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Inter-firm network: a methodological approach for operations strategy

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Abstract: *Most studies available about manufacturing strategy have been done under the business paradigm (SKINNER, 1969, HAYES & WHEELWRIGHT, 1984; FINE and HAX, 1985; SAMSON, 1991; HILL, 2000). Recently it has been proposed other extended and up-to-date approach for the operations strategy field, but still working under the business units paradigm (SLACK & LEWIS, 2002) and business units and intra-firm networks paradigm (RUDBERG & OLHAGER, 2003; HAYES et al., 2004). However, nowadays the “new” paradigm of inter-firm networks competition determines the need for studies under a more holistic approach. This paper presents the results of an ongoing field research to verify the validity of the manufacturing strategy theory, which has been developed under a business unit paradigm, under a inter-firm networks perspective. For that, it was necessary to make some adaptations on the existing methodological approaches and theoretical ground for operations strategy, to cope with the specificities presented by inter-firm networks. Under this context, this article presents one methodological approach to extend the scope of two decision areas of operations strategy (vertical integration and facilities) but considering an inter-firm networks perspective. Additionally, the paper presents one example involving a qualitative and exploratory research to illustrate the utility of the proposed approach in an inter-firm network. Preliminary results obtained by the survey suggest the validity of the extended model.*

Key-words: *inter-firm networks, manufacturing strategy*

1. INTRODUCTION

In the 90's, the world competition significantly increased, putting more pressure by flexibility in production and management. That caused to change of the vertical bureaucratic structures for the horizontal company, modifying the previous paradigm, of that, the competition gave between business units. In fact, the real operational unit becomes itself the

business project, enabled by a net. In this context, the manufacturing strategy field evolved and enclosed the broader field of supply networks, as the works of Slack & Lewis (2002) and Rudberg & Olhager (2003) demonstrate. Of this sense, the transformations occurred in markets as the removal of commerce barriers and the implications of the participation in multiple nets has in the company performance, suggest the existence of a inter-firm network in which firms are inserted.

2. MANUFACTURING STRATEGY

The desire to succeed in a market characterized by elevated competition has motivated a growing number of companies to seek strategies in a more effective and creative way. In many companies the more important strategic decisions are taken covering the consumers and the markets in growth without any attempt to include the perspectives of operations and its abilities to support these requirements and generate profits. The first author that identified the absence of connection between the strategies designed by the corporation with the manufacturing function was Skinner (1969). The manufacturing strategy approaches the configuration of the company's productive resources objecting aggregate value for clients.

2.1 Definitions and approaches for manufacturing strategy

The definitions for manufacturing strategy changes according to author's epoch and ideas regarding what constitute an operations strategy. The term operations strategy means that others form of operations was considered. More recently, Slack & Lewis (2002), defined the operations strategy as the total standard of decisions that mold the long term capacities of any kind of operation and their contribution for the general strategy through the reconciliation of the market requirements with the resources of operations. Different approaches for the content and process of operations strategy has been proposed. For the content formulation of an

operations strategy is necessary the studies about two essential elements. Those are: the competitive priorities and the decision areas (infra-structural and structural issues of the operation).

2.3 The competitive priorities and decisions areas

The competitive priorities can be understood as a set of priorities options that the operation has to compete in the market during a certain horizon of time. These competitive priorities were summarized and combined in different forms by diverse authors. For Slack & Lewis (2002) these priorities consist of quality, speed, dependability, flexibility and cost. Authors, as Bolwijn & Kumpe (1990), argues the existence of an other competitive priority, innovation. For this study, the competitive priorities considered are: cost (C), quality (Q), speed (S), flexibility (F), innovation (I) and reliability (R). The questions related to the decision areas also change with different authors. Table 1 presents the perspectives in the decision areas inside an operation strategy.

Table 1- Different perspectives in decision areas (adapted from Leong et al., 1990).

