills centers can serve as gateways, for example, to help firms bombarded with more information than they can digest and help them determine which training programs have the most relevant staff experience, technologies, best track record, and are most familiar with the industry. The private sector should be actively involved in the functioning of such skill centers.

Box 3
Characteristics of Cluster Skills Centers

- Cluster, not technology, based
- Emphasis on industry-specific knowledge, not job-specific skills
- Critical links to industry associations
- Uses business, not machine, as context
- Functions as information repository and information portal
- Budget stresses staff and curricula, not bricks and mortar
- Share curricula and information cluster-wide, and train faculty from other places
- Lead responsibility for cluster needs assessments, skill standards

Source: adapted from Rosenfeld, 2002.

Promote Linkages Between Firms

Create and Enhance Trust Between Firms and Promote the Establishment of Collective Projects. In Latin America and elsewhere, there is an increasing number of projects aimed at *stimulating the development of relationships between firms*. One of the oldest and best-known projects of this sort is Chile's PROFOs, which has been effectively promoting collective projects between firms for ten years.[24] UNIDO has also implemented various projects with a similar aim in countries such as Honduras, Nicaragua and India (Ceglie and Dini, 2000; Rabellotti, 1998). Another well-known project is Denmark's Network Brothers Program, introduced at the beginning of the 1990s (Bessant et al., 1999). In South Africa, a project to develop "learning networks" in the auto components industry has been remarkably successful. An auto components benchmarking club was created to benchmark SMEs against both their domestic and international competitors. After a period of months they were helping each other to improve, meeting at members' plants and sharing expertise through best-in-class workshops. The result has been a dramatic improvement in production and management efficiency. This shows that *collective action helps to improve collective efficiency* (Kaplinsky, 2001; Kaplinsky and Morris, 2001).

Typically, these projects provide incentives and technical assistance to compensate firms for some of the costs of participating in activities with uncertain returns and very high transaction costs. However, the idea of offering financial incentives for firms to participate can be strongly questioned because it can encourage participation as a means to gain access to funds, not necessarily with a real intent to cooperate. Therefore, incentives need to be temporary, decreasing with time and also involve a copayment of some sort by the participating firms. Moreover, the use of funds is often restricted and usually excludes the purchase of machines and raw materials or the payment of wages. However, financial incentives are not sufficient by themselves to induce joint actions and build trust. Specialized technical assistance is extremely valuable to this aim, and should be provided by people trained as network brokers or facilitators, who are able to promote trust, to increase firms' awareness about the importance of cooperation and to help them create and implement collective projects (UNDP, 2000). These brokers may be individuals or institutions with good technical skills, highly independent from local lobbies and vested interests, and enjoying sound credibility with local actors.

A crucial condition for the success of cluster development programs is also the so-called "ownership" of local actors, that need to actively participate and be engaged in the initiative in order to develop successful policy interventions (Dini, 2003). This has been ob-

[24] For an evaluation of the impact of PROFOs see Benavente and Crespi (2002).

served in several of the successful joint actions in our field studies (e.g. metalworking and fresh fruit in the Santa Catarina and Petrolina-Jauzeiro clusters in Brazil, and the salmon cluster in Chile). An interesting experience in this respect, which requires further analysis, is the participatory process of enhancement of the local context involving a coalition of local public and private actors (e.g. "*Patti Territoriali*", implemented in many clusters in southern Italy, see Cersosimo and Viesti, 2003). This places particular focus on how to provide the financial means, on cooperation with the private sector, and on implementing the collective entrepreneurial and infrastructural projects identified through the participatory process

A final point to emphasize is the *long-term perspective that this type of projects needs to take*. In a recent survey of different projects implemented in Latin America, Dini (2003a) notes that at least 12-18 months are needed to create a real change in the entrepreneurs' attitude towards cooperation, and at least 2-3 years to see an impact on firms' internal capacity. Although exact measurements for cluster development projects are not available, it is extremely likely that the time required may be even longer: the evolution of the Chilean salmon cluster took over a decade, and the ONUDI program in the Boaco and Chontales (Nicaragua) dairy cluster has been in place for five years.

Create and Strengthen Business Associations at the Cluster Level. Business associations are the collective voice of the clusters, providing it with a collective identity. They can play an important role in articulating the demands of the private sector as well as in providing services to member firms. Generally, business associations tend to be weak in most Latin American countries. Therefore, the first step is to examine the existing trade, labor, professional and civic associations with respect to membership and membership requirements, mission and services supplied. If there are no appropriate associations already in existence, interested companies may be assisted in forming one. Furthermore, it is important to verify how associations represent different types of firms, particularly how they represent the interests of SMEs as opposed those of large firms. If the cluster is already served by specialized and local business associations, they can assume additional responsibilities, including those mentioned below.

- Advice to local institutions and governments on the design of appropriate policies and strategies.
- Development of networks of firms, their suppliers, financial institutions, research centers, universities and government offices.
- Direct provision of some services like information about new markets, collective participation in international trade fairs, general business management services and financial assistance.
- Facilitate external connections of the cluster participating in international networks of business associations.

Strengthen the Local Supply of Financial and Nonfinancial Services. Various instruments may be used to enhance SMEs' access to financial services and indirectly spur their collaboration. Thus, funds may be tied to finance projects involving various firms, for instance, to award grants to groups of firms for providing training to associated companies. The experience of the recently created "cluster banks" in Brazil should be carefully observed and monitored (Vargas et al., 2001).

In addition to financial services, *"real" business development services are especially needed*. These services are geared to promoting and facilitating structural changes at the enterprise level, and may be provided through various means. In some more advanced countries, these services may be easily acquired on the market without public subsidies. Subsidies may be necessary only in an initial stage but not later (e.g. this was true for quality management and certification; Pietrobelli and Rabellotti, 2002). Careful location-specific analysis of each case should guide policymakers.

The creation of a local business development service (BDS) center may support the development of a supply of services whenever this is inadequate. The ability of BDS centers to provide the services demanded by firms depends on the extent to which they are embedded in the local business environment. From this point of view, three conditions are necessary for a BDS center to supply the right set of

services as demanded by firms: (i) a deep involvement of the private sector in the creation and operation of the center; (ii) a specific sector specialization, and (iii) a location close to potential customers.

An alternative to direct provision of services, is to support existing institutions in the development of those services that are currently. In this case, BDS centers would act more as "network facilitators" than as service providers. The successful implementation of this model requires the existence of institutions, such as universities, research centers, laboratories and training centers, to set up the network. This may not be so obvious everywhere, especially in developing countries. This is often a feasible alternative in more industrially advanced Latin American countries already endowed with numerous institutions with diverse missions and objectives, but sometimes lacking a unitary and integrated vision, or duplicating their role without enhancing their effectiveness.

In poorer countries, where industry is still incipient, a center is often bound to operate on its own, in the absence of other agents and institutions supporting local industrial development. This requires a different strategy. Within such a context, a center should first improve its management and technical skills and the quality of the services provided. In turn, this would improve its reputation, and raise enterprises' demand for its services. Once its presence is established in the local economy, the center should also aim at creating linkages with existing firms and institutions, and convincing firms of the mutual advantage of close collaboration.

BDS centers also have a role in *stimulating firms' demand of new services.* This requires anticipating tacit, unexpressed needs and convincing firms of their relevance for future competitiveness. This is especially true in less developed regions, where firms have not developed a full perception of their needs and lag behind in adopting a "strategic" and "forward-looking" business attitude. The pressure of competitive markets, such as the need for laboratory testing and quality certification services, may make the need for business development services obvious in a short period of time. But in other cases, such as innovative services, R&D projects, and development of new technological solutions, business development services may need to be subsidized for a long period given their public good content.

Finally, the activities of BDS centers should be constantly monitored, and their effectiveness, efficiency and impact regularly evaluated. Although the evaluation of a center's activities is a difficult task, it is nevertheless necessary. It is worth making efforts in order to quantify benefits, costs, and impacts although indicators should be used very carefully. Moreover, evaluation should be repeated on a regular basis to allow effective learning and improvements in methods and practices. Self-sustainability should not be necessarily an objective but, given that budget constraints are probably a common problem, it may be important for policymakers to be able to collect some measures of efficiency and value for money spent.

Facilitate External Connections of the Cluster. External connections are crucial to learn about innovations and potential new markets and to benchmark practices. There are several instruments that can be adopted, including study tours by entrepreneurs, the creation of connections between local institutions and business associations and their foreign equivalents, and invitation to external consultants to visit the cluster. This is especially relevant for industries where technology is constantly evolving, and local external economies in the form of information exchanges may not suffice to ensure the necessary levels of innovation and technology development.

In the case of an Italian industrial district studied by Rabellotti (2001), a very effective way of creating external connections consisted in an informal program of exchange between the children of the local entrepreneurs and the children of their German buyers. In this way, the producers could get some direct knowledge about their final market and also improve their German language skills, while the buyers could learn some production skills and some Italian. Both the Italian producers and their German buyers also highlighted the positive impact of this experience on the development of mutual trust.

In the Italian and Taiwanese clusters studied by Guerrieri, Iammarino and Pietrobelli (2002), the ability to link up with foreign firms and value chains marked a substantial difference in performance across clusters active in activities as different as garments and computer electronics. Such linkage activities have been fostered through several policy interventions, and *domestic linkages developed in parallel with international linkages*. Examples of specific programs are: informal peer group networks for technological knowledge and brand name recognition; hierarchical satellite to satellite systems, often subsidized and directed by government policies; linkages with large domestic firms, often in the form of cross-sectoral business groups; and business groups centered around a holding company.
In the Chilean wine cluster of Colchagua, international experts played a strategic role as visiting winemakers. Consultant oenologists provided advice to the companies in the cluster and kept them informed of the latest technological developments, fostering external linkages for the cluster. These foreign experts were necessary because, given the nature of this cluster, knowledge could not be spread simply tacitly through local proximity and interactions, but required trained professionals with the requisite tacit *and* codified knowledge (Giuliani, 2003).

Promote Innovation. Several instruments to promote innovation can be adopted to support research and technology transfer within and among SMEs, and between SMEs and research institutes and universities. In a cluster promoting collective efficiency, the access to grants and subsidies may be tied to the establishment of linkages and agreements of cooperation between two or more firms or institutions. Foreign experts and consultants may often facilitate the access to innovation and foster its adoption and adaptation to local circumstances. In addition, technology centers and incubators are one of the most popular economic and technological support instruments at the cluster level. The basic concept of these centers is to create a favorable environment for start-ups, especially innovative and technology-oriented firms, reducing fixed costs and sharing services, combined with technical assistance and effortless interactions with research institutes and universities. This appears to be especially relevant for new, emerging industries such as, for example, software clusters (Ruiz Duran, 2003).

The similarity among firms in a cluster justifies more highly specialized services and assistance and encourages learning and technology transfer among firms. Moreover, local universities and other advanced institutions can be encouraged to concentrate part of their research on topics relevant to the local economy. In the Chilean salmon cluster, for instance, this is being achieved through competitive tenders for joint research projects proposed by universities and cluster firms, and financed by the government (Maggi, 2003). Also, the review criteria adopted to evaluate the performance of local universities could add further importance to the regional economy and to the commercial potential of research relevant for the cluster (Rosenfeld, 2002).

