Associative Models and Business Competitiveness

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ABSTRACT

This article demonstrates using the simulation model of the supply chain, how SMEs using an associative strategy, optimize the use of resources and can become more competitive companies with greater economies of scale, especially in rapidly changing markets.

Key Words: Associativity, modeling, supply chain and competitiveness.

RESUMEN

Este artículo demuestra, empleando el modelo de simulación de la cadena de suministros, cómo las PyMES empleando una estrategia asociativa optimizan el uso de los recursos y pueden convertirse en empresas más competitivas con mayor economía de escala, especialmente en los mercados rápidamente cambiantes.

Palabras clave: Asociatividad, modelado, cadena de suministro y competitividad.

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1. INTRODUCTION

In Colombia more than 95% of companies are micro, small or medium, making them vulnerable at the time to compete, especially with multinational companies with large capital and financial leverage, or goods brought from abroad, with prices below the local market. This poor performance by the working capital investment makes established entrepreneurs refrain from making large investments in capacity expansion, increasingly losing market share and with little chance of success into the future.

Trade agreements between countries, only creates good opportunities for companies that are competitive, with advanced technology and a high degree of product differentiation and have enough installed capacity needed to meet the demands of an international market with representative product volumes. This is one of the major problems faced, such as textiles and clothing, to compete in markets such as the United States, although it has differentiated products, the production volume of the company falls short to meet market requirements, lost business opportunities, compared to the Chinese producers.

This article aims to demonstrate through the application of a production chain model, the strategy of partnering companies can be a solution to the problem of the vast majority of our businesses, which have highly differentiated products, but do not have sufficient capacity to achieve economies of scale, which will allow a better performance with competitive price.

2. LITERATURE REVIEW

Companies play an important role in the context of economic and social development, as well as being an ideal vehicle to create wealth, contribute to employment generation, are the ideal place for people to have access to knowledge and lifelong learning therefore support the formation of human capital, produce or market goods and services that the community requires, compete, required and always looking to be better to win the preference of the market, which benefits consumers. Innovate, do technological developments or appropriating technologies, which contributes to the improvement of the competitive conditions compared to other countries of the world; facilitate connectivity of regions and the country with the globalized world, contributing to the common good, to the extent that assume social responsibility and as taxes paid to state entities also help distribute more evenly and income opportunities among citizens.

For the above and many other reasons, companies are essential to meet the challenge of sustainable development, making it a priority to expand the business base and ensure conti-

nuity of existing businesses. In Colombia organizations like Chamber of Commerce and Acopi conducted studies competitiveness of their firms and defined as follows "the only meaningful concept of competitiveness at the national level is national productivity. A rising standard of living depends on the ability of a nation's firms to achieve high levels of productivity and to increase with the passage of time. "[1]

While that competitiveness through productivity is highly dependent employers, there is no denying that there is a share of the responsibility of the state, especially in developing countries like Colombia, and even more of the regional governments. Michael Porter associate professor of business administration at the chair C. Rolad Christensen at Harvard Business School and an expert on competitive strategy and international competitiveness states "as we enter the twenty-first century, it is essential to develop clear strategies, because unless we have a clear idea of how strategies should be different and unique, and we offer something different than what rivals offer a different group of customers, will eat us alive strong competition "[2].

The professor of business administration at the chair of Harvey C. Fruehauf professor of corporate strategy and international business at the University of Michigan CK. Prahalad says "the continuity of the corporation, as an institution, has value in itself. For example, many companies in the U.S., Europe and Japan are at least one hundred years. If we believe in the continuity of the institution, not on specific products and businesses, we realize that what makes a company will survive for a long time is the ability to change "[3].

While it is true that the great exponents in competitiveness in the world, base their research on multinational companies cannot ignore the strategies used to survive in the world of the globalized economy. That strategies is particular to each economic group, depending on internal and external variables and for the case study, modeling a chain.

Companies are not installed or are located randomly, but tend to agglomerate and concentrate geographically and sectorally to capitalize, as appropriate, proximity to major markets or their main inputs. Successful international experiences of SMEs show that the aforementioned accomplishments can be achieved if the production units are articulated in systems specialized companies operating in a context of trust and clearly defined rules. These systems can be presented in different forms and levels of complexity: from industrial districts in some European countries, extremely hierarchical systems of Japan, Taiwan and China, even the simplest forms of outsourcing or business networks.