Decision Areas	Hayes et al. (1984, 2004*)	Fine & Hax (1985)	Samson (1991)	Miltenburg (1985)	Skinner (1969)	Hill (2000)	Slack & Lewis (2002)
Structural decisions							
Process technology	√	√	√	√	√	√	√
Capacity	√	√	√	√	√	√	√
Facilities	√	√	√	√	√	√	√
Vertical integration	√		√	√	√	√	√
Infrastructural decisions							
Human resources	√	√	√	√	√	√	√
Organization	√		√	√		√	√
Quality	√	√	√			√	√
Production planning and control	√		√	√	√	√	√
New product development	√*	√	√				
Performance measurement systems	√*			√	√		

Subsequently, will be examined in details the components of these decision areas that has a higher impact in the inter-firm networks project. Following, is proposed an approach for a methodological investigation of the inter-firm networks under the manufacturing strategy perspective.

3. PROPOSAL FOR A METHODOLOGICAL INVESTIGATION APPROACH

To realize an analysis of operations strategy under the extended prism of the networks, is necessary to categorize the networks under the point of view of operations strategy decision areas. Finally, is presented a methodologic investigation approach that was applied to an exploratory and qualitative study of a net. Following, will be discussed the decision areas related to the inter-firm network project. We will analyze in details each one of the particular visions related to the traditional questions of operations strategy, in a broader decision area called “Inter-firm Network Project”.

3.1 Vertical integration

The vertical integration decision area of operations strategy traditionally deals with the question of property between the different stages of the supply chain. This decision is applicable to the inter-firm networks, since the vision can be amplified to not only include stages of supply chain but any companies participants in the inter-firm environment. Accordingly to Hayes & Wheelwright (1984), the vertical strategy of integration of an organization is defined in the direction from the expansion, from the extension demanded by the process and by the balance between the stages vertically integrated.

3.1.1 The Expansion Direction

The direction of the expansion in the supply chain traditionally is divided in upstream and downstream expansion. In the inter-firm networks the expansion direction cannot be utilized in those terms because exist a set of parallel activities that are not summarized as a previous or subsequent stream. Another question is that a member from the network may be participating of more than one network. Hakansson & Snehota (1995) refers to the units of the physical network as having a vertical character and that the units that affect the relation with the consumers as having a horizontal character.

3.1.2 The Extent

The decision of the extent of vertical integration ranges from the property of an operation to all operations along of the network. If a company owns the entire inter-firm network, the extent question dominates the vertical integration decision area, since a company cannot integrate for-wards or back-wards, and neither can the firm balance its relations with others suppliers (Rudberg & Olhager, 2003). The extent of vertical integration can vary between the vertical character, but also can be considered companies that acts in the horizontal character. In case of integration, a company needs to consider also the horizontal and vertical character from the network of which that company does part.

3.1.3 The Balance

The balance in the network part that is possessed by the company is the amount of capacity of each stage in the network which is devoted to supply the next stage. Fully balanced networks have the virtue of simplicity and also permit that each stage has focus in the requirements of the next stage along the network. In the network, the challenge is to create balance between all parts through cooperation. The connections with suppliers are also a

function of its bargain power and are reflected in the suppliers/clients margins. These perceptions related to power, influence the bargain positions that actors feel that can take (Bowman & Ambrosini, 2000). The balance in the networks is related not only with cooperation, but also with the bargain positions exercised by the network actors.

3.2 Facilities

After decide the form of their network operations through vertical integration decisions, an organization should decide location, size and specialization/focus of each operation.

3.2.1 Location

The main difference between location in the traditional operations strategy and location decisions inter-firm networks is that a location of a firm is determined with a high level of control since that is the company who decides where to be located, this enables the company to “optimize” their resources regarding its competitive strategy. In case of inter-firms networks the decisions of location are much more difficult to be taken due to system composition of individual different organizations that cooperate between themselves. The physical network can be changed through the choice of clients/suppliers with which the company wants to establish relationships. If this is not possible, the location has to be had as given (Rudberg & Olhager, 2003).

3.2.2 Size

The traditional interpretation of size is difficult to be employed in the concurrent networks. Accordingly to Rudberg & Olhager (2003) the search for an optimal network size is subject to fail. When size is discussed, is more a form concerned to find a measure for size,

than an optimal size for the network. The network size under the point of view from the inter-firm theory is usually focused in the quantity of nodes in the network (Noteboom, 1999).

3.2.3 Specialization/Focus

At present are used two generic forms of focus by different authors, the product and process focus (Rudberg & Olhager, 2003). The product focus means that the plant is designed to produce a restricted series of products or only one product. The focus in process means that one or more process forms the competence of the plant and that those few process can manufacture a series of products. Rudberg & Olhager (2003) argue that the network focus can be described as an continuum where the two final points are: vertically focused and horizontally focused.