Strengthen the Local Position Within Value Chains

During the design and implementation of policies and programs, particular attention should be paid to the enhancement of collective efficiency needs and, in particular, to the value chain(s) in which local SMEs are participating and their mode of governance. The intensity of the linkages between firms belonging to the same value chain, the opportunities offered by the chain for SME upgrading, and the ability to exploit them vary greatly depending on the pattern of governance of the value chain; the sector of specialization[25] and the existence of alternative value chains in which firms can operate.

Attract the Chain Leaders into the Clusters. The objective of a first type of support in *quasi-hierarchical value chains* is to attract the chain leaders into the clusters, supporting their process of choice with the provision of relevant information. National or local fiscal incentive and subsidies programs are also often adopted to attract these firms. In some cases, these incentives are tied to the commit-

[25] For instance, in traditional industries product specifications cannot be easily codified in technical norms and require a substantial amount of tacit knowledge. Given that buyers rely on the abilities of their suppliers, they are obligated to assist their suppliers in process and product upgrading.

ment of the leading firms to assist local suppliers in process and product upgrading. For instance in Chile, CORFO has implemented a program to sustain a process of suppliers upgrading whose cost is shared among the local supplier, the buyer and CORFO (Dini, 2003).[26]

Sustain the Upgrading of Suppliers. Support is especially necessary to strengthen skills and abilities in the backward production stages along the chain. *National Financiera* and UNDP (2002) have recently implemented a program to sustain the upgrading of suppliers in Mexico. One of the first results of the program was the creation of an interactive methodology to train consultants specialized in facilitating supplier upgrading. The program provides financial services, such as credit and guarantees, and also nonfinancial services, such as technical assistance and training. The program identified the following as key conditions for success: (i) the need to develop a win-win relationship, even facing a problem of unequal distribution of power between the local suppliers and the leading firm; (ii) the existence of an alternative market for both firms involved in the relationship; (iii) the existence of a real technical collaboration between firms, involving information, knowledge and technology transfer; and (iv) the commitment to set up long-term relationships in order to allow investments in upgrading strategies.

Initial results show that both suppliers and customers appear to enjoy substantial benefits. The main benefits obtained by the customer firms are improvements in the quality of inputs, a reduction in delivery times, more competitive prices, and increased flexibility to adapt to changes in demand. On the supplier side, the most common benefits are increases in sales and profits, a more stable demand, productivity increases and cost reductions, improved access to technology and the adoption of a more quality-oriented approach.

From the foregoing, it can be concluded that the success of the initiatives aimed at supporting SME upgrading within quasi-hierarchical value chains depends on the interest of chain leaders in getting involved and directly sustaining the process. The reasons why a leader should be interested in supporting the upgrading process of its providers are a function of the importance of the inputs produced in the cluster, how easily local firms could be substituted by other providers and the relative share of the total market held by the main chain (i.e. the dependence on only one value chain as a market outlet). In addition, the general impact of a program to sustain SME upgrading in value chains depends on the intensity of the relationships existing within the cluster (i.e. on its degree of collective efficiency). When vertical relationships between suppliers and leading firms predominate, and when suppliers are not fully embedded and integrated into the local cluster, there are limited spillovers to the rest of the cluster. In contrast, when firms in the cluster are highly integrated within the local system, the results of their upgrading strategies spread to other firms, generating a process of dissemination of upgrading at the cluster level that may open the opportunity to successfully enter new alternative markets and extend the upgrading process to other SMEs. For this reason, when the leading firms actively collaborate in their providers' upgrading process, it is always useful to develop an alternative strategy of new market search and export assistance at the cluster level. The objective is to reduce the risk of being locked in just one global value chain, with a strong dependence on the leader's strategy, which would clearly be beyond the cluster's control.

Facilitate the Interactions Within Value Chains. The role of *consultants as intermediaries between suppliers and their customers* is particularly useful when the economic structure is extremely polarized. Consultants facilitate interaction between the parties, reducing transaction costs and promoting the development of mutual trust. A similar role is played by CEDMEC in the Espírito Santo cluster (Cassiolato et al., 2003). In addition, consultants and other intermediary institutions also provide technical assistance to support local suppliers' modernization process. However, the success of this upgrading process is also strongly dependent on the customers' commitment to guarantee a stable and substantial demand.

[26] For similar evidence on how Singapore attracts foreign direct investment and ties it to a clear commitment to train local human capital, see Manzocchi and Pietrobelli, 2001.

Business associations may also have an impact on the development of relationships between SMEs and the chain leaders (UNCTAD, 2000). They can contribute in the following areas:

- Providing assistance in pre-selection. They have an important role to play in facilitating and enhancing the linkages between local firms leading firms in the chain by preparing updated records of enterprise profiles, and supplying clear and relevant information on the existing and potential capabilities of enterprises interested in entering into the chain.
- Fostering partnerships between potential customers and local suppliers by organizing fairs and other events and increasing awareness about the benefits of improved relationships.
- Providing the institutional assistance required for SME upgrading.

Furthermore, business associations can play a crucial role in the search for new alternative markets where local firms may try to overcome the obstacles to functional upgrading that are common in most quasi-hierarchical chains.

Promote Access to New Markets and Value Chains. Individual small firms often lack the resources and knowledge to effectively enter new markets. Marketing (especially exporting) is usually one of the most widely accepted horizontal forms of cooperation. Interventions in this area should promote market links by providing information about potential markets, particularly overseas markets, and by promoting local products in these markets, particularly through participation in trade fairs. Joint stands at key international trade fairs are an example of a way to pool resources and act together. Participating in these trade fairs is not just about selling, it is also about learning by establishing direct contacts with potential customers (Humphrey, 2002).

A more ambitious cluster objective (one that may be suitable for a government support program) could be to promote and market the cluster to investors and customers, creating a brand that identifies the place with quality, establishes customer loyalty and becomes a prime destination of buyers. This may be especially valuable as a means to gain access to multiple value chains and exploit the opportunities for learning and for more advanced forms of upgrading (i.e. functional, in addition to product and process upgrading) and break the lock that participation in only one hierarchically governed value chain creates. This appears to have helped SME upgrading in the Sinos Valley cluster in southern Brazil, as well as in the Nicaragua dairy cluster.

Assist SMEs in Meeting International Standards. Globalization of value chains has been sustained by the parallel drive toward the standardization of practices and procedures. Firms' interactions along the value chain require conformity with agreed standard business practices in contracting, accounting, environmental management, labor standards, health regulations and the communication of product design and engineering information (Nadvi and Waltring, 2002; UNIDO, 2002). Access to international markets is conditional upon fulfillment of these standards, and noncompliance frequently allows importing countries, value chain leaders and foreign buyers to reject imports. Technical assistance may go a long way toward reaching this objective, especially if administered at the cluster level and through collective institutions and joint actions, involving small firms together with buyers and chain leaders.

An adequate *regulatory framework* may be the right instrument to urge local producers to respect environmental and sanitary controls, and health and labor standards. The importance of this is often not apparent in the incipient stages of a cluster's life cycle. However, as soon as the cluster approaches the international market, and eventually starts to enjoy success and threatens the consolidated market shares of existing exporters, protectionist measures may start to be felt. The experience of the Chilean salmon cluster offers an example is a case in point. Although initially salmon exporters gained market shares relatively easily with minimum formalized standard requirements, as their market shares began to grow, they started facing rising barriers, often of a nontariff nature (Maggi, 2003).

A SECTORAL APPROACH TO POLICY DESIGN AND IMPLEMENTATION

Given the significant sectoral differences emerging from the empirical evidence, policy priorities are different for each sector. However, some overlap exists and some policies can be used effectively to promote upgrading in several sectors. This section provides an overview of the main areas of intervention for each sector.

Traditional Manufacturing

- Ensure consistency between microsupport policies and programs and the overall macroeconomic framework
- Promote linkages between firms
- Promote access to new additional value chains

A fundamental preliminary condition that is relevant everywhere but especially in the traditional manufacturing sectors is the need to *maintain macroeconomic conditions under control*. Recent examples from Mexico and Argentina illustrate this point. Research has shown that in traditional manufacturing clusters *external economies and, especially, joint actions have a significant positive impact on upgrading.* This all the more important if the cluster or some of its member firms participate in a global value chain. We have already discussed how the development of collective efficiency in the cluster can be sustained (by promoting vertical and horizontal joint actions, increasing firms' sensitivity to cooperation).

Support to Promote Local Production in Larger (and in Foreign) Markets is especially relevant for this group. A cluster policy should, therefore, constantly monitor new developments in technologies and international markets. This may help by promoting local producers independently of their value chain, thus providing them with alternative market outlets, and a stronger negotiating position in the main value chain. This is especially necessary when the mode of governance of the = value chain is quasi-hierarchical (as is the case in most traditional manufacturing sectors) and only provides an opportunity for product and process upgrading, keeping a strong hold over its core areas of competence and inhibiting the functional upgrading of its providers. Actions to foster clusters' search for alternative markets could include support for marketing and branding of the cluster (e.g. the "Made in Brazil" project in the Sinos Valley shoe cluster, or Salmoexport in the Chilean salmon cluster); support for the creation of export networks; and support for collective participation in international trade fairs.

Natural Resource-based Clusters

- Promote public-private collaboration in research and disseminate research results to SMEs
- Improve skills and abilities of producers in the backward stages of the value chain (i.e. agriculture, breeding)
- Facilitate the entry of SMEs
- Promote the adoption of quality and sanitary standards and environmental regulations, and enforce quality inspections and controls
- Promote access to foreign markets and overcome nontariff barriers
- Improve the access and availability of good basic infrastructures

An essential field of intervention in natural resources-based clusters is *access to scientific knowledge*, which is clearly a necessary condition for participating in global value chains. If research is concentrated in the leader of the chain, SMEs do not easily get access to its findings (see the case studies on Rio Grande do Norte in Brazil in Gomes, 2003). The role played by local public research institutions in disseminating research results and assisting SMEs to adapt and internalize the advancements in their production process becomes, therefore, very important. However, the development of efficient and effective local public research institutions is often difficult for various reasons, including the fact that there is no collaboration between local institutions and large enterprises that also carry out research. Another reason is that large firms control the connections with the market from which the stimulus to innovate usually stems. And finally, as shown in the case of the melon cluster (Gomes, 2003), large firms may control local institutions to the extent of having a say in their research strategy.

Policy programs should *help disseminate research to SMEs*. The IDB could promote agricultural programs and projects that explicitly reach SMEs, like for example the programs developed by EMBRAPA/SEBRAE with seedless grape variety in Petrolina-Jauzeiro and the development of integrated production practices in Petrolina-Jauzeiro and Santa Catarina (Gomes, 2003). This effort could be undertaken in collaboration with the public sector agricultural research agency already active in each area.. To this aim, public-private collaboration in research should be promoted. Given the paucity of research on the effectiveness of different mechanisms to promote public-private collaboration in research in Latin America, research in this area could also be supported. Efforts to engage SMEs in collaborative projects with research institutions should be pursued to guide the research priorities in directions that are useful to SMEs as well as large firms and exporters (and not only to the latter).