Moreover, such clusters often result following external economies of learning, product of repeated interaction between suppliers and producers, and the development of factors and

inputs. The result is that raising the efficiency of business agglomeration well above the efficiency that would each separately. Therefore, it is useful to underline that for SMEs to develop their potential and contribute to the above objectives, it's important that companies develop relationships that allow influence transaction costs and information, the learning process, diffusion of innovations, etc.

We define a chain as a set of interrelated components that integrates the entire production cycle, from procurement of supplies and services, through processing or manufacturing, marketing and reaching wholesale and retail, which runs until customer. The chains work in an environment that determines their development potential. This environment consists of the institutional environment, expressed by the rules and laws governing the chain and the organizational environment, composed by all public and private institutions that support the operation of the chain, comprising research organizations and extension, training and technical assistance, and in addition to other organizations providing services but not directly involved in the business.

Competitiveness refers to the ability of an entity to maintain a leading position in certain markets that allow growth and economic and social development and sustained high [4]. From a business productively chained in its various stages (from input supply to the final consumer) is required while operating as properly integrated networks, deploying their specializations and complementing form value chains constituting them allow the market place with the highest quality products and affordable prices.

A country, region or local authority is equally as competitive in their production and their inhabitants and public, social and private together are effective, efficient, enterprising, innovative, relying on media infrastructure, equipment, human capital, and institutions to exploit their comparative advantage in competitive constituting them. Porter himself formulated in his book "The Competitive Advantage"[5], the value chain is an internal model in which it is defined for a company factors that determine its competitive advantage from internal activities.

The "cluster" is groupings of industries producing, and related support that intertwine through customers, suppliers and other relationships, working to support, innovate and improve the quality of a product or service. In each group there is an element of affinity (a product or service) and has concentrated on improving the competitiveness of the sector as a whole to achieve together the different actors: producers, suppliers, customers, innovators, brokers, support activities for unite experiences, knowledge, ideas, etc.

In his book "The Competitive Advantage of Nations", Michael Porter proposes that the competitiveness of a company or group of companies is determined by four fundamental attributes

of their local base. These four attributes and their interaction explain why innovate and remain competitive companies that are located in specific regions.

Not only the basic factors such as land, labor and capital, are responsible for the generation of competitive advantages of a given region are also specialized factors. These specialized factors are not inherited, but created by each country; arise from specific skills derived from its educational system, its unique legacy "know-how" technology, specialized infrastructure, etc. and respond to the particular needs of a specific industry. It requires significant and continuing investments by companies and governments to maintain and improve them. Specialized factors conducive to a country's competitive advantage, because they are unique and difficult to replicate or access by competitors from other regions.

In a world headed toward globalization would seem that local demand is minor, but the evidence shows otherwise. The most competitive companies invariably have a local demand that is among the most developed and demanding in the world. Demanding clients allow companies glimpse and meet emerging needs and become another incentive for innovation. Having these customers close allows companies to respond more quickly, thanks to shorter lines of communication, increased visibility and the possibility of joint projects. When local customers anticipate and shape the needs of other countries, the benefits for local businesses are even greater.

The existence of efficient specialized support industries, creating competitive advantages for a country. Related industries and support given to firms within the cluster inputs, components and services, tailored to lower costs, higher quality, and delivered quickly and preferred. This is a result of closer ties of cooperation, better communication, mutual learning and constant pressures that facilitate innovation and continuous improvement in the supply chain.

Clusters offer a variety of advantages to firms located within them, such as the availability of inputs, given the concentration of suppliers and buyers, you have access to economies of scale and reduced transportation costs, opportunity and warehousing, among others. The congregation of labor, where skilled workers agglomeration acute presented, to maximize efficiency in the use of these, reducing the costs of search and selection of individuals and ensure job security to workers to companies. The concentration of knowledge, where the proximity of businesses and workers, aims for a rapid and effective dissemination of knowledge in both technical and deep, thanks to a greater possibility of interaction between individuals.

The cluster constitute something like a "family" of companies, which generate and strengthen bonds of trust - Social Capital - which results in a smoother business interaction and in lower transaction costs. Incentives are generated due to the proximity, companies can easily compared with its competitors and implement best practices more quickly. The cluster attract all sorts

of different training individuals, which, according to numerous studies have concluded, creates greater potential for innovation that those industry sectors where there is a high homogeneity of the workforce. Also, there are strong relationships with target markets, enabling faster perceive trends and needs of these.

