

Alternatives for Industrial Upgrading in Global Value Chains

*The Case of the
Plastics Industry
in Brazil*

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1 Introduction

The globalisation of businesses is accelerating the rate of change in the way that production of goods and services is conceptualised, designed and implemented. After the hegemonic and almost universalistic conception of large-scale Fordist-Taylorist factories and the divisional model of organisational structure for large enterprises (Chandler 1962), we are witnessing the emergence of a complex system of new concepts and formulas for the organisation of industrial companies in general and the production function in particular.

The focal point of this article is the discussion of industrial upgrading in a context where:

- The restructuring of enterprises and their businesses requires collective efficiency; very seldom will an isolated firm succeed in current market conditions; firms will have to focus on their core competences and look for partners to complement their resources and implement their strategies.
- The new entrepreneurial arrangements (alliances, chains and clusters) that are currently observed are both the outcome of historical processes and of actual businesses decisions.
- In that restructuring process, the exercise of power is of utmost importance; new forms of governance are being created and exercised by the leading firms and countries; the balance between cooperation and command among firms in the new arrangements will be dependent on the relative bargaining power of each partner.

Under those circumstances, individual firms in developing countries are facing new and complex decisions related to their transition to that new organisational pattern. In the case of Brazil, for example, the change has been radical. Until the beginning of the 1990s, local firms operated in a very protected and supportive environment. From then on they had to rely on themselves to compete in an open market, one which is particularly attractive to foreign enterprises (Fleury 1995).

Thus, firms have had to learn how to operate in that new context, to revise their competitive strategies, to rethink their core businesses and markets and to create new competences. In short, they have to upgrade to survive and, hopefully, to

prosper. One of the alternative choices for local firms involves engagement in value chains, eventually in global commodity chains, that as Gereffi suggests (1999:38) are a possible option for creating the conditions for upgrading.

The aim of this article is to discuss the conditions under which industrial upgrading in value chains is viable, with a particular emphasis on the cases of small and medium enterprises operating in traditional industries.

We base our findings on a study of the plastics manufacturing industry in Brazil. Initially, this industry comprised a myriad firms, and specialised in one or two specific transformation processes supplying different types of markets. Under the new logic of industrial organisation, those firms had to reframe their strategies. We found cases of alignment of local firms within different types of chains – both producer-driven chains and buyer-driven chains (Gereffi 1994) – and we also observed cases where the lack of preconditions for the formation of chains resulted either in a network type of collective alliance or the absence of any substantial relationship among the firms. The impacts of those changes upon the choice of competitive strategy and the process of competences-building were analysed under that framework.

We conclude with a critical analysis of the actual perspectives for industrial upgrading in different types of value chains.

2 The Scope of ‘Industrial Upgrading’

2.1 Organisational learning: the critical process for industrial upgrading

It is interesting to start from Gereffi's (1999) definition: 'Industrial upgrading involves organisational learning to improve the position of firms or nations in international trade networks.' Thus, upgrading is at the same time a process (organisational learning) and an aim in itself (becoming more competitive in trade networks).

It seems common sense that much of the current process of restructuring and reconfiguration of industrial activities was triggered and primarily inspired by the success of the Japanese in the

eighties and nineties. One of the key features of the success was the organisation of learning processes in the production sphere. This emerged quite clearly in the work of Ohno (1988). Learning processes that involved the Japanese companies as a whole were described by Nonaka and Takeuchi (1995) in their 'knowledge-creating companies' and by Aoki (1990) and Fruin (1992) when they described the Japanese management system.

For the Western companies, awareness of the strategic importance of managing organisational learning grew during the eighties. One of the first promoters of this argument was Arie de Geus, a former chairman of Shell. For him, the only sustainable competitive advantage is the ability to learn faster than the others.