3.3. A proposal of integration between the inter-firm network project and the competitive priorities

As previously discussed, the manufacturing strategy is an attempt to reconcile the requirements of markets with the operations resources. This task is a difficult thing to obtain, due that markets move with frequency (Table 2).

The matrix of integration between the business network project and the competitive priorities propose to be a tool that links the operations strategy to the resources of the inter-firm network (that given its nature of cooperation tend to be a complex task).

Table 2 - Integration matrix between the business network project and the competitive priorities

Decision Areas		Competitive Priorities					
		Cost	Quality	Speed	Flexibility	Inovation	Reliability
Business Network Project	<i>Vertical Integration</i>						
	Direction						
	Suppliers Relationship						
	Extension						
	Balance						
	<i>Facilities</i>						
	Localization						
	Size						
	Specialization / Focus						

In the first column, from the left to the right, of Table 2 are the main questions related the decision area of “inter-firm network project” treated in details in the previous sections. In the last columns are the competitive priorities from the operations strategy. The decisions related to the resources of operations should be analyzed in terms of the effect in the competitive priorities. Following, will be applied the tool of analysis in an exploratory and qualitative research of the inter-firm network project of the Brazilian steel industry sector.

5. CASE STUDY: THE STEEL INDUSTRY AND THE MANUFACTURING PLANT

This section was elaborated based on the primary data collected from the interviews, the comments and notes made during the visits and on secondary data obtained from the reports and documents supplied by the company. Some information contained in the site of the focal company was also considered. As detailed in the research methodology section, and in this paper, the relationship network was mapped from a representative company of the steel industry, which is called focal company or company F. After the elaboration of the research protocol of the case study, a pilot study in an external company of the studied network was

carried out. After this stage, several structuralized interviews with executives and directors of the focal company and related companies were also performed. Later, some non-structuralized interviews were performed and were recorded in micro-cassettes.

5.1 Steel industry

In 2004, the Brazilian output of rough steel was of 32.9 million tons, maintaining Brazil in the eighth position in the world output ranking (IBS, 2004). In 2002, 23% out of the 12 million tons of flat steels produced in Brazil were produced by the focal company. The focal company was founded in the 50's and there were other expansion periods. The company became private in 1993, when the administrative restructuring and the reorganization of the management process started. With the privatization, the focal company became part of a conglomerate, led by another steel company, the matrix company. The group includes steel distribution companies, as well as a metallic structures manufacturer company. The focal company produces steel plates, thick steel plates and hot and cold laminate for the most diverse economic segments. The revenue have tripled in the last five years and reached R\$ 4.5 billion in 2003 (US\$ 2 billion). The exports (41% of the physical sales, in millions of tons), represented the main indicator for the economic performance. The focal company trades their products in all the laminated flat plates segment. The thick steel plates are utilized in diverse sectors of application, as industrial machines, pipes, wagons, boilers, reservoirs, maritime platforms, naval industry and construction. The products had the following participation in the external sales: cold rolled laminate, 19%; thick plates, 13%; hot rolled laminate, 5%; and blanks, 3%. In export, the majority of the customers are trading companies. The trading companies act as intermediates between the effective customer and the focal company. The trading companies look for business and markets for the focal company. The market of thick

steel plates is an important market for the focal company. Around 25% of the output capacity of the focal company is directed to this market. The direct competitor in the domestic thick plate market is the matrix company, showing that in the domestic market there is no strong competition, because the companies belong to the same group. The matrix company and the focal company do not compete, however, in case of thick steel blanks, the competition is direct: the branch office manufactures blanks, stamped and metallic structures. The operational unit of the focal company is located around 70 km from the metropolitan region of São Paulo (the largest market in Latin America). In order to serve the domestic market, the company utilizes the road system and a railway terminal with the capacity of 4 million tons by year. In order to guarantee the export logistics and receive raw materials, the focal company utilizes a private maritime terminal, which can handle 12 million steel tons yearly. The main inputs used in the production by the focal company are the iron ore, coke, coal and iron alloys. There are 5 main iron ore suppliers, all of them located in Brazil. The main coke supplier is a Chinese company, whereas the mineral coal has a supplier in Australia, two in the U.S.A. and one in South Africa. The iron alloy is exclusively supplied by a Brazilian company.