Finally, where the cluster members are interdependent, and therefore have a high pressure to coordinate activities and increase the efficiency with which they are performed. Given the good reputation we usually enjoy the cluster, you may have better access to credit from financial institutions. Also, all the resources for the existing business, and due to the high specialization of labor, requires less active, though very specific.

The benefits flow from customers to suppliers and between competing companies, so the "clusters" grow in the direction of new industries that appear as a result of vertical or horizontal integration of businesses.

There are other types of associative models used in countries like China, such as the "industrial districts", Humphrey & Schmitz authors define an industrial district as "a structure that arises when a cluster develops more than specialization and division of labor between firms that comprise it, "in an industrial district are derived aspects of collective efficiency of inter firms, joint learning and collective innovation, further within an industrial district presents the emergence of explicit and implicit forms of collaboration between agents firms and local districts to generate local production and sometimes innovative capacity, likewise presents the emergence of strong industry associations "[6].

According to a compilation by Marco Dini in 1997, an industrial district is defined as "a cluster of hundreds and sometimes thousands of companies small and / or medium same industry oriented and concentrated in the same area. Typically, within the district include several stages of production and producer services "[5]. The current concept of industrial district has been inspired by the work of Marshall [7] and has been updated by Giacomo Becattini [8].

Industrial districts, can be described as geographically defined productive systems, characterized by a large number of enterprises and production units of small and medium-scale focused mainly on a small number of stages (and a high percentage only) for one cycle production. Among the different companies and production units are defined variously and alternative relationship and collaboration, which, however, rarely result in strictly hierarchical relationships. Finally, as a defining characteristic of the particular nature of industrial districts, district agents (companies, unions, government, banks, etc..) Identify with a community defined and precise, and his propensity for cooperation is based on trust inspired by a social and collective sense of belonging to the same group.

The organization of the production cycle of industrial districts is characterized by a marked segmentation of production phases. At each level of production lots are operating companies focused largely cases, only in a productive phase, although they are always present simultaneously numerous companies in more levels. Relations between companies operating in the same segment of the cycle are usually characterized by complete independence and autonomy.

We define, therefore, a situation of intense competition in terms of quality and price of the goods produced. However, with respect to relations between firms belonging to different levels, the speech appears to be more complex, showing cooperative relationships of varying intensity, depending on the case.

One can distinguish the characteristics of the production process of industrial districts as of multipurpose equipment and training markets used equipment, high capacity to respond to individual and changing demands and good adaptability. High qualification of labor and high costs of production variables, exploitation of economies of scale, but offset by the specialization phases collective control of the production and dissemination of information through the network established by the decentralized production relations.[9]

Another feature of competitive advantage in industrial districts is due to its characteristic system of organization of production, which allows small businesses produce optimal levels of scale in production specialization, keeping, from the point of view of industrial district, a level nearly optimal activation productive. This is precisely one of the most attractive features of industrial districts, which has led to the preparation of this article, to try to show by developing a model of supply chain, competitive advantage that small businesses could be working on a associated companies face greater capacity to work in isolation, particularly when changes occur in the market without notice, causing the bullwhip effect in supply stores and manufacturing companies.
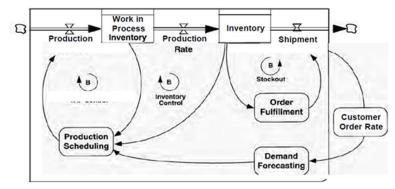
As Peter Senge puts it "building a shared vision encourages a long-term commitment. Mental models emphasize the openness needed to unearth the limitations of our current way of seeing the world. Team learning develops the skills of groups of people to seek a broader figure that transcends individual perspectives. And the domino staff encourages personal motivation to continually learn how our actions affect the world. [10]