In the academic sphere, the evolution of approaches in terms of organisational learning is shown in the following definitions:

- Organisational learning is the process of upgrading based upon improved comprehension (Fiol and Lyles 1985:803)
- A learning organisation is the one which is continuously expanding its ability in terms of creating the future (Senge 1990:14)
- Learning organisations are organisations that are able to create, acquire and transfer knowledge and to modify their behaviour to incorporate new knowledge and insights (Garvin 1993:80).

The main question dealt with in that literature is: how would industrial enterprises better organise and manage their learning processes? This is not an issue that concerns firms in developed countries only but it has to be considered at a still higher priority level in the case of developing countries, if their firms intend to catch-up with the world's best performers. For Kaplinsky and Readman (2000) industrial upgrading is more than the capacity to innovate and to ensure continuous improvement in production and process development. Upgrading means innovating faster than competitors.

But learning can be of no value if it does not result in an enhanced competitive position for the firm. Therefore, the key questions are: how is it possible to know if the learning process has resulted in an improvement of the competitive position of the

Ambiguous upgrading: the case of the Mexican Maquiladoras

Carrillo (1999) argues that new developments in Mexico's northern border region constitute a form of regional upgrading. These are third-generation maquiladoras, now incorporating R&D activities. More specifically, he refers to a plant of an American assembler that 'develops and manufactures solenoids and sensors'. The main indicators of the distinctive character of that factory are (1) the existence of product development activities and (2) the fact that more than 800 local engineers are being employed.

At a first glance, it might be considered a case where there was functional upgrading. However, it is worth considering that:

- The decision-making process was mainly in the hands of external parties
- The American company was basically relocating a non-strategic activity
- There is no proof that the functioning of both the laboratory and the plant were not essentially based on standardised procedures defined elsewhere.

Therefore, the aspects of purposefulness and learning are not very clear.

firm? How should the outcomes of the learning process be measured ?

2.2 Indicators of industrial upgrading: self reliance and purposefulness

Humphrey and Schmitz suggested an approach by identifying three possible changes that would be an indication of upgrading (2000:3):

- Process upgrading: transforming inputs into outputs more efficiently by re-organising the production system or introducing superior technology
- Product upgrading: moving into more sophisticated product lines
- Functional upgrading: acquiring new functions such as design or marketing.

In our view, some additional features should be considered, to better characterise the nature of the changes captured by those indicators. There would be upgrading if:

- There was an improvement in the competitive position of the firm: (i) relative to its previous position, (ii) vis-a-vis other firms, (iii) catching-up the best performers in the field
- The changes were a consequence of an improvement in the firm's competences
- They meant increased discretionary power regarding other firms.

This last point is relevant because, in our view, there are cases of change that do not necessarily lead to sustainable upgrading. Those are cases that might be called 'routinised upgrading', that is when changes in the operational conditions of the firm are more a consequence of external pressures than of the efforts of the firm to improve their competitive position and by building their own competences. For example, there are many cases where the adoption of standards, such as the ISO 9000, was a reaction on the part of some firms to invest the minimum of resources required to achieve certification.

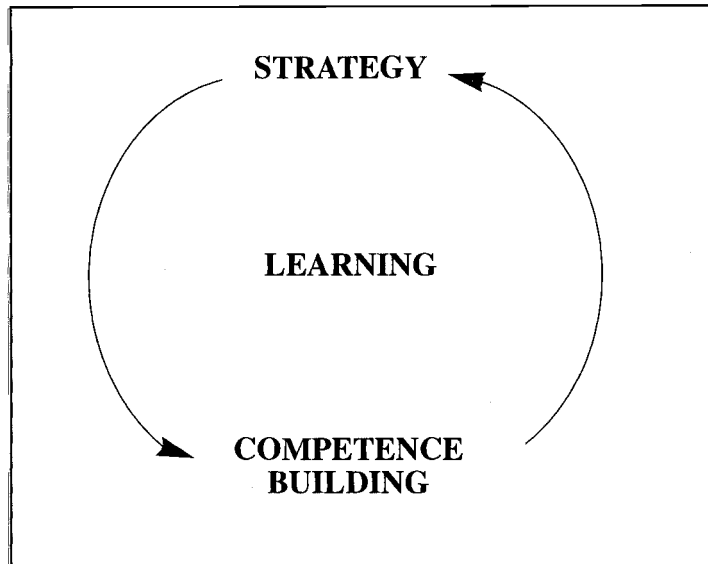
To summarise, continuous and sustainable upgrading will take place only if it is a consequence of purposeful actions based upon learning processes, aiming at an improvement of competitive strengths, consciously established by a firm, region or country.