5.2 The production plant for thick steel plate blanks

The initial incentive for the installation of a plant designed to cut steel thick plate blanks was the safeguard 201, which prevented the entrance of steel thick plates into the American market. In 1999, the American government imposed restrictive tariffs on the import practices for thick steel plates, but the blanks (tailored steel parts) of thick steel plates were not included in the restrictive measures. With the American protectionism, the focal company had an incentive to seek alternative markets for its products. The focal company projected the implementation of a plant to manufacture thick steel plate blanks and cold rolled laminate,

aiming at becoming an exporting base. The focal company was not interested in providing customers in the domestic market with blanks, because that would not enable the aggregation of volume with new sales. The branch of the focal company (a distributor) had the function of cutting the cold rolled laminate blanks. For the distributing company, the blanks were high standardized products, at a low volume. The products were drum covers, and 3,000 tons were exported monthly. Those covers were not taxed by the safeguard 201. In addition to this value aggregation, the covers enabled the focal company to serve markets which were out of their range. Then, the initial objective for the installation of a manufacturing plant inside the focal company for the output of blanks was the aggregation of volume with export practices; therefore the domestic market was not interesting, since it would not promote new sales opportunities for thick steel plates. With the installation of the industrial unit of blanks inside its plant, the focal company aims at: satisfaction of end customers by applying cost reduction, enabled by the improved efficiency and the value aggregation to the products supplied; interest in the implementation of new industries (steel consumers) inside the focal company plant; "Get around" the trade tariff barriers in export practices; increase in the variety of products available.

Some companies were already focal company customers, others became customers due to the offer of more customized products. The companies described above are intermediate customers, not end customers. These companies are mentioned, however they are not identified. Some of them belong to more than one network. The main customers of the focal company in the thick steel plate blank market are described below:

Company 1 - Its customers are most of the construction and earthmoving equipment manufacturers in Brazil. The company 1's annual revenue is of approximately US\$ 100 million, 80% from tractor parts sales to manufacturers, and 20% from the trading of others products.

Company 2 - Company 2 manufactures more of 40 models of products, among them retro-diggers, bulldozers, front-loaders, tractors and hydraulic diggers.

Company 3 - Company 3 has as main activities for its products the construction of large infrastructure projects, power plants, highways, railroads, airports, reforestation projects, mining, agriculture and energy generation.

Company 4 - Company 4 is a division of a large American Corporation that has more than 10,000 diesel-electric locomotives operating around the world and has been a leader in the production of diesel-electric locomotives since the 80's.

Company 5 - Company 5 is part of a Spanish group that operates in the industrial, aeronautic and energy sectors. The company 5 possessed their own capacity of technological development and design for manufacturing wind turbines.

The cutting of thick steel plates is a necessary process for blank production. The focal company associated with the companies 1 and 2 and with the steel distributor of the group, as the focal company did not pursue the necessary competences for the service. The focal company concentrates on large sales, however, it is going to be less agile than the required by the market regarding low volume and high variety. The situation of the network relationships of the focal company in the thick steel plate supply chain is represented in the Figure 1. The focal company proposed to company 1 to cut the thick steel plates in "tailored blanks" (pieces cut according to the customer's specification) inside its plant. The problem for the focal company was that the new business would cause the company to face competition in an already existing market, represented by the companies that cut thick steel plates under contract. However, some advantages would enable a better competitive position for all the companies involved in the partnership.