3. PROPOSED MODEL
John D. Sterman, in his book Business Dynamics, also the model The Manufacturing Supply Chain, supply chain for manufacturing enterprises, which presents the links of a chain from the

supplier's link, via the link in the manufacturing company and ending with delivery of products or finished goods to customers.[11]
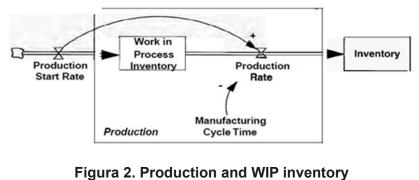
In Figure 1, the policy structure of Inventory Management, or the structure of the management policies of finished product inventory, we observe the behavior of the model end supply chain. Where goods production is marked by Customer Order Rate, in response to customer requests, the company presents a Shipment Rate, which depends directly on the Desired Shipment Rate and Order Fulfillment Ratio. See equation No 1.

$$Shipment\ Rate = Desired\ Shipment\ Rate * Order\ Fulfillment\ Ratio \quad (1)$$

Figura 1. The policy structure of Inventory Management
Fuente: Jhon D. Sterman

The Desired Shipment Rate, which equals the Customer Order Rate, this means is desired delivery rate equal to the rate of customer orders. The Order Fulfillment Ratio, is given in terms of the ratio of the rat $SR = DSR * OFR = DSR * f(MSR/DSR) \quad (2)$ maximum value of unity, according to equation No. 2.

To determine the value of inventory levels of finished goods, Inventory and Work in Process Inventory on, product inventory in process, as shown in Figure N ° 2 of Production and WIP inventory is determined by the equations No 3 and No 4.

Figura 2. Production and WIP inventory
Fuente: Jhon D. Sterman

$$Inventory = INTEGRAL(Production\ Rate - Shipment\ Rate, Inventory_h) \quad (3)$$

$$Work\ in\ Process\ Inventory = INTEGRAL(Production\ Start\ Rate - Production\ Rate, WIP,) \quad (4)$$

Similarly the Production Rate is determined by its relationship with the Cycle Time Manufacturing and Production Start with Rate, by Delay3 function, or tertiary. As seen in Equation No. 5.

$$Production\ Rate = DELAY3(Production\ Start\ Rate, Manufacturing\ Cycle\ Time) \quad (5)$$

To complete the supply chain model, only missing link in the Supplier or supplier who supplies all the raw materials needed to meet the production schedule, as shown in Figure No 3, called Adding a materials inventory.
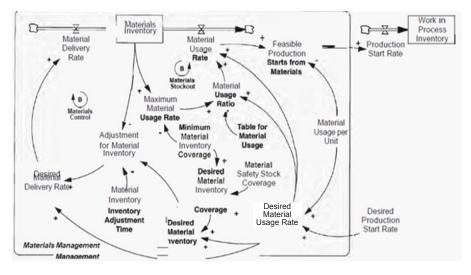

Figura 3. Adding a materials inventory
Fuente: Jhon D. Sterman

The attention focus will be on the Material Delivery Rate, which depends on its relationship with the Desired Material Delivery Rate, who in turn depends on the relationship between the Desired Rate Material Usage and Inventory Material Coverage Desired, according equation No. 6, for its policy of inventory management.

$$Desired\ Material\ Inventory = Desired\ Material\ Usage\ Rate * Desired\ Material\ Inventory\ Coverage \quad (6)$$

This completes the supply chain model, with the three most important links covered, as are the customer, the manufacturing and the provide.

4. VALIDATION

For purposes of determining the behavior of the model, it takes a surge of 20% from the week number 5 in the Customer Order Rate, which until then was in dynamic equilibrium and corresponded to 10,000 units, from 12,000 units from week 6.

The results of the model run in VENSIM, obtained are presented in Figure N ° 4, Response of Manufacturing Model to a 20% Step Increase in Orders. The time series correspond to Material Delivery Rate, Production and Shipment Rate, a Weekly and Time Step Time Final 50 weeks. The value of Initial Customer Order Rate is 10,000, the values for the Safety Stock Coverage, the Minimun Order Processing Time, WIP Adjustment Time and Material Inventory Adjustment Time are 2 weeks, the Time to Average Order Rate, the Inventory Adjustment Time and the Cycle Time Manufactury are 8 weeks. The value per Unit Usage Material, Material Safety Stock Coverage and Minimun Material Inventory Coverage is 1 week.
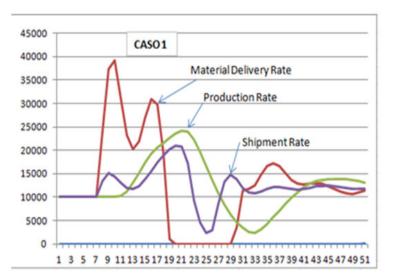

Figura 4. Response of Manufacturing model to a 20% step increase in orders
Fuente: Elaboración de los autores

The above situation corresponds to the results obtained for the Case Study No. 1, where the model represents the situation of a company that has historical sales of 10,000 units, but from week 5, suddenly its sales increase by 20%, which means a disorder in the behavior of its production plant and for the behavior of its raw material supplier. The model has no restrictions regarding the installed capacity of the plant or manufacturing, nor your provider, so it is assumed that both can meet the production levels set in the graph, however high they may be.