2.3 Learning as the essential link between competitive strategy and competence building

There is upgrading as long as the learning process results in a stronger competitive position and greater internal competences. That virtuous cycle is shown in Figure 1.

We now turn to the building of typologies for strategy and competences. Following the approach used by Woodward (1965) in her classic book *Industrial Organisation*, we argue that every

Figure 1



Source: Fleury and Fleury (2000)

enterprise has, necessarily, but at different levels and proportions, competences in three different areas: operations, product (development) and sales and marketing.¹ This threefold categorisation should be seen as complementary to the upgrading typology of Humphrey and Schmitz (2000). Upgrading thus means becoming stronger in operations, or alternatively creating competences in product development and/or sales and marketing.

According to the causal cycle depicted in Figure 1, the process of competence building must be designed to support and improve the competitive strategies of the firm. Based on typologies proposed by Treacy and Wiersema (1995) and Porter (1996), we consider that there are three different strategies through which companies may relate one to the other and compete in the market:

(i) Operational excellence. The objective of a company that adopts the strategy of operational excellence is to offer to the market a product that optimises the quality/price ratio. The typical example of operational excellence is the automobile industry. The critical function and key competence for the success of the company resides in operations, including the whole logistical cycle: purchasing, manufacturing and distribution.

(ii) Product innovation. The companies that compete in terms of product innovation are continuously investing to create radically new concepts of products for defined customers and market segments. The critical function is research & development & engineering (R&D&E). Unlike the companies which compete in terms of operational excellence, the triggering information in the development of new businesses comes from the laboratories of R&D&E. Examples of industries in which competitiveness is ruled by Product Innovation are the IT industries – telecommunications, computers and the Internet, and the Biotech industries.

(iii) Client intimacy. These are companies concerned with the needs of specific clients in specific areas; they specialise in developing solutions to manifested demands in the form of products or systems. Such companies have to acquire a profound knowledge about each client and its business. Sales and marketing become the critical function, pulling the efforts of R&D&E and operations. The packaging industry is a typical example. As packaging is increasingly considered an important part of product success, the strategic positioning of companies is to develop packaging that maximises the value of the

Table 1 : Types of strategies and competencies*

Competence strategy	Manufacturing	Product development	Sales and marketing
Operational Excellence	World class manufacturing/lean production	Incremental innovations	Marketing for mass markets
Product innovation	Scaling up production	Radical innovations (breakthrough)	Technical marketing
Client's intimacy	Agile manufacturing	Development of specific solutions	Marketing services

*competencies marked in bold are the core competencies for each strategy

customer's product as a function of the expectations of their markets.

In the dynamic circularity that exists, the choice of strategy and the competence-building process must be aligned. One competence corresponds to a given strategy in which the firm has really to excel; the other two are supportive competences. Table 1 synthesises the typology of strategies and competences.

Thus, when defining its competitive strategy a company must have a full understanding of the alignment of that strategy and its core competence as well as the characteristics of the competences required for every supportive function. At the same time, the existence and the upgrading of such competences enable the continuous assessment and renewal of the strategic choices made by the company, thus creating a virtuous circle.

The following study of the plastics industry is essentially focused at the level of the interplay between strategies and organisational competences (core competences).

3 A Study of the Plastics Manufacturing Industry: Methodological Aspects

In Brazil, the universe of plastics transformation companies used to be very heterogeneous. In view of the versatile application of plastic products there is an infinity of niches that results in the existence of over 5,000 firms in the country as a whole.