SMEs often face higher entry costs in several productive activities and in value chains. Government programs should facilitate SME entry into these businesses, particularly in the case of natural resources-based clusters. Programs and projects should explicitly benefit SME production by SMEs and could be undertaken with the public sector agricultural agency already active in each cluster (Gomes, 2003). Actions could include (i) allocation of lots in public projects for SMEs and larger growers, (ii) having development banks make working and investment capital available, (iii) providing access to appropriate storage facilities at ports, and (iv) providing support for participation in national and international fairs where SMEs could display their products and make contacts with potential buyers.

This group should also receive support to strengthen skills and abilities in the backward production stages along the chain. Thus, for example, the dairy cluster in Nicaragua needs to help cow breeders and small milk producers to improve their technical and managerial expertise. They also need assistance in areas and with techniques that could be usefully applied but that are little known in the area (e.g. those related to productivity and to cheese manufacturing). The main value chain led by Parmalat helped introduce and make widespread a culture of quality in the sector, and imposed higher standards (Artola and Parrilli, 2003). However, it did not directly help small producers to fulfill these requirements, a hard task for all, and especially for those not involved in producers' cooperatives.

Quality, sanitary and environmental standards and patenting are playing a growing role in these sectors. Technical assistance could be helpful in this area, especially if administered at the cluster level and through collective institutions and joint actions involving small growers, buyers and chain leaders. Policy support actions should be designed and developed together with local cluster agencies or business associations and may include (i) awareness raising campaigns about the importance of environmental and hygienic standards, directed to small producers; (ii) technical assistance to help local SMEs fulfill international standards requirements; (iii) technical assistance to strengthen local regulatory institutions and institutions that set environmental and sanitary standards for local producers; and (iv) establishing loan and grant conditionalities relating to the effective implementation and maintenance of quality and sanitary standards.

In addition to the rising requirements that international standards create, other forms of nontariff barriers to international trade are widespread in these sectors. While larger firms usually have the ability and means to overcome these barriers, SMEs are especially threatened by them. There are several interesting examples that bear noting. A cooperative of small enterprises in Pará, in the Brazilian Amazon, tried to export traditional sweets made with *cupuaçú* (an Amazon fruit) to Europe, only to learn that a Japanese trading company had already registered the indigenous name *cupuaçú* and the traditional process of extracting the pulp and making the sweet at the European Patent Office. With the support of the Brazilian government these firms are suing the Japanese firm, but the process will take some time and harm has already been made. There are several similar cases, including an attempt to increase exports of *cachaça*, the Brazilian sugar cane spirit to the United

States, by a cluster of SMEs in Minas Gerais.[27] These cases show that access to external markets when tried independently is very difficult, revealing the need for *programs to support SME access to international markets*.

Finally, *access to and availability of good basic infrastructures* (e.g. roads, water, energy) are key competitive factors for these sectors. Competitiveness policies at the local level should cater to such needs in order to improve prospects for SME upgrading in clusters and value chains.

Complex Product Systems Clusters

The evidence shows that *this group offers the least opportunities for SME upgrading* because it is governed by the global logic of large transnational corporations and quasi-hierarchical value chains. Nevertheless, there are policies that could improve the limited chances for upgrading.

- Promote and/or support the active and dynamic role of actors working as network brokers or facilitators of the cluster, especially of the relationships between large anchor firms and local small suppliers.
- Set up an incentive framework to encourage large firms to source their intermediate inputs and services locally and to support their suppliers' upgrading strategies.

A network broker or facilitator is necessary to help the local cluster improve its collective efficiency and, in particular, to build bridges and negotiate with large value chain leaders. Initially, this person can be someone from an existing organization (e.g. local firms, cooperatives, institutes, universities, agencies in charge of promotion, development or financing) or an individual agent (e.g. a leading entrepreneur, researcher, consultant, policy-maker). As the constraints and opportunities become clearer to the group, the facilitator must be available for a considerable period of time.

Who should play the broker's role? There is no answer to this question that applies across the board. The case of CDMEC in Espírito Santo suggests is that it can, at times, be played by someone from a government development agency. Yet, at other times it may be crucial that the role of facilitator by played by someone chosen from among the SMEs' peers. In other occasions the best choice might be someone with a deeper understanding of what is taking place at the cutting-edge of the industry and might be better prepared to foresee opportunities and challenges for the local cluster. In the Espírito Santo cluster, the person who became the main cluster broker had the technical credibility of the group (his previous work was with an engineering consulting firm) and the political ability to build bridges between SMEs and their anchor customers (Cassiolato et al., 2003).

Financial backing for this stage is also essential. In the case of the Espírito Santo cluster, the local development bank (BANDES) played an important role when in 1995 it helped CDMEC to finance a study about the potential of SMEs to supply the anchor companies during their expansion projects. Moreover, the direct involvement of anchor firms is crucial to promote local SME upgrading. In the Espírito Santo metalworking cluster, the anchor (leader) Aracruz Cellulose was essential in opening doors abroad and allowing SMEs to visit some of the paper pulp industry's leading international companies. This enabled the SMEs to present themselves as potential local partners for these top firms and, as they interacted with them, they learned from technologically better-equipped customers.

However, if there is no obvious reward *for anchors to collaborate and promote suppliers' upgrading, some external pressure must be applied*. It can come from a financial institution in the form of a loan conditionality clause requiring improvement in their local suppliers/customers. Or it can come from the local government if a special license is required for the operation of the anchor companies (e.g. an environmental license) (Cassiolato et al., 2003).

The evidence suggests that *local governments may play an indispensable role in convincing large chain leaders to foster local SME upgrading efforts*. Local content and trade balance requirements are among the traditional

[27] José Cassiolato, personal communication, March 7, 2003.

instruments used to encourage transnational corporations to cooperate with local small providers. However, they have often produced disillusioning results revealing that *forcing transnational corporations* usually leads to multiple inefficiencies and undermines the competitiveness of the cluster as a whole (Altenburg and Meyer-Stamer, 1999). Instead, the advantages to the chain leaders should be emphasized in an effort to engage them in cooperative and mutually beneficial initiatives. Related policy programs should, whenever possible, that is whenever a tradition of collaboration is already in place and produced mutual benefits, assist second and third tier suppliers to the accumulate financial and managerial expertise needed to enter international markets when they have the opportunity to follow sourcing, that is, supply services and parts to the same anchor firm in its different locations.

Specialized Suppliers (Software)

- Invest in highly skilled professionals
- Intensify industry-research collaboration

Evidence from the Brazilian and Mexican software clusters shows that the availability and training of skilled professionals are essential for cluster competitiveness. To ensure the availability of skilled professional clusters should *integrate with universities and other higher education institutions to gear the curriculum in directions useful for the industry*. Moreover, policy programs could provide incentives to lure back highly qualified migrants (e.g. Mexican software engineers working in Boston) to work for the cluster's firms. Similar efforts have been successful in other software clusters around the world such as in Bangalore, India (Bowonder, 2001).

Cluster-based technology poles and incubators may provide useful *infrastructural support to start-ups* in this sector, as shown by recent Mexican experience (Ruiz Duran, 2003). International certification is increasingly gaining strategic importance in this sector and could be usefully supported by international agencies and development banks.

In sum, policies aimed at supporting the upgrading of SMEs located in clusters and operating in value chains across sectors are characterized by being highly intensive in coordination, information and human capital, highly location-specific, and highly dynamic and multi-institutional processes requiring clear leadership.

Highly Intensive in Coordination. Most of the interventions suggested in this report are related to the need for creating linkages between firms, between large leading global firms and small local suppliers, between the private and the public sector, and between industry, researchers and universities. The IDB can play a crucial coordinating role in supporting the establishment of policy roundtables with the participation of the local private sector, large firms leading the relevant value chains, local policymakers, and representatives of research and educational institutions. Moreover, the IDB can promote the process of trust building among partners by providing human capital and appropriate incentive schemes. Finally, it may facilitate access to the funds needed to implement the collective projects identified through the participatory process.

Highly Intensive in Information.The design and implementation of support policies should be based on adequate information to map and analyze clusters and to constantly monitor international markets. At the local level the information usually available is often insufficient and collected for different purposes. Moreover, the availability of intelligible impact indicators is necessary to convince policymakers and the private sector about the relevance of this policy area. The IDB can play a key role in developing new, rapid and low-cost systems for collecting information monitoring results.

Highly Intensive in Human Capital. Actions to support clusters are highly intensive in human capital. Skilled people able to promote trust, to increase firms' awareness about the importance of linkages, to help firms in creating and implementing collective projects, and to relate and negotiate with large chain leaders, play a crucial role in cluster policies. The IDB can play a very important role in the selection and training process of these leading figures.

Highly Location-specific. The same standard methodology cannot be used in all circumstances, as learning and upgrading paths are

specific to each case and are affected by factors specific to each location. Policies have to be embedded in different business environments and cultural and institutional frameworks as well as in different governance systems. Local participatory processes in policy design and management appear especially promising. To consider such diverse contexts, the policies approaches have to differ.

Highly Dynamic and Multi-Institutional Processes, Needing Clear Leadership. Finally, policies need to evolve over time to take into consideration the evolution of clusters and value chains, must involve several organizations, and require a clear leadership.

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Annex 1.

Statistics

Table 1: Traditional Manufacturing. EXTERNAL ECONOMIES*

Clusters	Specialised labour market (a)	Availability of inputs (b)	Easy access to information (c)	Market access (d)	External economies index** (EEI)
Textile: Medellín (Col.)	2	2	1	1,5	6,5
Itaji, Santa Catarina (Br.)	3	1,5	2	2	8,5
Garment: Bucaramanga (Col.)	3	1	n.a.	2	6
Gamarra (Peru)	2	2	2	2	8
Torreón (Mex.)	2	0	0	0	2
Shoes: Sinos Valley (Br.)	3	3	3	3	12
León (Mex.)	3	3	3	3	12
Guadalajara (Mex.)	3	2	2	2	8
Campina Grande (Br.)	2	2	1	2	7
Furniture: Serra Gaucha (Br.)	3	1	2	1	7
Uba, Minas Gerais (Br.)	1	1	1	1	4
Espírito Santo (Br.)	1.5	1	1.5	2	6
São Bento do Sul (Br.)	3	3	3	3	12
Segusino/Chipilo (Mex.)	1	2	2	1	6
Tiles: Santa Catarina (Br.)	3	2	2	2	9
Total	35.5	26.5	25.5	27.5	114
Average	**2.36**	**1.76**	**1.7**	**1.83**	**7.6**

*3=High; 2=Medium; 1=Low; 0=Absent, ** (a+b+c+d)