Case 2, it suggests that there are just as historical sales of 10,000 units, which also increased sales from week 5 so suddenly by 20%, but now the situation does not corresponds to a single

company. It is up to two manufacturing companies work with a partnership model, together with two raw material suppliers. It is assumed that this model allows them to work together and in parallel, with similar production standards, technologies shared machinery and equipment as well as personnel with appropriate training and expertise to fulfill tasks set character. The behavior of the time series is illustrated in Figure 5.

The parameters used in this modeling, raced VENSIM correspond to a Manufacturing Model of Response to a 20% Step Increase in Orders. The time series correspond to Material Delivery Rate, Production and Shipment Rate Rate, a Weekly and Time Step Time Final 50 weeks. The value of Initial Customer Order Rate now is 5,000, the values for the Safety Stock Coverage, the Minimun Order Processing Time, WIP Adjustment Time and Material Inventory Adjustment Time is 2 weeks. The value per Unit Usage Material, Material Safety Stock Coverage and Material Inventory Coverage Minimun one week, the Time to Average Order Rate Inventory Adjustment Time and 8 weeks, but the Manufactury Cycle Time passes of 8-4 weeks. The reason of this change is due to the fact that the market is now divided to two manufacturing companies and two of supply of raw material, where each company separately manufacturing begins its work, making deliveries of their products simultaneously. This is one of the main advantages of the partnership model, reducing delivery times.

The other advantage of the model corresponds to the need of smaller capacity, in order to optimize the use of machinery and equipment, is economy of scale by leveraging the participation of businesses, without losing their autonomy.
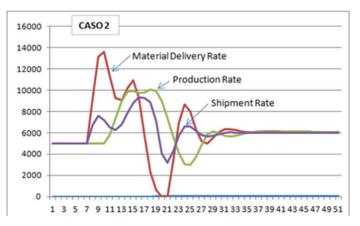

Figura 5. Response of Manufacturing model to a 20% step increase in orders
Fuente: Elaboración de los autores

Similarly, it can present the partnership model for more than two manufacturers and two suppliers, participating in a competitive market, but for the analysis of this article will consider only cases 1 and 2 above.

5. ANALYSIS OF RESULTS

To establish the differences presented in cases 1 and 2, we will work with two indicators of business management, the first is the default rate on products shipped to customers and the second to the utilization rate of installed capacity manufacturing plants and for suppliers. To set the indicators will be based on the results of time series Material Delivery Rate, Production and Shipment Rate, in each case.

To calculate the default rate, we used the data produced by the model run in VENSIM, for Shipment Rate, in the case of the first 5 weeks is subtracted 10,000 units, corresponding to customer orders until that moment, but from week 6, is subtracted 12,000 units, corresponding to the new level of customer orders. The total sum of the differences units, or units not delivered, is divided by the total quantity required by customers, that ratio is the percentage of units not delivered, or what is the same percentage of non-compliance to orders.

To calculate the utilization rate of installed capacity of manufacturing plants and procurement, we used the data produced by the model run in VENSIM for the Production Rate, in the case of manufacturing plants and the Material Delivery Rate, for those of suppliers. Initially determines the value of the installed capacity of the plant, this corresponds to the highest value yielded by the Production Rate, in the case of the manufacturing plant and the largest value in the simulation thrown in the Material Delivery Rate for companies suppliers. These values correspond to the maximum that may be able to produce each of the plants to meet the demands of customer orders and inventory policies. The ratio between the value of the Production Rate or the Material Delivery Rate thrown weekly between installed capacity corresponds to its utilization rate for the manufacturing plant and suppliers respectively. For the average weekly value, adds all values of weekly use and divide the 50 weeks of modeling.

Table No. 1 shows the results obtained for cases 1 and 2 as well as the variation between the two situations.