According to expert opinion, less than 10 per cent of those companies can be considered as able to compete within the globalised economy.

Originally, the plastics companies were specialised in technical processes (injection, extrusion), simultaneously supplying a broad range of different clients and markets. In the recent past, competition occurred both downstream (that is, among their clients, those industries that make use of plastic products: automotive, electronics, food) and upstream (that is to say, among their suppliers, the chemical companies: the resin producers). In the re-engineering process that followed, the concepts and techniques for Logistics and Supply Chain Management were adopted and implemented, and supply or value chains gradually took shape. In that process, the relationships between buyers and suppliers were radically redefined.

The first step in the design of the field research was to sketch an initial view of the value chain: who were the main suppliers of the plastics companies and who were the main clients? Upstream, the suppliers included resin producers, equipment producers, moulds manufacturers. Downstream, the main consumers of the transformed plastics were the automotive, electro-electronics, household appliances, packaging and construction industries.

Thus, the initial step of the field research encompassed structured interviews with 18 upstream and downstream companies to gather information about their relationships with plastics companies in general. As a sub-product we

obtained an initial assessment of the competitive performance of individual plastics-manufacturing companies. Considering all interviews, about 100 plastics firms were mentioned as good performers. Of these, 38 were studied in detail, using the following selection criteria: type of client/market (that is which value chain they operated in), size and geographic location.

Information collected in each plastics company was organised, aiming to analyse the role and contribution of each firm to the competitive performance of the production chains. The following features were considered: (i) general characteristics of the particular firm and its strategic and operational choices; (ii) relationships with clients and suppliers; mechanisms for inter-firm coordination; (iii) nature of the relationship, concerning time-frame and eventual formalities; (iv) the formation and management of competences. The information about the management of human resources revealed how the competences required for the adequate performance of critical functions were being created and developed, so as to ensure achievement of the elected strategies.

4 Patterns of Governance and Possibilities for Upgrading

Analysis of the information collected in the field research disclosed that the plastics transformation industry is undergoing an intense process of restructuring. What was to be a fuzzy set of over 5,000 companies is today being organised on a different basis. We observed a gradual alignment of the plastics companies that formerly operated in different markets with distinct clients, into one of the five value chains that we initially identified: automotive, electro-electronics, household appliances, packaging and construction.

In the restructuring processes conducted by the buyers, usually large transnational firms, plastics companies that did not manage to meet their performance expectations, quality standards and other requisites were not accepted or excluded as suppliers. For those firms that were accepted or maintained as suppliers, major changes in terms of choice of strategy and internal organisation had to be undertaken, as we shall see later.

The pressures for compliance generated diverse forms of reaction. Usually, there was a strong resistance to focusing on a single market and losing the autonomy to deal with different types of clients. As a consequence, migrations from one chain to the other, due to lack of capacity or disagreement with the governance style, were often observed.

The automotive and electro-electronic industries are examples of producer-driven chains; packaging is a clear example of a buyer-driven chain. In our sample we have also observed the formation of a network type of organisational arrangement by the producers of plastic components for construction. The production of plastics household appliances revealed no clear organisational pattern; it can be better considered as a buffer for firms operating in other chains when they have spare capacity. Finally, there is a large proportion of firms that were not able to access those new organisational arrangements. Those are firms that are operating on the periphery of the markets, usually by supplying local demand with products that have particular attributes.

A more detailed analysis of each one of these groupings offers a better understanding of the dynamics of the new business arrangements and the scope for upgrading.

4.1 The automotive and electro-electronic chains

The recent restructuring process of the automotive sector is well known: the spreading of the Japanese production management tools and methods, the concept of *lean production* and the current trend of associations between assemblers and first-tier suppliers. The electro-electronic sector follows the same trends, with large international corporations leading the formation of production chains. The leading companies (Philips, Electrolux, Sony, Samsung, among others) are designing and marketing products on a world-scale basis and outsourcing the development and supply of parts and components from a few preferential suppliers.