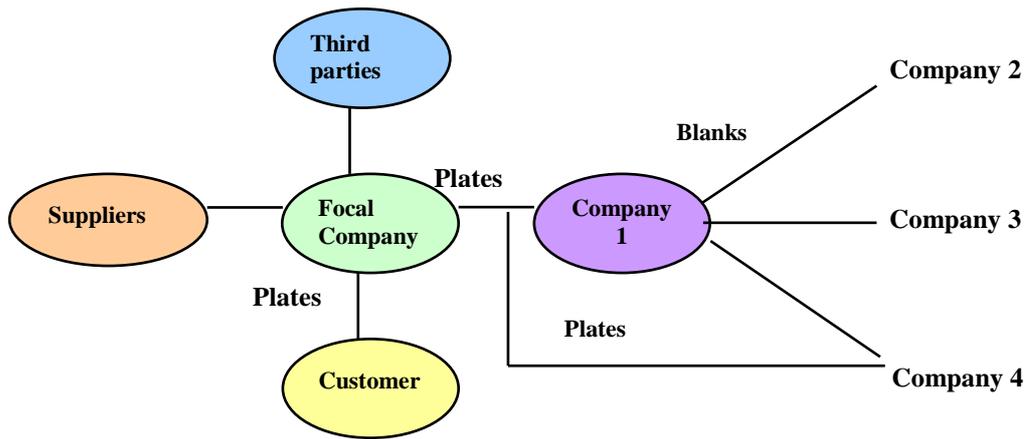


Figure 1 – Business Network of the thick steel plate market (previous situation)

The initial project consisted of an agreement among the focal company and the companies 1 and 2. The project was initially intended to supply blanks to the company 2. The company 4 usually used parts of thick steel plates supplied for company 1. The strategic partnership between the companies promoted the installation of a unit of the company 1 inside the manufacturing plant of the steelworks (focal company). The blanks began to be produced inside the focal company in 2001, and the operations were led by company 1, with equipment that was made available by the company 2. In that plant, the pieces are cut and undergo other operations (as welding and assembly), according to the customers specifications. The waste generated in the process is from the steelworks, as well as the raw material utilized (natural gas and thick plates); the payment to the company 1 is made according to the industrialization service carried out. That partnership allowed for the satisfaction of specific needs of the customers, by producing a new supply network configuration in the steel industry (Figure 2).

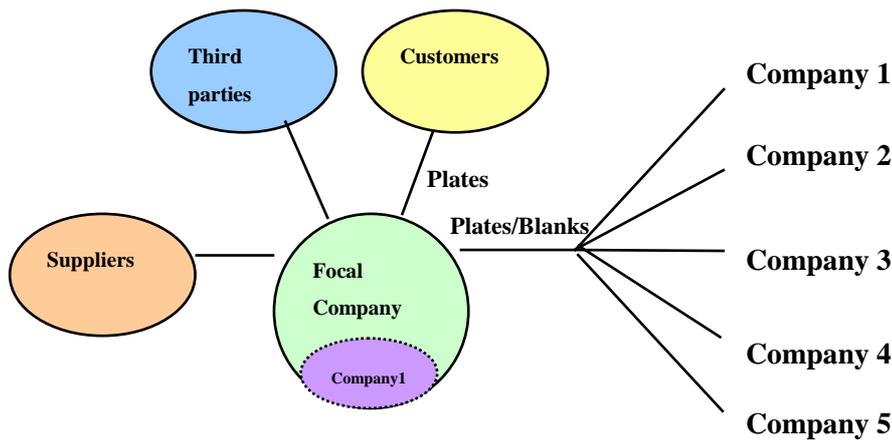


Figure 2 – Business network in the thick steel plate market (current situation).

The configuration change of the supply network for the current configuration enabled the focal company to innovate. The costs were limited by means of the drastic reduction in waste transportation, increase in the cutting efficiency and lower transaction costs. The increase of the perceived value occurred through the customization of products supplied by the focal company, as well as new relationship channels (as the B2B).

However, there are hazards for both partners, as the copy of the model by competitors or the incorporation of the competences of company 1 by the focal company. The ordering of the competitive priorities of those companies can be seen in the table as follow. The client's numbers 4 and 5 passed to be part of the portfolio of both companies after the transformation occurred.

Table 3 – Competitive priorities, order-winners and qualifiers factors of clients.

<i>Company</i>	<i>Products</i>	<i>Competitive priorities</i>	<i>Order Winners</i>	<i>Qualifiers Factors</i>
1	Parts	C, R, F, Q, S, I	C, R, F	Q, S, I
2	Tractors	C, R, F, Q, S, I	C, R, F	Q, S, I
3	Tractors	C, R, F, Q, S, I	C, R, F	Q, S, I
4	Trains	C, Q, R, S, F, I	C, Q	R, S, F, I
5	Wind Mills	C, Q, R, S, F, I	C, Q	R, S, F, I

Following, will be analyzed the standard of decisions taken in this inter-firm network using the matrix of integration from the strategy of operations with the competitive priorities.