Table 2: Traditional Manufacturing. JOINT ACTION*

Clusters	Backward vertical linkages (a)	Forward vertical linkages (b)	Horizontal bilateral linkages (c)	Horizontal multilateral linkages (d)	Joint Action index** (JAI)
Textile: Medellín (Col.)	1	2	1	2	6
Itaji, Santa Catarina (Br.)	1	1	1	2	5
Garment, Bucaramanga (Col)	1	2	1	1	5
Gamarra (Peru)	1	0	1	1	3
Torreón (Mex.)	1	1	0	0	2
Shoes: Sinos Valley (Br.)	3	2	1	2	8
León (Mex.)	2	2	1	3	8
Guadalajara (Mex.)	2	2	1	2	7
Campina Grande (Br.)	1.5	1.5	1.5	1.5	6
Furniture, Serra Gaucha (Br.)	0	1	0	2.5	3.5
Uba, Minas Gerais (Br.)	0.5	0.5	0	1	2
Espírito Santo (Br.)	1.5	2.5	1.5	1.5	7
São Bento do Sul (Br.)	1	1	0	2	4
Segusino/Chipilo (Mex.)	2	1	0	1	5
Tiles: Santa Catarina (Br.)	3	1	1	2	7
Total	21.5	20.5	11.0	24.5	78.5
Average	**1.43**	**1.36**	**0.73**	**1.63**	**5.23**

*3=High; 2=Medium; 1=Low; 0=Absent , ** (a+b+c+d)

Table 3: NR-based Clusters. EXTERNAL ECONOMIES*

Main Product	Location	Specialised labour market (a)	Availability of inputs (b)	Easy access to information (c)	Market access (d)	External economies index** (EEI)
tobacco	Rio Pardo, RGS (Br)	3	2	2	1	8
wine	Colchagua (Ch)	3	3	3	2	11
wine	Serra Gaucha, RGS (Br)	3	2	2	2	9
sugar	Valle del Cauca (Co)	2	3	2	2	9
marble	ES (Br)	3	2	2	2	9
copper	Cuajone-Toquepala (Pe)	2	1	1	1	5
salmon	Región Austral (ch)	3	3	2	2	10
milk -dairy	Boaco,Chontales (Nic)	2	2	2	2	8
man-goes&grapes	Petrolina-Juazeiro (Br)	3	3	2.5	2	10.5
melons	Rio Grande Norte (Br)	2	3	2	2	9
apples	Santa Catarina (Br)	3	3	2.5	2	10.5
	Total	29	27	23	20	
	Average	**2.55**	**2.45**	**2.09**	**1.82**	**8.91**

*3=High; 2=Medium; 1=Low; 0=Absent ** (a+b+c+d)

Table 4: NR-based clusters: JOINT ACTION*

Main product	Location	Backward vertical linkages (a)	Forward vertical linkages (b)	Horizontal bilateral linkages (c)	Horizontal multilateral linkages (d)	Joint Action index** (JAI)
tobacco	Rio Pardo, RGS (Br)	1	3	1	1	**6**
wine	Colchagua (Ch)	1	1	1	2	**5**
wine	Serra Gaucha, RGS (Br)	1	2	1	3	**7**
sugar	Valle del Cauca (Co)	2	2	3	3	**10**
marble	ES (Br)	1	1	0,5	2	**4,5**
copper	Cuajone-Toquepala (Pe)	0,5	0	0	1	**1.5**
salmon	Región Austral (Ch)	3	3	2	3	**11**
milk -dairy	Boaco,Chontales (Nic)	2	2	2	2	**8**
man-goes&grapes	Petrolina-Juazeiro (Br)	3	2	2.5	3	**10.5**
melons	Rio Grande Norte (Br)	3	2	1	1	**7**
apples	Santa Catarina (Br)	3	2	2.5	3	**10.5**
	Total	20.5	20	16.5	24	
	Average	**1.86**	**1.82**	**1.50**	**2.18**	**7.36**

*3=High; 2=Medium; 1=Low; 0=Absent ** (a+b+c+d)

Table 5: COPS. EXTERNAL ECONOMIES*

Main Product	Location	Specialised labour market (a)	Availability of inputs (b)	Easy access to information (c)	Market access (d)	External economies index** (EEI)
aeronautics	SJC, São Paulo (Br)	3	1	3	1	10
automotive	Nova Serrana (Br)	2	1	2	1	6
automotive	Caixa do Sul, RGS (Br)	2	1	2	3	8
automotive	Juárez (Mex)	3	0.5	2	2	7.5
metalworking	Espírito Santo (Br)	2	2	3	2	9
electronics	Jalisco (Mex)	3	1	2	0	6
Audio-visual eq.	Baja California (Mex)	2	0	1	1	4
Intel ICT	San Jose (Costa Rica)	3	1	2	2	8
high tech	Campinas, São Paulo (Br)	3	1	2	2	10
	Total	23	8.5	19	14	68.5
	Average	**2.56**	**0.94**	**2.11**	**1.56**	**7.61**

*3=High; 2=Medium; 1=Low; 0=Absent ** (a+b+c+d)

Table 6: COPS. JOINT ACTION*

Main product	Location	Backward vertical linkages (a)	Forward vertical linkages (b)	Horizontal bilateral linkages (c)	Horizontal multilateral linkages (d)	Joint Action index** (JAI)
aeronautics	SJC, São Paulo (Br)	2	2	1	3	**8**
automotive	Nova Serrana (Br)	2	2	1	1	**6**
automotive	Caixa do Sul, RGS (Br)	3	2	0	1	**6**
automotive	Juárez, (Delphi) (Mex)	1	1	0	1	**3**
metalworking	Espírito Santo (Br)	1	3	2	2	**8**
electronics	Jalisco (Mex)	1	0	1.5	0.88	**3.38**
Audio-visual eq.	Baja California (Mex)	1	0	0	0.5	**1.5**
Intel ICT	San José (Costa Rica)	0.5	0	0	0.5	**1**
high tech	Campinas, São Paulo (Br)	2	1	1	2	**6**
	Total	13.5	11	6.5	11.9	42.9
	Average	**1.5**	**1.2**	**0.7**	**1.3**	**4.8**

*3=High; 2=Medium; 1=Low; 0=Absent ** (a+b+c+d)

Table 7: Software Clusters. EXTERNAL ECONOMIES*

Clusters	Specialised labour market (a)	Availability of inputs (b)	Easy access to information (c)	Market access (d)	External economies index** (EEI)
Joinville (Brazil)	3	1.5	2	3	9.5
Aguascalientes (Mexico)	2	1.5	2	2	7.5
Distrito Fedral (México)	3	1.5	2	3	9.5
Guadalajara (Mexico)	3	1.5	2	3	9.5
Monterrey (Mexico)	3	1.5	2	3	9.5
Total	14	7.5	10	14	45.5
Average	**2.8**	**1.5**	**2**	**2.8**	**9.1**

*3=High; 2=Medium; 1=Low; 0=Absent, ** (a+b+c+d)

Table 8: Software Clusters. JOINT ACTIONS*

Clusters	Backward vertical linkages (a)	Forward vertical linkages (b)	Horizontal bilateral linkages (c)	Horizontal multilateral linkages (d)	Joint Action index** (JAI)
Joinville (Brazil)	1	3	2	3	9
Aguascalientes (Mexico)	1	1	2	3	7
Distrito Fedral (México)	1	2	2	3	8
Guadalajara (Mexico)	1	2	2	3	8
Monterrey (Mexico)	1	2	2	2	7
Total	6	10	10	14	39
Average	**1.2**	**2**	**2**	**2.8**	**7.8**

*3=High; 2=Medium; 1=Low; 0=Absent ** (a+b+c+d)

Annex 2

PRODUCTIVE AND INNOVATIVE SYSTEMS IN BRAZIL: A POLICY PERSPECTIVE FROM A STUDY OF THE METAL-MECHANICS SYSTEM IN ESPÍRITO SANTO

Description of the Clusters

The institutions that comprise the capixaba metal mechanic productive cluster are: (i) at its core, SMEs, to a large extent suppliers of large companies; (ii) large highly demanding companies which produce low value added commodities for export; (iii) an organization (CDMEC) which supports and alerts SMEs for their need to improve competitiveness in the local and other markets; and (iv) other organizations that directly or indirectly have contributed of the development of the cluster.

The core of the cluster is characterized by SMEs (about fifty) which manufacture made-to-order parts and components and render maintenance and assembly services. The largest of them (which are about 10 percent of the total) had annual sales in 2002 of about US$ 15 million; while the medium one (about 60 percent of the total) sold about US$3.5 million; and the small ones (about 30% of the total), had annual sales in 2002 of about one million dollars. Contrary to what takes place in the metal mechanic sector as a whole in Espírito Santo, the SMEs that comprise the cluster employ more than 30 people (the largest one with 850).

Prevailing activities are grinding, boiler works, and foundry. The level of subcontracting is of about 70 percent. Historically other services such as engineering and project design were mainly supplied by firms outside the local production cluster. Large firms demanding the manufacturing of parts and accessories for maintenance and assembly lines make up the downstream local productive network, and the same applies to industrial services. In fact, based on invoicing, it was found during interviews that these large customers' represent, on average 60 percent of sales of the metal-mechanics SMEs; in some cases, up to 90 percent of sales go to these large firms.

About 90 percent of SMEs are contractors of large companies There are also a few firms with specialized production of low value added products (such as carts for the building industry) and that sell all over the country. The local SMEs rely on suppliers located in the States of São Paulo and Minas Gerais as source for more than 90 percent of their inputs (both capital and intermediary goods).

External Economies and Joint Action

The major coordination role in the cluster's institutional setting is played by CDMEC (the center for the development of the capixaba metal mechanic industry). It was set up in 1988 with a strong support of the Espírito Santo state development bank (BANDES). At the beginning only 18 local SMEs associated to the Centre; nowadays its membership is above 60. CDMEC aims at promoting the strengthening of capabilities of the local metal mechanic firms and at improving their collaboration with large customers. The center's constitution is a positive outcome of long held discussions under the strong leadership of BANDES, Aracruz Celulose, CST, CVRD, and active participation of a few local SMEs.

CDMEC has played a major role in fostering exchange of information and co-operation agreements among its members and between them and national and international firms. A major persuasion instrument for SMEs' membership is that they get closer (through regular meetings and field trips organized by the center) to major customers (the anchor firms) and have easier access to information on new business opportunities, new trends in technology, that is regularly gathered by the center's executive group and which is perceived as important for their competitiveness.

Since the beginning the major focus of CDMEC activities has been on strengthening the capabilities of local suppliers in order to enable them to increase their share in the sup-

ply of goods and services to the large local customers. Among these, the most important in the 1990s were the new investment plans that expanded capacity of all four anchor companies. As these planned expansions came to an end in 2002, the foci of the center's supporting activities to local metal-mechanics SMEs have become increasingly geared towards: (i) targeting new markets as they are supplying other large firms in other states in Brazil and other LA countries; and (ii) supplying other large firms which have become interested in the exploration of natural gas on the coast of Espírito Santo state.

Upgrading Processes

An example of the networking role performed by CDMEC among its members, are the production agreements which have been designed in order to combine industrial capabilities of different SMEs. These are:

- CONVIX (the electro mechanical consortium), which comprises five local SMEs. The idea of the consortium was to combine the different specialization and industrial capabilities of these five SMEs to allow them to play a more active role in the construction of CST's second blast furnace, and in the construction of KOBRASCO (CVRD in association with Korean POSCO's plant for the production of iron ore pallets unit). This consortium has also worked in the construction of CST's recently inaugurated HSM (hot strip mill).
- METALMEC (metal mechanic consortium) which has been active since 1997. It comprises four local SMEs aiming at using their expertise (most of which was acquired through their past work for the anchor companies) to take part in turn-key projects such as CVRD's fifth grain sile, and KOBRASCO's mixer.
- IMETAME/FORTES/ESTEL By combining their specialisation and industrial capabilities these three firms have been able to take active part in the construction of the biodigestor of Fiberline C of Aracruz Celulose S.A, which brought the perspective for new demands. ESTEL is mainly responsible for the maintenance of industrial electrical machinery, assembly and start-up of electrical installations and industrial instrumentation. Fortes Engenharia is specialized in the civil engineering, and Imetame manufactures metallic structures and other parts and specialises in maintenance of mechanic equipments.