Currently, the use of plastics has the following features:

- In both industries, technological progress allowed for the replacement of components

previously made of metal, with major gains in terms of ease of manufacture.

- In the case of the car industry, plastic is now considered a strategic material, insofar as its utilisation reduces vehicle weight and increases the percentage of components that can be recycled; therefore, R&D activities have been reinforced and the design and manufacture of main plastics components is kept in-house; the other components are outsourced.
- In the case of electro-electronics, plastics have become a raw material for an increasing number of parts and components, and have replaced cases formerly made of wood.
- Development of new products worldwide has permitted alliances among main assemblers and/or mega-suppliers and their plastics resin suppliers following the scheme of global sourcing; for example, Ford with Dow, Philips with Dow, Renault with Rhone-Poulenc.

Regarding their local plastics-components suppliers, a process of gradual selection, hierarchisation and upgrading is in progress. In general, access is subject to compliance with the ISO 9000, QS 9000, APQP standards and other regulatory ordinances. Once such requirements are met, the position of each company rests basically upon its capacity at least to follow and in the best cases to anticipate technological developments set by the leading companies.

This is exemplified by the suppliers of internal parts, especially the front panel, which interfaces with users. After the initial selection of suppliers who were certified, the assemblers and mega-suppliers started gradually to require a substantial investment in those firms with the aim of outsourcing their design and manufacturing activities. In addition to the obvious requirement of co-design competences, the assemblers increasingly required the suppliers to assume the laboratory activities such as crush tests. Therefore, a clear ranking of the suppliers took shape as a function of the strategic intent of each plastics manufacturer and its capacity both in financial and human resources.

The strategic behaviour of the plastics suppliers can be classified into two groups: the first comprises two firms that did have some bargaining power, the second, those firms that did not.

The firm that can be considered the most advanced among the sampled firms has invested consistently to improve its technological and operational competences since the beginning of the eighties. It decided to maintain a position in the automotive industry but created another operation in the telecommunications field. It is important to stress that the requirements for operating in telecoms are much more stringent, both in technological and financial terms. But the decision of that firm was based on the argument that it was mandatory to proceed with the upgrading process since there was little room for growth and insufficient margin in the automobile chain.

The other company was not so competent in technological terms, but was very strong in production. It also considered the alternative of moving laterally to other chains. This firm was formerly supplying other markets, even though its focus was on the auto chain. Its plans were being set for increasing the investments to supply other chains, utilising its strong engineering capacities.

The two cases are slightly different, given the fact that the movement of the first firm aimed to reach a much higher level of technological and operational capabilities, while the second firm intended to apply its current portfolio of competences to other markets, a less demanding objective.

The remaining companies in this chain (which are placed at the third tier of sourcing) exhibit similar behaviour in terms of commercial and operational strategies. They give priority to cost, quality and delivery as the primary factors to compete in the market, highlighting the commercial, production and logistics functions as being more important in the implementation of their strategies. These are companies that essentially supply plastic transformation services, insofar as they receive almost everything specified by their client: the drawings with the specification for the material and the moulds. These firms only have to minimise costs and prices.

Thus, participation by local companies in this value chain is contingent upon their managerial, technological and operational qualifications to comply with the demands of the leading companies. Therefore, it can be stated that this

chain is 'governed by technology'. Companies that intend to be part of it must achieve operational excellence.

4.2 The packaging industry

The packaging industry comprises an extremely large and diversified universe. Seventeen packaging companies were surveyed, seven in the food chain, seven involved in the production of heavy packages for industrial application, and three producing for the pharmaceutical and cosmetics industries.

The most distinctive aspect of this group of firms is that they produce for buyers that usually either do not possess or are not interested in keeping and developing the competences required for packaging design and manufacturing. This creates rather distinct conditions for upgrading.