6. MAPPING THE INTER-FIRM NETWORK RE-CONFIGURATION

In this section are made an analysis of the inter-firm network project under the perspective of the companies involved. We are analyzing the advantages that were brought by the change in the business network project. Subsequently, we will be analyzing how these changes affected the competitive priorities of the operations strategy and reflect the competitive priorities that the clients valued. As follows, in the Table 4, we will analyze in detail the performances of each one of the competitive priorities that were affected by the decisions taken by the companies involved in the business network.

With the Table 4, we analyze which went the more affected competitive priorities in terms of performance improvement, by the reconfiguration decision of the business network. As we can see, the competitive priorities that had their performances improved by the reconfiguration of the inter-firm network are in decreasing order: cost, flexibility, reliability, quality, speed and innovation. The competitive priorities more important for the companies in this inter-firm network accordingly to the order winner factors in the Table 4 are: cost, reliability, flexibility and quality. The competitive priority cost is maintained in the first place in the requirements of the companies regarding the business network project as well the requirements of the clients companies involved. In case of flexibility and reliability had an inversion, being more valued by the clients the reliability (which is in third place as priority more affected by the reconfiguration). This supposes that the companies that took the decisions of reconfiguration of that network should emphasize that priority (reliability) in

future improvements. Regarding quality, that remains in fourth place in the importance for clients and in terms of performance improvement obtained by the choices made.

Other priorities were fitted as qualifiers factors, therefore an improvement of performance would not signify necessarily an increase in the business. It possible to perceive that the decisions related to reconfiguration of the inter-firm project network analyzed in this article, in a wider sense, reflect the competitive priorities more valued by clients.

Table 4 – Analysis in the matrix of integration between the inter-firm network and the competitive priorities of the decisions toked in the context of the study case.

Decision Areas		Competitive Priorities					
		Cost	Quality	Speed	Flexibility	Inovation	Reliability
Business Network Project	Vertical Integration						
	Direction “Virtual” integration backwards decision	Customers inventory reduction; parts for a lower cost.	Higher quality specifications.	Better availability of plates improve speed.	Increase in product mix; volume flexibility.		Higher raw material control.
	Suppliers relationship Decision to form strategic partnerships	Low cost financing for Parts to invest in capacity.	Specific thick steel plates development for customers.	Logistic infrastructure availability for clients and Parts.		Steel plates production with new material combinations.	Increased the reliability capacity perception
	Extent From thick plates production to cutting	Reduction of the waste transport for recycling		Faster service for requests.			
	Balance Decision to increase capacity balance	Increase in customers number lead to scale economies.			Permits deal with volume variations.		Higher cutting capacity installations.
	Facilities						
	Localization Decision to locate inside the Steel Mill	Low cost labor workforce; logistic infrastructure; raw materials proximity.	Obsolescence cost reduction.		A larger mix availability of steel plates specifications.	Access to tacit knowledge	
	Size Decision to increase the number of organizations involved	Production scale increase.			Improved flexibility; new service access.		Financing access; market opportunities information access.
	Specialization/Focus Decision to increase vertical focus	Efficiency improvement.	Consumers requirements focus.				

7. CONCLUSION

This work analyzed the manufacturing strategy under the perspective of inter-firm networks. In this way, the transformations occurred in markets as the removal of the barriers to commerce and the implications that the participation in multiple nets has in the company's performance, suggest the existence of a inter-firm network in which the firms are inserted. It becomes necessary to develop an approach more structured to obtain a valid description of a net, equating the dynamics nature of the activities and the competitive dimensions involved. For this, each one of the inter-firm networks dimension was categorized and an analysis of the different perspectives under the operations strategy vision. Was suggested subsequently, a proposal of integration of these different perspectives in an empirical study to analyze the restructuring in a inter-firms network. The study showed that the change in the inter-firm network project reflected, in a general sense, the main competitive priorities of clients. The suggestion of new researches pass for the impact analysis that the inter-firm networks has in the performance of individual companies, by the development of strategies for concurrent networks and the perspective that these nets have about the existing theory in supply chain.

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