Besides these three cases, other informal agreements among local SMEs have been fostered by CDMEC. Their main motivation is that they are a proper response to the needs of anchor customers in three ways. First, local purchases of goods and services increase their relevance to the local economy in terms of indirect job and income generation. Second, they do that without giving up their corporate strategies of pursuing low cost and proper quality of goods and services. Thirdly, given that single SMEs could have problems of reliability in the delivery of goods and services, cooperation among them to fulfil specific orders is seen as a proper response to the anchor's management needs for reducing transaction and negotiation costs.

CDMEC has also organized international trips which have enabled firms to come to direct contact with some major world metal mechanic suppliers. An example of such an initiative is the 1997 trip to Europe called 'Hot Strip Mill (HSM) European Mission'. It aimed at putting local SMEs in contact with European firms which were most qualified to become suppliers of CST's expansion project towards the production of hot strip steel. The mission had the political backing of the state government and was used as a way to foster negotiations between small local players and international suppliers such as Kvaerner Metals, Danieli United, Vost Alpine, Demag-Manesmann e SMS – Schloemann Siemag Aktiengesellschaft. As a result of this mission, some of its participating firms have been subcontracted (mainly in less complex technological components). in the construction of CST's HSM project.

Another example of CDMEC's role in getting its member in closer contacts with international bigger counterparts, was the trip to Europe organized in September 2000. The aim of the journey was to foster contacts between local and international firms that are technology leaders in engineering and construction of paper pulp mills. The mission was a positive response to the windows of opportunities,

which could be foreseen due to the decision of Aracruz to expand its production capacity through a third production line. All the SMEs which took part in that mission recognize that it would have been impossible for them to establish any contact with what became their international contractors without the presentation by Aracruz to its major foreign suppliers. Thus, even though there was no financial support given by Aracruz, SMEs interviewed indicated that its political backing was crucial.

Policies

The first specific recommendation is that financial backing must be given if a better understanding of SMEs about themselves is required. Usually operating on tight time and money budgets, SMEs' entrepreneurs very seldom have a broader vision about the potential of their industry. Since a common identity is required if cooperation is to emerge, and since one should not expect that SMEs would put money outside their own business, external support is essential for identity to be built based on a better understanding of their social, political and economic role in the local socio-economic formation. Thus, financial support from other agents has to be put in place in order to carry out a diagnosis of the cluster's constraints and possibilities based on its SMEs' vision of their ability to compete. Furthermore, such a vision has to be contrasted with a more elaborated perception of supporting organizations of what is taking place in the SMEs' surroundings and beyond.

The second recommendation is that a "network broker" must be in place if the waves of change will have any chance of success amongst SMEs. For a while she/he can be someone from an existing organization (local firms, cooperatives, institutes, universities, agencies in charge of promotion, development or financing, etc.) or individual agent (a leading entrepreneur, researcher , consultant, policy maker, etc.). As the constraints and possibilities become clearer to the group, there must be someone available for a considerable period of time. In the case described here, the person who became the main broker ("articulator") of the cluster had the technical credibility of the group (his previous work was with an engineering consultant firm) and the political ability to build bridges between SMEs and their anchor customers. Financial backing for this stage is also essential. Here the local development bank played an important role when in 1995 it helped CDMEC to finance (about 2/3) a study about the potentialities of SMEs to supply the anchor companies during their expansions projects. Part of this money was used to pay the articulator's wage bill.

Thirdly, it is important to emphasize the need to foster processes and activities that lead to and improve interaction and cooperation among the different agents of the cluster, such as joint training programs, purchase and sales activities, consultancy and R&D projects etc. These have demonstrated their net positive results not also as a short-term target, but also in terms of stimulating and consolidating alliances between these agents.

A fourth recommendation regards the possibility of involving big customers / suppliers of SMEs in their processes of productive and innovation upgrading. An illustration of what can be done, emerges from the case of the cluster described here. As mentioned before, the anchor Aracruz was essential in opening doors abroad in order for the SMEs to visit some of the paper pulp industry's leading international companies. This enabled the SMEs to present themselves as potential local partners for these top firms. Later, their interaction with them fostered learning to innovate from technologically better customers. If there is not any obvious reward for anchor customers / suppliers (cost reduction, reliability, political visibility, etc.) to cooperate, some external pressure must be sought. It can come from a financial institution in the format of a clause which requires improvement in their local suppliers / customers of anchor companies when they are being financed. Or it can come from local government if a special license is required for the operation of the anchor companies.

Key Questions

- How to foster technical assistance and financial backing in order to improve a better understanding of SMEs about themselves? One should not underestimate the importance of this understanding if cooperation is to emerge among the different agents in the cluster. In the case of the capixaba metal-

mechanic, the local development bank played an important role when in 1995 it helped CDMEC to finance about 2/3 of a study about the potential of SMEs to supply the anchor companies during their expansions projects;

- How to put in place a "network broker" who can make the necessary waves of change amongst SMEs? Should she/he be someone from an existing organization (local firms, cooperatives, institutes, universities, agencies in charge of promotion, development or financing, etc.); or should she/he be an individual agent (a leading entrepreneur, researcher, consultant, policy maker, etc.)? For how long a period should this setup be in place?
- How to foster processes and activities that lead to and improve interaction and co-operation among the different agents, such as joint training programs, purchase and sales activities, consultancy and R&D projects ?
- How to exploit the possibility of necessary involvement of big customers / suppliers of SMEs in their processes of productive and innovation improvements? If there is not any obvious reward for anchor customers / suppliers to cooperate, such as for example cost reduction, reliability, political visibility, should some external pressure be sought?

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Annex 3

UPGRADING WITHOUT EXCLUSION: LESSONS FROM SMES IN FRESH FRUIT CLUSTERS IN BRAZIL

Description of the Clusters

The establishment and growth of the mango and grape cluster in Petrolina Juazeiro (PJ) was the consequence of centralized government planning. The San Francisco River Valley Development Agency (CODEVASF) – a public institution created to promote navigation and agro-industrial development – expropriated land in order to implement its public irrigation projects. Different size growers and agricultural processing firms in each project were enlisted, and incentives for agricultural industries to be established in the region were provided. CODEVASF also supported the creation of a grower association (VALEXPORT) that was crucial to the formation of export channels.

The development of the apple cluster in Santa Catarina (SC) followed a slightly different path, as the cluster was the result of the initiative of pioneer entrepreneurs together with public support. These pioneers began to experiment different apple varieties, establishing a market for domestically-produced apples at a time when Brazil imported 90 percent of its apples. Following this example, many other growers started their activities in the region. Public policies also played an important role in generating the cluster, through institution building: the early federal fiscal incentives clearly enabled the pioneer growers to expand their production of apples and take risks that they otherwise would not have taken, and the creation of the Project for Temperate Fruits (PROFIT) contributed to the advancement of the technical know-how in the sector.

In the case of melon production in Mossoró, Rio Grande do Norte (RN) public sector support didn't play any major role, as the cluster was generated by the initiative of two innovative and risk-prone entrepreneurs. In a region characterized by the production of cotton, corn, and beans, a large commercial firm embarked in the late 1980s on the production of melons, foreseeing the potential for this crop in the area. By the mid 1990s, this firm was the single largest melon grower in Brazil and its success inspired another entrepreneur from Sao Paulo to establish a second firm. Together, they accounted for about 70 percent of the melons produced in the region between the late 1980s and mid 1990s.

The production of fresh fruits in PJ, SC, and RN share the following characteristics which make them comparable:

- Growers in all cases produce fresh fruit for the domestic market as well as for export to the EU and/or the US.
- Commercial (versus home-based, backyard) production in all of them began in the mid-1970s, so growers have had over 20 years in which to learn different strategies for upgrading, including to establish their relationship with each other and local support agencies.
- They all have large, medium, and small growers, allowing to evaluate the diffusion/reach of upgrading efforts developed by grower organizations and public sector agencies across different size growers.
- These are all clusters in that they have an agglomeration of firms, a skilled labour pool, local input suppliers and support services (agricultural consultants, transportation, repair shops).
- The problems facing the three cases are similar as growers try to upgrade in light of increasing demands from buyers on the one hand, and tighter profit margins on the other.

In spite of these common features, the three cases differ in terms of public sector involvement in the process of adoption and upgrading of fruit production:

- At one extreme is mango and grape production in Petrolina-Juazeiro which

is the result of concerted planning by a federal institution.
- At the other extreme is melon production in Rio Grande do Norte, mostly the result of private entrepreneurship and only minimal public support relative to that in Petrolina-Juazeiro.
- Somewhere in between is apple production in Santa Catarina, where the state was particularly active with research and extension.

External Economies

All three clusters enjoy similar levels of external economies, given the similar long history of production for all of them.

- Specialised labour market: Since all three clusters have been established more than 20 years ago they have nowadays the possibility of relying on a labour pool qualified to work with each crop.
- Availability of inputs: in all three cases major inputs are purchased through local input stores.
- Easy access to information: Larger firms tend to have easier access to information on markets and technology than SMEs, given the formers' direct contact with buyers and, in some cases, seed companies. Nevertheless, in all cases information is readily spread through formal (associations, cooperatives, input suppliers-growers) and informal (social) networks.
- Market access: larger firms have easier market access than SMEs, which often channel their products through larger firms.

Joint Action

Findings reveal that less concentrated structures of production are associated with a greater level of joint action (JA) among growers. The explanation for joint action does not rest solely on the structure of production, of course. The nature of the problems confronting growers, the nature of each crop, and the nature of the different markets they face also influence the likelihood for growers to collaborate with each other and with the public sector.

Interestingly all three cases have similar levels of external economies but remarkably differ in terms of JA and institutions that growers and the public sector have created to aid the process of upgrading. Further differences are also related to the role and the governance model of the value chains in which they are inserted.

In SC, firms and small growers also interact through vertical coordination, ranging from the outsourcing of production through long-term contracts to on the spot negotiations at harvest time. In PJ (mangoes and grapes) the relationship between firms and growers varies. In some cases, the exporting firm visits suppliers weekly, provides technical assistance, does soil analysis for fertilizer schedule, suggests the harvest calendar, and harvests and transports mangoes to the pack house. The situation of forward and backward linkages in the melon cluster of RN is radically different: the now defunct pioneering firms also left their legacy in inducing a remarkable lack of cooperation among growers. The two lead firms never managed to collaborate in anything beyond the few activities of the melon growers association, PROFRUTAS, which itself was created only in response to demands from the USDA, but remained a weak and disarticulated association, with limited reach and limited voice.