In the food chains there are two types of products and firms: those who produce complex packages, composed of plastics and other types of materials such as wood or metals, and those who deliver simple packages, transforming resins only, such as supermarket bags. The first group competes through product differentiation. In the second group competition is confined to the price, quality and delivery. Both groups are part of a production chain governed by large food companies (Nestlé, Danone, Unilever and local players such as Sadia and Perdigao) and by the large distribution networks (Carrefour, Walmart, and Pao de Assucar, a local chain).

By comparison with food packaging, industrial packaging is less sophisticated (sacks, drums, containers). On the other hand, it requires a deeper specialisation associated with a more specific knowledge of the industrial clients' requirements. In Brazil there are very large producers, subsidiaries of transnational corporations and a plethora of small and micro companies that produce for small businesses serving regional and local consumption.

Packaging for cosmetics and pharmaceutical products is an increasingly internationalised industry, due to the dynamics of specific innovations, strongly influenced by marketing and fashion. It entails technological advances responding to the increased demands for quality and

reliability from the consumers, especially in the upper segments of society. In Brazil, this is a market very vulnerable to imports. As the vast majority of cosmetics and pharmaceutical producers are foreign, the field research revealed a recent trend of these firms to acquire local producers or to build their own new plants.

Parameters-setting is rather different from the former case, because the buyer firms are unable to specify technical terms. Therefore, there is always tremendous pressure in terms of price, quality, delivery and innovation. But it is in the hands of the supplier to develop the packing system or the solution that is the most suited to the buyers' needs.

In the specific case of food packaging, compliance to the generally established standards for the protection of public health is compulsory. At the same time, compliance with ISO 9000 standards is optional: it creates an additional advantage.

Scale is another important competitive advantage, this being translated into the possibility of negotiating prices upstream with the chemical industries and of developing a closer relationship with the client companies, including setting-up *in-house* plants, in the case of food and beverage companies.

To summarise, packaging is generally an activity in which the buyer does not hold the competences or the interest to manage the production chain via technology. So, it is the supplier who is in charge of developing the required competences and knowledge. Companies that wish to participate in those supply chains must develop a thorough understanding of the end markets of their clients and create systems or components that will strengthen their competitive advantages. In other terms, plastics-transformation firms will have to be client-oriented: sales and marketing are their core competences. Upgrading in operations and product development supports and reinforces the relationship between both parties.

4.3 The producers of plastic components for construction

This case is also different from the previous ones, insofar as governance is practised by local

companies in a shared configuration. Thus, the appropriate model is not a chain type of quasi-hierarchical relationships. Rather, it concerns the formation of an alliance among the leading producers to create a set of national standards that will regulate the access and the evolution of firms in that market.

Two specific characteristics of this industry need to be stated for a better understanding of the scope and reasons for that initiative. First, consumers are extremely dispersed. Second, there is neither a strong standards system nor a strong culture of standards in this industry. Insofar as the builders, those who are in contact with the final consumer, are not interested in standardising designs and products, the companies that deliver the components are able, in a relatively autonomous manner, to define the supplying standards.

This not only strengthens the group vis-à-vis other local producers (including the informal ones), but the group is also currently setting manufacturing criteria and norms more in its favour vis-à-vis the competition with foreign companies, which eventually may be interested in competing in the Brazilian market. However, rather than being squeezed by foreign investors, firms involved in this partnership are spreading their influence towards other Mercosur countries.

The main factor required to compete in the market is availability (coupled to delivery) and cost. The principal functions are production, logistics and sales. In this case, there exists a type of collective learning in the development of norms and standards that provides a shared ground for upgrading in products and production. Nevertheless, the core competence is associated with logistics and distribution.

5 Final Comments

Table 2 summarises the principal observations made in this study.

The point that clearly emerges from the previous analysis is the dynamic relationship between governance and upgrading. In the chains where governance is *strong*, such in the auto and electro-electronics industry, there is room for upgrading,

but that is regulated both in technical and commercial terms by the leading firms. Suppliers have to comply with the overall strategy and governance style of the governing firm.