Tabla 1. Tabla Comparativa

	PROVEEDOR	FABRICANTE	CLIENTE
	TASA USO CAPACIDAD INSTALADA %	TASA USO CAPACIDAD INSTALADA %	TASA INCUMPLIMIENTO
CASO 1	33,2	52,2	6,6
CASO 2	47,4	63,1	3,0
VAR	30	17	-121

Fuente: Elaboración de los autores

There is a very significant improvement in the default rate, from 6.6% of default to only 3%, with a negative change of 121%. This means that more than half of the finished products to the company in case 1, was unable to deliver to their customers, business case 2 could have been handed over, without deterioration of image it represents, especially in highly competitive markets, where failure is punished with the loss of customers and possible economic sanctions.

In the case of the rate of use of installed capacity, the manufacturer's link goes from 52% for a manufacturing company, to 63%, representing an increase of 17%, greater use of their equipment and machinery or what is the same, reducing fixed costs due to optimization of resources. This is highly representative especially for businesses that require high technology in its production processes, with expensive machines and equipment, which have high levels of investment in their facilities.

The most critical case is presented in the link supplier, exhibiting an occupancy level of installed capacity by 37% for 1 at an occupancy rate of 47%, in case 2, the situation improved by 30% . Which means that with such low occupancy levels as being presented in case 1, the supplier would have no prospect of staying in a competitive market, because it would require higher contribution margins in order to pay the high costs fixed, requiring very high prices for it, perhaps, customers are unwilling to pay. Two suppliers on the contrary, with less investment of installed capacity, with lower fixed costs and an occupancy rate of 47%, could persist and survive, but requires additional steps that will allow you to make even a low level of occupancy.

6. CONCLUSIONS

In countries such as Colombia, where over 95% of companies are micro, small and medium, the result of this article, provides a message of hope to compete in international markets such as the U.S., with companies with economies of scale and large investments but at the same time with high fixed costs and low maneuverability to make their processes more flexible and suitable for rapidly changing markets.

The simulation of situations like those outlined in this paper, we show the potential benefits that may have firms operating under a partnership model, where the rate of compliance with customer orders has a significant importance to the competitiveness of companies, and the use or enjoyment of installed capacity represents an optimization of the resources used.

Reduce non-delivery of orders in half, increasing by more than 15% utilization of the installed capacity of the manufacturing plant and 30% that of the suppliers, are figures that are worth analyzing with great careful because associatively work with groups of companies in certain highly specialized areas, may be the strategic solution that the country needs to improve their competitiveness.

7. REFERENCES

[1]   J. Cabal, "Towards a new comprehensive policy to support SMEs: reflections and pro-posals" Intervention in the opening ceremony of 40 °. National Congress of Small and Medium Enterprises and First Iberoamerican Meeting, ACOPY.,1995.

[2]   C. K. Porter & G. Hamel, "Rethinking the future", Human Resource Management Jour-nal, n°. 9., 1999.

[3]   G. Hamel & C. K. Prahalad, Competing for the Future, Harvard Business School Press, Boston.,1994.

[4]   M. Porter, Competitive advantage of nations: creating and sustaining superior perfor-mance. Simon and Schuster, 2011.

[5]   M. Porter, Competitive advantage: Creating and sustaining superior performance. Si-mon and Schuster, 2008.

[6]   H. Schmitz, "Collective efficiency: Growth path for small□scale industry", The journal of development studies, n°. 4, pp. 529-566.,1995.

[7]   A. Marshall, Principles of Economics, Madrid: MacMillan, London, Spanish Translation Principles of Economics, Aguilar 4 edition, 1890.

[8]   G. Becattini, "Dal 'Settore' Industriale to 'Distretto' Industriale. Alcune sull'Unità Consi-derazioni Industriale di Indagine dell'Economia" Rivista di Economia e Industriale Poli-cy (now L'Industry), n°. 1, pp. 7-21., 1979.

[9]   M. T. Costa, "runout Industrial Production and Dissemination. The flexible specializa-tion model", Spanish Economic Papers, n°. 35, pp. 251-276, 1988.

[10]   P. Senge, The Fifth Discipline.. Bogotá: Editorial Norma. First Edition, 1998.

[11]   J. Sterman, Business Dynamics.. Bogotá: Mcgraw Hill. First Edition ,2000.