Value Chains

The value chains in which growers participate have changed in recent years, together with the coordination of activities between growers and buyers ("governance"). The global market for fresh fruit has changed in i) its consolidation of global retailers which are gradually substituting small, national retailers and local vendors, and ii) its sourcing strategies, where the need to define and control for product and process standards has forced buyers to develop tighter relationships with their suppliers (importers and/or growers).

This transformation in the global market for fresh fruits is epitomized by the experience in the UK in the 1990s. UK supermarkets and major retailers increased their market share (in terms of revenues from all final sales) of fresh fruits and vegetables from 44 percent in 1992 to 76 percent in 1997. At the same time, supermarkets shifted from sourcing from whole-

sale markets to working directly with UK importers who, in turn, sourced directly from growers. This shift enabled supermarkets to move away from standardized products towards greater variety in products, packaging, and marketing, and also established a system of traceability along the chain.

In Brazil, the consolidation of food retail has been especially rapid since the stabilization plan of 1994 which attracted increased foreign direct investment by multinational supermarket chains. Between 1994-2000, the market share of the top ten food retail chains increased from 24 percent to 47 percent. In this scenario, the distribution of fresh fruits, historically through the wholesale markets and distribution centres the federal government created in the 1960s (CEASAs), has increasingly shifted towards large food retailers.

The increased participation of large food retailers has changed the relationship between growers and buyers. Whereas previously this relationship was generally segmented with an intermediary, retailers are increasingly shifting away from middlemen and wholesalers to alternative, more direct forms of procurement. These alternative strategies include formal and informal contracts directly with growers and the establishment of their own distribution centres, practices which allow the supermarkets greater leverage in enforcing their quality and safety standards. The restructuring of food retail has therefore given more power to retailers and their importers.

The greater power of importers and buyers in these chains has meant mounting pressures for growers to make the necessary changes in their products and production processes to meet the demands of these buyers. That is, growers are under greater pressures to upgrade because they now have fewer buyers and these buyers are more demanding than ever.

Upgrading

The value chains literature claims that global buyers are likely to engage with their suppliers in efforts to upgrade, actively supplying information and monitoring the implementation of the recommended innovations. This explanation, however, does not always hold for value chains of agricultural products, in which retailers are not concerned with backward or forward integration, preferring to reallocate the risks in food procurement and quality maintenance with other actors in the chain. The intermediaries in these chains relay market information on to their suppliers, but are less likely to engage in the actual process of upgrading than would be the case in buyer-producer relations in other sectors.

Growers on their own can often acquire the knowledge and skills needed to upgrade. Buyers, for instance, may provide growers with information on particular inputs, production methods, or post-harvesting techniques. Alternatively, growers may obtain the necessary skills and knowledge from in-house technical expertise, a consultant, local input suppliers, or conversations with each other. Input suppliers across all cases host numerous seminars and field days to disseminate varieties and agricultural inputs. The use of consultants, many of them producers themselves, is also prevalent.

There are, however, a host of activities which by their very nature demand public sector action, including adaptive research, biological control of pests and pathogens, and particular improvements in farming practices and management, along with other research products that have public good attributes. As such, results from research, once disseminated, become freely available (i.e. non excludable), and one grower's use of this knowledge does not reduce its supply to others (i.e. non-rival). Public sector involvement in these activities is also justified on the grounds of risk and uncertainty associated with research, as well as in its economies of scale, both which would keep the private sector from taking on these kinds of activities itself.

Growers, especially in PJ and SC, have turned to the public sector for support in their upgrading efforts. These experiences reflect how the public sector can foster collective efforts among growers and, in the process, assure that small and medium growers also benefit from this process.

Role of Policy

The three clusters analyzed are strikingly different when it comes to public sector support, ranging from the concerted multifaceted strat-

egy of the federal parastatal CODEVASF in PJ, to the research and extension based approach of the state government in SC, to the limited support by the federal government in RN. Smaller growers have participated in the market alongside larger growers largely because of earlier policies that favoured their entrance, such as allocation of lots to smallholders in PJ and the extension service in SC. In both PJ and SC, public sector research agencies have explicitly included small growers in their research projects as a means of making the technology and research relevant to the small grower and to disseminate findings to small growers.

The greater effectiveness of public-private collaboration in SC relative to the other cases can partly be explained by the Santa Catarina state's continued support of the apple cluster. Even with greatly reduced budgets in the 1990s compared to earlier decades, the state agricultural research agency (EPAGRI) has continuously engaged with growers through research, field days, and seminars.

Much of the public-private collaboration in research across the three cases resulted from the availability of competitive research grants from the federal government, which required researchers to submit proposals endorsed by grower associations. The experience of these programs has been mixed, with particular success in SC, but allegations of misuse of funds for several associations, including those of PJ and RN. Placing public funds in private hands does not therefore necessarily improve the efficiency and effectiveness with which these funds are used.

Reference

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Annex 4

THE CLUSTER OF SALMON FARMING AND PROCESSING IN SOUTHERN CHILE

Description of the Cluster

Since the early 1980s, salmon farming on a commercial scale in Chile has transformed the productive and socioeconomic structure of the Southern Region of Chile (*Décima Región Sur* and *Undécima Región Norte*, between 1,000 and 1,700 km to the south of Santiago). This Region absorbs approximately 98 percent of the national production and 25 percent of the world production, with a direct and indirect employment of over 40,000. The core of the cluster is composed by more than 500 centres of farming, 34 processing companies and nearly 150 direct suppliers. In addition, other 100 companies are located in the area, and their production occasionally serves the cluster. The Chilean salmon industry, with a sharp growth during the 1990s, reached an annual turnover of about US$ 1,000 million, with exports to 62 countries, mainly Japan and the USA, which together account for 84 percent of the total value of the shipments in 2002.

The expansion of this industry was possible thanks to inter-enterprise collaboration accompanied by public-private cooperation efforts. Nevertheless, these patterns varied substantially over time. During the first stage of initial learning, between 1978 and 1985, numerous initiatives were encouraged, to exploit the comparative advantages around which the industry began to establish itself. This stage started to be successful in 1985, when the first 1,000 tons of product were exported (mainly fresh and frozen salmon). During the second stage of maturation, the imperative became the acquisition of productive capacities to maintain competitiveness in an industry whose profits margins were quickly shrinking. Some of the challenges during this phase were confronted by means of collective actions, with impact at different levels in the value chain. The third phase (globalization) marks a rupture with the previous ones, as during this phase larger companies with better insertion in the world market become predominant; they are generally associated to foreign equities, and operate in different phases (farming, processing and distribution).

As a consequence, the qualification of the cluster workforce has substantially. This is reflected in the evolution of labor productivity, whose increases have not been equalled by the wage increases, due to the reduction of the industry's profit margins.

External Economies and Joint Actions

The fast expansion of the salmon industry in Southern Chile can be ascribed to a combination of existing and acquired external economies.

Among the first ones it is worth mentioning:

- Favourable natural conditions: existence of optimal hydrographical and environmental conditions for the salmon culture, and counter-seasonality with respect to the other main producing countries and centres of consumption;
- Availability of critical factors: proximity to the supply centres of fish food necessary for farming (mainly flour and fish oil, originating from VIII Region);
- Human resources: availability of university professionals, also trained in the Region;
- Coherent institutions and public promotion mechanisms: administrative and economic legal framework that did not hinder the expansion of the activity, by means of the awarding of coastal marine concessions, and in general of a favourable regulation. Public supports with respect to sanitary matters, commercialisation (ProChile) and technological transfer (Corfo, Chile Foundation) since the mid-eighties. Besides, two other crucial initiatives were undertaken: the pioneering experience of the Chile

Foundation and its subsidiary firm Salmones Antartica, and the establishment of the fish farming in the Institute of Fishing Promotion (INFOP), in the Region of Aysén.

- Existence of entrepreneurial skills to envisage the future opportunities of this business, and undertake the high initial risk.

- Among the external economies acquired and transferred to the Region, the main ones are:

- Technological learning: development of local capacity to strike certain critical links within the value chain, public investment for capacity building and acquisition of foreign know-how on the part of national entrepreneurs, thanks to experts brought to the country during the learning phase and the continuing organisation of technological missions of local companies, with support of the public sector;
- Development of local supply of instruments and services: food, vaccines, raft-cages, marine transportation, networks, with an important presence of entrepreneurs from other regions of the country, like Valparaíso, Bío Bío and Santiago;
- Training of skilled human resources.

Joint Actions

During the first two phases of cluster development (initial learning and maturation, between 1984 and 1993) several collective actions of great relevance for the cluster were undertaken. Nevertheless, after the mid-nineties this "network approach" became weaker, due to the larger company size, to their individual positioning in the markets of destination, and to the greater competition which reduced profit margins.

The capacity of collective action is demonstrated by the creation of the Association of Producers of Salmon and Trout, an organisation that led excellent collective actions like the management, vis-a-vis the authorities, of the implantation and improvement of regulatory norms; and others such as the promotion campaign – together with producers of Canada and Alaska – to raise salmon consumption in the USA. Nowadays, the Association represents its associates in regulatory matters and lobbying, as in occasion of the recent accusation of dumping on the part of North American and Norwegian producers.

Value Chains and Governance

The hierarchical relations at the beginning were characterised by horizontal collaboration between actors with little individual power and an important common challenge, which was to penetrate external markets accustomed to a product originating from a select group of developed countries. Nevertheless, the cooperation between companies gradually lost force when the cluster moved from the stage of maturation to the one of globalization. The rapid growth of the producing companies and their integration into the value chain, the appearance of global actors (specialized European companies and transnational groups), as well as the establishment of a local network of SMEs supplying services and intermediate goods, made inter-enterprise relations more and more of the quasi-hierarchic type, initially led by the larger companies of the cluster (food suppliers and the integrated producers). Simultaneously, final demand in the markets of destination started having an increasing influence.

This case does not constitute a pure form of governance, either of high cooperation or strict hierarchy, inasmuch as the competitiveness achieved after the phase of initial learning opened new opportunities. Nevertheless, globalization imposed more demanding conditions of collective efficiency. Economies of scale in some critical stages of the productive process facilitated the entry of global actors in recent years, and impelled local actors to grow bigger. These new actors brought about more hierarchic forms of relation with local suppliers, harnessing the tendency to outsource logistic services.

Upgrading

In order to understand the reason of the cluster upgrading, it is necessary to recognize that the pioneers began to introduce not only the final

products (i.e. salmon), but also most of the technology and machineries needed, to then gradually adapt them to local conditions.

In the production process, during the three phases of cluster development, adaptation and technological acquisition played the most relevant role. In hatchery, the transfer and then local development, by means of licenses, acquisition of technology, and in the last phase, direct incorporation of branches of transnational companies, played a major role. In food production, adaptation and R&D was a crucial condition for survival. In "hard" technologies, acquisition and some sort of import substitution, particularly in the case of equipment (e.g. lighting systems, biotechnological structures, software) was also important.

Two main aspects of the introduction of innovation and upgrading in the productive processes throughout the productive chain may be singled out. First, the reduction of the risks inherent to the industry: quality of genetic material, absence of diseases, security of the farming environment (i.e. clean and healthy water). Second, the need to increase the profit margins, by means of higher returns of fish diets, of the duration and security of farming facilities, a better handling of harvesting periods, and a steady reduction of losses due to mortality during transport.