Under those conditions, Brazilian plastics producers reacted in two ways. Firms that are highly competent and have a good reputation were able to resist losing strategic autonomy: even when they did not exit the chain, they were reducing their dependence from one specific chain and creating alternative trajectories. It is interesting to observe that for one of those firms the choice was to go to a new business requiring increased production capabilities. For the other, the choice was to move laterally to other industries where their engineering capabilities, developed in the interaction with the auto industry, could be applied.

The other firms remained highly dependent on the auto industry. But those were firms that did not have the resources and/or the strategic intent to move. Those firms became typical service providers, in a rather submissive position. Perspectives for upgrading seem to be remote, even if a strong effort to improve operations competences could lead to an eventual repositioning as a manufacturing contractor.

Those outcomes address the issue of quasi-hierarchies raised by Humphrey and Schmitz (2000). If the pattern shown by the local suppliers has been correctly interpreted, the most capable local suppliers will slide laterally, searching for other relationships that are not so restrictive. The less capable will remain as suppliers but, if they do not upgrade following a 'client's intimacy strategy', they will soon be discarded. Therefore, at these levels the configuration of the chain is unstable, temporary.

For the local suppliers attached to buyer-driven chains, such as food and beverage, the conditions are more comfortable in the sense that there is no direct intervention in their operational features; autonomy in decision making remains unchanged. Nevertheless, external pressures are really strong and if the firm does not voluntarily invest in upgrading it will be soon replaced by another supplier. Again, it is important to recall that upgrading is organised by the sales and marketing imperative which privileges the needs of each client.

Table 2 : Scope for upgrading of the plastics transformation companies in the production chains

	Auto/electrical	Packaging	Household appliances	Construction
Current organisational pattern	Governed by auto manufacturers and mega-suppliers; local enterprises being gradually displaced.	Ruled by global enterprises. Few local enterprises qualify to act according to the standards expected by the clients.	Not yet structured; few small- and medium-sized enterprises centered on this market; functions as buffer for companies that operate in other chains.	Gradual concentration into large local enterprises.
Requisites for competitiveness in the production chain	Mastering of technology; financial health; quality; delivery; international price.	Knowledge of the end market; capacity to develop packing systems; quality; delivery; price.	Design; quality; price.	Distribution of standardised products; price; gradual increase of importance of innovation.
Critical factors for the success of companies	Simultaneous engineering; technology management; negotiation.	Customer intimacy; market forecast; product/systems development.	Product, processes and moulds development; negotiation with retailers (large or specialised).	Production in scale within the standards of quality; distribution.
Essential competencies	Plastics technology; production management.	Marketing; packaging technology; application engineering.	Design; process engineering.	Commercial and logistics; efficient operation; cost management.
Scope for upgrading	Fairly restricted by the leading firms except for those willing to fight to become dedicated global suppliers	Relatively open, requiring a fine-tuned process of relationship with buyers.	Completely opened the difficulties remaining in the creation of distribution channels.	Now that standards have been established, competition will require upgrading in production and new competencies in product development.

The concept of quasi-hierarchy deserves some comments here. Even if there are large differences in terms of size, resources and power, the relationship

between buyer and supplier is horizontal, complementary. If there is synergy between both parties, collective efficiency will develop.

Finally, the construction industry reveals the formation of a proactive coalition aiming at the collective upgrading of a group of local producers and the creation of barriers against the eventual 'invasion' of the local markets by foreign enterprises. It seems to be a rare example of effective cooperation among large firms in developing countries, where the University of São Paulo played an important mediating role. The resulting upgrading is quite specific because, even if there was upgrading in terms of products and production processes, a major part of the learning process concerned the issue of 'Institution

Building': creating cooperative relationships among rival enterprises, local technology centres, the Brazilian Association for Technical Standards and the National Institute for Metrology.

In that case, it is also relevant to stress that the creation of the network was achieved in circumstances where vertical links are very weak and the industry is not ruled by technical standards.

Note

1. We are not focusing on the area of financial issues in this study.

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