Role of Policy

Three types of strategic institutions may be singled out within the cluster. These are: (i) regulatory institutions; (ii) institutions for promotion and technological development; and (iii) institutions for human resources development.

In general, the interaction with the regulatory organisations is not perceived as a critical problem yet; nevertheless, regulatory delays need to be tackled. Although self-regulation has been encouraged from within the cluster, public regulations. Support policies have played an evolving role over time:

- Initial learning: "pioneering" institutional investment, through the activities of "Fundación Chile".
- Maturation phase: Use of public subsidies to create capacities and to gain new markets (CORFO-FONTEC, ProChile).
- Globalization phase: greater use of public subsidies (approx. US$ 10 million per year). Emphasis on innovation, technological development and environmental sustainability of the business.

Open Questions

One of the critical competitiveness factors of a cluster is given by the specialisation of the various companies in the different phases of the value chain. Nevertheless, market conditions impose larger firm-size and vertical integration. Is there any scope for collective actions that aim at reducing the trade-off between firm-specialisation and economies of scale?

The predominant relations within the cluster are at the present time quasi-hierarchical. What actions can be encouraged to prevent that this situation hinders local suppliers development?

The size and leadership reached by this industry, raise unprecedented challenges to public institutions, mainly with respect to regulatory capacity, infrastructure creation and promotion mechanisms. Are there any policy indications, or public-private actions that can act as a reference for the process of modernisation of public policies relevant to the sector?

Given the characteristics of the industry (high environmental vulnerability; difficult sustainability of labour practices in local suppliers), which collective actions could stimulate the cluster, and how?

Referente

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Annex 5

SOFTWARE CLUSTERS IN MEXICO:
GUADALAJARA, MONTERREY,
DISTRITO FEDERAL, AGUASCALIENTES

Description of the Clusters

The Mexican software industry went through a period of considerable expansion during the 1990s, with an annual average growth rate of 9 percent in the period 1993-2001, reaching a total value of US$ 196 million in 2001. Today, the sector gives employment to around 22,000 people.

This growth is mainly explained by the good performance of micro and small enterprises agglomerated in a few localities; as a matter of fact, 92 percent of the firms involved in the software clusters are micro businesses, 7 percent are small businesses, 0.88 percent are medium businesses and only 0.2 percent are large companies.

The software clusters analyzed in the case study are all demand-driven: all of them are located in areas characterized by a strong concentration of economic activities. In software, barriers to entry are normally low, encouraging start-ups near mayor clients and agglomeration of potential customers. Moreover, in some cases the growth process has also been sustained by the strong participation of large transnational companies (Microsoft, IBM, Oracle, SAP) and mainly by the spin-off of skilled people from locally-based high tech TNCs.

The clusters under investigation are located in Mexico City, Monterrey Nuevo Leon, Guadalajara and Aguascalientes. These are knowledge intensive regions, where skilled labor is easily found; still, the expansion process has followed different models of cluster development:

- the cluster of Mexico City started to grow thanks to the involvement of IBM since the 1960s and the spin–off of engineers, becoming the main source of a new generation of software entrepreneurs in the nineties;
- in Monterrey the growth of the cluster is explained by the large domestic corporations that in the 1980s decided to move from in-house software development to outsourcing, allowing many of the engineers internally trained to open their own software business;
- in Guadalajara the software sector grew as a by-product of some transnational companies specialized in electronics (e.g. IBM and Hewlett Packard);
- Aguascalientes is the only software cluster that has been developed as a result of a government policy.

Even though the growth of these Mexican clusters has followed different paths, it is clear that the demand of software by the enterprises as been the factor that sped up the process. Therefore generally speaking, the process of cluster formation has been induced in most of the cases by the market, and enterprises' commitment has motivated local and federal governments to intervene and encourage this process, creating a local favorable environment and, above all, a good endowment of educated labor force.

Collective Efficiency

Various forms of external economies and joint actions have been detected in these software clusters.

Concerning *external economies*, in all these clusters there is a local *well developed local labor market* with highly skilled people moving from one firm to the other, representing an important channel of learning and knowledge exchanging within the clusters. Furthermore, in this sector formal education of the labor force is important, given that the large majority of people involved have a university degree, often in computing, engineering or mathematics. Therefore, the existence of lo-

cally based universities and research centres providing education and training in relevant disciplines is an important condition for the development of the clusters.

Access to information represents another important external economy common to all the clusters analysed. Skilled people moving from one firm to the other are one of the most important channels of circulation of information. Besides, proximity of firms represents an important factor to facilitate information exchange. Informal learning and know-how acquisition require the face-to-face contacts that occur through social, professional or business situations. This is one of the main reasons to explain why in the D.F. and in Aguascalientes there are projects to create science parks or technopoles, where software firms could relocate, expecting a positive effect on information exchange and collaboration among firms.

The circulation of information is also facilitated by the *common social and cultural background of many entrepreneurs*, in some cases sharing a past work experience in large TNCs as IBM or HP in Guadalajara or in others coming from the same local University.

On *joint action*, in all these clusters *horizontal cooperation among firms is quite common*, mainly consisting of agreements of integration of different types of software. In fact, in order to be able to offer their customers full systems satisfying all their needs, many firms set up agreements with other firms to complement their software products. In some cases, these agreements may also imply technological cooperation in order to match the different software programs.

In all our software clusters, *horizontal joint action through institutions* is the most diffused form of cooperation. In the Mexican clusters of the D.F., Guadalajara and Aguascalientes there are very active business associations, promoting various initiatives as training courses, joint promotion and collective catalogues of products and of the human resources locally available (the latter is an initiative of the Aguascalientes Business Association).

Finally, in all the clusters analyzed there is a very strong collaboration between firms (through their business associations) and local universities. In many cases, as in Aguascalientes, the collaboration is inducing a reorganization of the curricula in order to more effectively satisfy the needs of local firms. The process of renovating the courses has been managed by a committee composed by University professors as well as people working in the local software firms. Furthermore, an intense exchange of people is occurring in all these clusters: there are many academics working as consultants or setting up their own enterprises, students spending a period of their university career to work in local firms and people from the private sector going back to University to attend training courses.

In sum, we may conclude that there is a medium to high degree of collective efficiency in software clusters. Specifically, there appears to be a surprisingly high degree of joint action through collective institutions. This fertility of collective initiatives is particularly surprising because most of these clusters are quite recent and normally institutions and associations take time to become effective. An explanation could be the attractiveness of an high-tech sector, as it is software, in terms of industrial policy, given its high intensity in highly skilled labour force and also its symbolic role in promoting the idea of a highly developed area.

Value Chains

In the software clusters the relationship with clients is mainly of a market/network type. There are only a very few cases in Mexico of local enterprises integrated in quasi-hierarchical global value chains. Thus, among many of the Mexican entrepreneurs interviewed, there is a common opinion that the outsourcing market is generally low paid, due to the competition from India.

Therefore, the main market for these clusters is domestic and local, and relationships with clients are mainly based on market rules. In some cases, and mainly with local clients, there is a relationship that could be defined of a network type, because it involves a lot of feed-backs and information exchanges between the software firms and their users. This form of cooperation plays a central role in product upgrading.

Upgrading

In all the software clusters studied, *product and process upgrading has been generally high*.

Most cluster enterprises produce '*ad hoc*' software packages and often adapt existing packages to the specific needs of their customers. In these cases, most of the *product upgrading* consists of incremental improvements, favored by the network relationships with users. Besides, in all these clusters there are a few firms which have been able to evolve from producing '*ad hoc*' solutions to develop standardized systems, implemented and sold to a large number of customers. A case in point is a small enterprise located in Aguascalientes that has developed a software for ophthalmologists, translating into Spanish and adapting other existing packages to Mexican doctors' needs. The software is now sold in other Latin American countries.

In all these clusters the degree of collective efficiency is positively influencing product upgrading. This is confirmed by most of the entrepreneurs interviewed, who consider the exchange of information and the circulation of skilled people inside the clusters as central determinants of their product upgrading strategies. Besides, the numerous collective initiatives also enhance firms' knowledge, access to information and to skilled resources.

With regard to *process upgrading*, it is very strongly related with the process of obtaining the Capability Maturity Model (CMM) certification. The CMM is aimed at improving the process of software development. This is a very time consuming and expensive process for SMEs and therefore there are various collective initiatives aimed at obtaining the certification. Besides, the linkages between software enterprises and local universities are also very important in supporting process upgrading.

Finally, *functional upgrading* appears to be more common in this sector than in others. In all the clusters there are examples of firms making efforts to improve their marketing activity. To this aim, collective initiatives may help SMEs to undertake the investments required. An examples is the creation of a cluster catalogue in Aguascalientes, where the business association is also starting to take care of a marketing policy at the cluster level.

To conclude, *network type relationships with customers*, who are mainly local users, *play an important role in supporting product upgrading strategies*. In addition, the degree of collective efficiency also explains the capability of software firms to upgrade.

Role of Policy

The sector is supported by the Mexican Federal government, which has promoted a program to develop the software industry, aimed at taking advantage of the large US market as well as of the domestic market. Besides, it has to be underlined that local Governments also play an important and innovative policy role. Finally, the variety of collective initiatives involving firms' associations, local public institutions and local universities is notable, contributing to the high level of collective efficiency.

The experience of the cluster in Aguascalientes is the most interesting as far as local policy is concerned. In Aguascalientes, a business association of the software sector has been created within the framework of a state cluster program aimed at the development of *agrupamientos industriales* in various sectors (i.e. automobile, furniture, garments). In each cluster, the program promotes the establishment of an association involving enterprises, the state government and other relevant local institutions. In the case of the software cluster, the association includes 34 enterprises, the Economic Secretary of the State, three local universities and the national institute of statistics (INEGI), all located in Aguascalientes. The association has been recently created and several training courses and an intense activity of meetings among entrepreneurs help create a cooperative atmosphere. Moreover, with the universities belonging to the association there is an increasing collaboration aimed at adjusting the curricula on the basis of local firms' specific needs.

The association is also involved in some important future projects as the creation of a

technological institute and the development of a technopole, where it is expected that many of the enterprises could relocate. A further very promising future project is the participation of the cluster firms to a certification program aimed at *collectively obtaining the CMM (Capability Maturity Model) certificate*. The issue of CMM certification is also among the main future collective projects of the business associations in the D.F. and in Guadalajara. In both cases, the associations are working to elaborate a program to assist small software firms in the difficult and costly process of acquiring this internationally recognized certification.

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Annex 6

THE RISE AND FALL OF THE FURNITURE CLUSTER OF CHIPILO, PUEBLA, MEXICO

Description of the Cluster

Rustic Mexican furniture began to penetrate US and European markets at the end of the 1980s. During the first half of the 1990s the market expanded quickly, together with the value and volume of exports. Most of the Mexican furniture industry was localised in the state of Puebla, and the first company to profit from this newly-born market was Segusino, established at the end of the 1980s in Chipilo, a small town near Puebla, with 20 employees and two subcontractors.

The company consciously pursued a strategy to create a wide network of subcontractors, thereby originating an embryonic furniture cluster. The amazing export boom of Segusino, which managed to increase exports from few hundred thousand dollars to a record of more than US$ 30 million in 1998 (it entered the class of the 500 largest exporting firms in Mexico), has deeply transformed the local economic system. During the 1990s in Chipilo, a village of no more than 5000 inhabitants, many of Italian origin, traditionally specialised in cattle rearing and artisan diary industry, many cattlesheds were rapidly turned in carpenter's shops, and many farmers learned how to produce a piece of furniture or part of it.

Segusino was clearly the leader of the cluster and the model of organisation of the industrial district was explicitly chosen at the outset. In its best years, Segusino grew to reach 1,500 direct employees and a network of more than 100 specialised subcontractors, with another 1,500 workers overall.

Apart from Segusino, in the area around Chipilo there are between 5 to 8 other medium to large firms, some of them former subcontractors of the leading firm and others that began to produce country style furniture following the initial success of Segusino. A large part of the cluster is composed by very small artisan firms, recently established, mainly or, very often, exclusively working as subcontractors for Segusino or one of the other leading enterprises.

Since 2000, the growth of the cluster has begun to slow down and in January 2003 Segusino closed its plants and declared bankruptcy. Several reasons explain this decline: (i) micro inefficiencies like excessive employment, a huge increases in wages without adequate productivity increases and bad financial management and (ii) macro factors like increasing internal and external competition (Segusino's success has attracted new local producers, and Chinese firms begin to produce Mexican country style furniture at a competitive price), the global recession and a general decline in demand, and the Peso real appreciation, raising costs of wood and other imported inputs.

The crisis quickly spread to many firms in the furniture business. Many of Segusino's subcontractors went back to cattle rearing. Some other enterprises became subcontractors of the remaining large and medium firms. A few small firms began to sell independently in the market.

Collective Efficiency

The cluster has grown too rapidly to generate any solid form of collective efficiency. The degree of collective efficiency is lower than the average in traditional manufacturing clusters. This may be explained by a combination of factors: (i) the very recent origin of the cluster and (ii) the prevailing organisational pattern, dominated by vertical relationships between Segusino and its network of subcontractors. The predominance of these strong vertical relationships interferes with the development of external economies and, especially, joint actions.

External Economies

- Specialised labour market: the export boom of Segusino has induced many local farmers to rapidly turn themselves into carpenters, but this requires time, training, and access to tacit knowledge, not easily circulating in a cluster without a furniture tradition;
- Availability of inputs: Segusino supplied inputs to its network of subcontractors;
- Easy access to information: in Chipilo the small local community is characterized by strong family and ethnic ties, because of the common Italian origin. Although the owner of the leading firm came from outside Chipilo, he strengthened his social ties with the locality through his wife whose family emigrated from Segusino, a village near Treviso in Veneto. Imitation of products is also widely diffused;
- Market access: few firms have direct access to the market, and the majority are working as subcontractors.

Joint Actions

- Backward vertical linkages: in Chipilo, vertical collaboration between Segusino and its subcontractors has been rather good since the beginning because there was an explicit choice of the leader to enhance a strong division of labour. Segusino organised its network of subcontractors favouring their specialisation in specific products, i.e. chairs, tables, etc., assisting technically and financially many of the workshops, training the workforce and continuously checking the quality of products. At the same time, the best subcontracting firms were able to participate in the process of quality improvement and sometimes also contributed to the introduction of new designs.
- Horizontal multilateral linkages: a difficulty in representing various interests within a cluster is the main explanation of two unsuccessful efforts: the creation of a technological centre to assist the furniture industry in Chipilo, and the creation of an association among local producers. Both these initiatives were in fact endorsed by Segusino and therefore considered by the rest of the cluster with suspicion. In general, these attempts to develop an institutional setting were seen by the local producers not belonging to Segusino's network, as individual initiatives, aimed at protecting the private interests of the leading firm.

Value Chains

In the Chipilo furniture cluster, since the beginning the leading firm sold its products under market conditions to a large number of foreign buyers, getting *directly involved in distribution both in the domestic and in the international market*. In the Mexican market, Segusino opened its own stores, setting up also a franchising retail chain, while in the US market often preferred joint ventures with local retailers. Although some US buyers maintained a system of quality control in Chipilo, the VC cannot be defined as a quasi-hierarchical chain because market conditions prevailed, and Segusino maintained a full control on product definition. Definitely, quasi-hierarchical was instead the VC existing between Segusino and the other leading firms and their subcontractors, because in this case the small workshops operated under conditions set by the chain leader, holding all the strategic design and marketing capabilities for itself.

Upgrading

Upgrading has taken the form of: (i) fast improving performance in the areas of design and distribution and (ii) enhanced and innovative production process, particularly with regard to the treatment of wood. Segusino sustained the upgrading of its network of subcontractors supplying training, continuously checking the production process and the quality of products and also financially assisting the acquisition of new machinery. Upgrading was also supported by various public support programs providing resources mainly for training.

Role of Policy

The federal, state and municipal governments had an important role in supporting the export of wood furniture from Puebla:

- Through the Banco de Comercio Exterior, producers had access to training in export procedures and received support to participate in international fairs;
- Through employment and trade governmental offices, support was given to improve skills, and equipment in small shops, many of them associated with and financed by large factories;
- Support was also given to help meeting labor and environmental regulations by small shops;
- Municipal authorities of Chipilo also contributed with the provision, with concurrent funds from shops and factories, to supply the town with adequate urban infrastructure. This is a key factor in order to transport wood furniture from one firm to the other during the rainy season.

However, none of these policy interventions were specifically targeting the increase of collective efficiency. The two cluster policy initiatives attempted failed because of the lack of collective commitment of the majority of the firms.

Reference

Zepeda M.E., 2003. Segusino: auge y caida de la exportación de muebles**.** Agorà 2000 mimeo for IDB.

Annex 7

THE RECENT BOOM OF THE DAIRY CLUSTER IN BOACO AND CHONTALES, NICARAGUA

Description of the Cluster

This study focuses on the recent development of the dairy cluster of the provinces of Boaco and Chontales, in the V region of Nicaragua, where nowadays 10,000 small producers and around 500 large dairy companies operate, with a total production of 60-80 million gallons per year. The shift from a traditional sector, with 80% of the production directed to the internal market, towards an industrial production system targeting international markets, started at the beginning of the 1990s, with the implementation of PRODEGA – a Finnish government-sponsored dairy development project – and then continued in the second half of the decade with the intervention, among the others, of the Italian Development Cooperation.

Since the mid-nineties there has been a remarkable development of the sector, which has been partly catalysed by the investment in some processing plants by a few Salvadoran businessmen. This, together with the presence from 1999 of a multinational company (i.e. Parmalat), pushed the local producers towards a wave of investments and upgrading in the quality of product, process and organisation of their own firms. Moreover, these firms and people have been able to cluster in political terms, forming a lobbying institution called CANISLAC (Nicaraguan Chamber of Milk and Dairy Producers). This institution acts to defend the interests of this sector in front of the government and foreign countries, with which have recently sprung conflicts on trade agreements and health regulation that could put at risk the access to the international market that these Nicaraguan producers have gained in the mid 1990s.

Degree of Collective Efficiency

In terms of external economies, the general level is medium. The labour market is relatively specialised; the availability of inputs is moderately good, apart from some specific inputs related to machinery; the access to information is acceptable, while the access to market is rather good, even though in recent years the very important connection that has been established in the early 1990s with the Central American market is facing serious obstacles (i.e. stricter health standards and regulations). The innovation flow is relatively satisfactory, in terms of the imitation mechanisms that are operating in this geographical area.

Joint Action

In terms of joint actions, the results are the following: backward and forward vertical relations are of a medium type, due to the relations existing among producers, suppliers and traders that sometimes become problematic (e.g. milk producers and processing cooperatives with TNCs). Nonetheless, these relations seem always manageable and leading to overall positive results. Considering the horizontal bilateral and multilateral relations, the level can be considered fairly good, due to the recent creation of several cheese processing cooperatives, of the Chamber *CANISLAC*, of *Alianza Amerrisque* and their important lobbying and increasing service activities.

Value Chains

Many value chains operate in the Boaco-Chontales dairy cluster. This study identifies the most relevant ones, both for their production capacity and for their potential for endogenous growth. The first is the chain led by Parmalat, that tends to create "hierarchical" relations with suppliers and retailers. In the case of large landowners and groups of

producers this relation tends to become more equal ("market type"). The second type of chain is led by the Salvadoran medium-sized processing plants and exporters; this chain tends to create "quasi-hierarchical" relations between the foreign exporters and local milk producers. The third is the chain led by the small local cooperative processing plants. This chain has been remarkably improving its collection and processing capacity in recent years, on the basis of imitation and learning but also thanks to the relevant support received from international agencies. They have also reaped significant benefits from their own lobbying activity. These latter actors (and chain) tend to establish a "network" type of relations among themselves.

Upgrading

All product, process, and functional upgrading has been experienced by the cluster. They may generally be considered "medium", because in these regions many traditional rural firms are still lagging behind; on the other hand, if one considers the leading small enterprises in the cluster of Boaco and Chontales, they have experienced "high" level of product, process and functional upgrading (e.g. Camoapán, Masiguito). With regard to inter-sectoral upgrading, few new competences have been set up and/or improved.

Role of Policy

The policy lessons that can be identified from this field study are several. The collective efficiency has worked for the promotion of the competitiveness of local producers and firms. Their collective organisation, in particular CANISLAC, strengthened their position in front of the government, the main multinational company and the foreign competitors and traders. A gradual liberalisation supports the trend towards exporting and upgrading the quality standard of production; it also promotes the exploration of new channels for products commercialisation. It becomes more and more common for firms to attempt to obtain some kind of international certification to get better access to more remunerative markets, such as the export markets or the high-income segments of the national market (e.g. supermarkets). In this sense, the importance given to the connection with international markets is another key lesson coming from this experience. To this aim, the importance of having clearer rules in the export markets, as a means to prevent the growth of smuggling practices is also clear. This would also improve relations among the actors and the overall efficiency of production and commercialisation.

A further lesson lays on the role of international development cooperation. This has been extremely useful for the financial, technical and organisational support it gave to the producers and their organisations in the past ten years. Moreover, the importance to think in terms of production chain proves its importance in the third and more local type of chain. There, a better coordination is taking place among the public business development agencies (e.g. *PRODEGA, PROCOMPE*, etc.) and the private initiatives (e.g. cooperative enterprises) and it is generating an easier integration among milk producers and agro-industry. This productive articulation among local and external actors acting locally enhances the overall cluster upgrading process.

Among the main policy suggestions put forward by this experience, this study indicates the relevance of supporting the creation of an Applied School for Dairy Products, in order to develop the human resources available in this cluster for the local processing. The national institution for training could be involved in this effort (i.e. INATEC), together with the producers' associations, the municipalities and specialised consultancy firms. Another area of intervention could focus on the upgrading of basic infrastructure (i.e. roads, electricity, etc.), to strengthen the agro-industrial private initiatives and make them more profitable.

Reference

Artola N. and Parrilli D. 2003. El despegue del cluster de productos lácteos de Boaco y Chontales. Agorà 2000 mimeo for IDB.