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**Innovation in Supply Networks: an exploratory study**

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## **Abstract**

The increasing competition in the 90's had placed still more pressure for flexibility in production and management. This took the change of the vertical bureaucratic structures for the horizontal company, modifying the previous paradigm, of that the competition is between business-oriented units. In a competition environment, where the innovation is important, the organizational ability in increasing all the knowledge sources becomes the base of the innovative company. In tuning with this subject, this article revises the literature related with innovation and supply networks and through a qualitative and exploratory study case considers a series of steps to accelerate the innovation efforts of the supply network operations.

Key-words: innovation; supply networks

## **1. Introduction**

The characteristics of organizations operations have been deeply modified in the last years. Those changes were produced by a set of events, among of which are: the globalization, the advanced technological evolution (generally related to information) and the inter-companies network formation (Hayes et al., 2004). The emergence of time based competition and the consequent change of paradigm for the competition in networks is requiring of the researchers a stronger effort regarding an extensive re-evaluation of the corporate strategies and of the manufacturing positioning (Fusco & Gobbo Junior, 2004). This environment has required larger flexibility in the operations of companies, what has caused a change of the vertical bureaucratic structures for the horizontal company, modifying the previous paradigm, when the predominant vision was that to competition gave between business units (Gobbo Junior and Pires, 1997). Of

fact, the real operational unit becomes a project of business enabled by a network. In an environment of competition, where innovation is important, the organizational ability to increase knowledge becomes-itself the base for an innovative company. Therefore, the potential of innovation multiply when the company acts in a network. These transformations offer an opportunity and obligation for that researchers obtain a better comprehension and understanding of its nature. As research objective, this paper proposes to identify the main events in the process of innovation generation in the supply network operations. For this, the article revise the literature related with innovation and supply network and through an exploratory and qualitative case study proposes a tool of analysis for accelerate the efforts of innovation in the supply networks operations.

## **2. Competitiveness and innovation**

Competitiveness can be defined as the ability that the organization have in allocate and administer the scarce resources for growth in the market, or, the capacity to increase in markets share and profits; the capacity of a company to fortify its position in the market (Di Serio, 1998). According to Di Serio (1998), the factors that affect competitiveness for companies are:

- Efficiency: the capacity of the organization to reach their objectives with the best possible benefit cost relation using the available resources;
- Quality: the capacity of the organization of offer a product or service according to the specifications and/or needs determined by clients;
- Time: the capacity of the organization of answer promptly to the new requisites of markets;

- Flexibility: the capacity of the organization to offer a vast range of products and service levels with customization, which answers (inside the limits) the individual needs of each client;
- Innovation: the capacity of the organization to conceive ideas, practices, products/ services that are perceived as new by the market.

In the beginning of the 90's, some academic works identified innovation as being the main determinant factor of the future competitive advantage (see Bolwijn and Kumpe, 1990). The innovation is not a recent factor in the market, but with the exacerbation of competition, companies become to search how to acquire competitive advantages that can be sustainable or temporary. Therefore, the companies are having two choices: can continue to explore wealth from an already existing market, or create a new space of market. The problem is that, generically, any novelty can be considered as an innovation. But in the context of a company, to be considered an innovation should cause a positive impact in the relationship between the company and their clients (Machado and Moraes, 2002). Accordingly to Schumpeter (1955), innovation is represented by the activity of development of an element already invented in a commercially helpful element that is to be accepted in a social system. An innovation can be a new product, a new productive process, new behaviors of market, use of new raw materials or a new form of organization.

Inside this concept we identify three basic characteristics of innovation, which are:

- Novelty: should be new for the organization, for the business branch, for the community or for the market as a whole;
- Concrete nature: necessarily should have been put in practice;

- Utility: should have improved the value perceived by the client when interacts with the company.

Others subsequent developments increased two more types of innovation, the technological innovation and the market innovation (Chandy and Tellis, 1998; Van de Ven, 2000). Accordingly to Foster (1986), when a technology is new, is needed a stronger effort to improve a little the performance of the product. Adapt evolves, and enters in a path where the efforts are rewarded with a stronger increase of performance. And when finally arrives the limit of that technology, is needed once again a larger effort and investment to obtain a small increase of performance. On this basis, is possible to distinguish two basic types of innovation: incremental and radical. When in a determined technology are made improvements that not change the employed technology and that causes a small differential in the perceived value by customer, we have the incremental innovation. Already the radical innovation occurs when in a determined technology, that in the beginning was more expensive and brought lower results, to the previous technology, begins to develop, and passes for a period in that the returns are significant in comparison to the employed effort, equalizing the benefits of the previous technology. Inside the market innovation are the concepts of "value innovation" and the capability to create new "spaces of market" (Kim & Mauborgne, 2005). The value innovation is seen as the capacity to challenge suppositions about strategy and to turn competition irrelevant, instead of compete in established space. The space of market is the process by which companies can generate a new demand. That challenges the corporations to create new markets, instead of worry about the markets in which they already operate. The innovation does not occur only through new technologies/products or by the creation of a new space of market. The innovation can

occur in markets traditionally attended by the company. Hammer (2004) proposes the concept of operational innovation. For the author, with the increasing world competition, one of the forms to gain market share is through smaller prices and by offering extremely highly levels of quality and service. The operational innovation should not be confused with improvement or operational excellence. Improvement refers to obtain high performance through the ways of existing operations, or to be, the obtaining of better performances through the same way of work. Operational innovation, instead, refers to the entirely new ways of configuration of the operation, affecting as the work is done.

### **3. Supply Networks: a conceptual revision**

Historically, the research in operations, have focused in the management of "companies". Lately, the operations management area passed to worry about questions of the relationships between companies (Corrêa, 2003). The spread of the research about supply chain is attributed by some authors to logistics management (GATTORNA and WALTERS, 1996; RUDBERG and OLHAGER, 2003). Usually has been preferred the use of the term Supply Chain Management - SCM (CHRISTOPHER, 1997; GOBBO JUNIOR and PIRES, 1997, BALLOU, 2001; BOWERSOX and CLOSS, 2001; CHOPRA and MEINDL, 2003). Vollmann et al. (1996), define the supply chain as flows in a channel in that are processed raw materials, transforming them in products or services that are delivered to the final consumers. More recently, some authors (SLACK and LEWIS, 2002; CORRÊA and CAON, 2002) began to utilize the term "supply networks". The suppliers network term refers to all the operations, connected for supply products and services for an operation and, to the final consumer. The

authors differentiate the supply chain to the supply network, emphasizing that the network is composed by parallel relationships –operations connections whose intersection is in the focal company – of the different chains that form the network. Vollmann et. al. (1996), proposes the integration of specific competences of the business units and the development of differential competences, with has the aim to offer a product or service to the final customer. Others authors (CHRISTOPHER, 1992; POIRIER and REITER, 1996; VOLLMANN and CORDON, 1996) argue that it is necessary to improve the performance of the productive chain. Accordingly to Vollmann et al. (1996), competition, in the context of the SCM, occurs between productive chains, or, between "virtual business units", a combination of different corporations. The new competitive paradigm is that the supply chains compete among themselves and the success of any company will depend how well this administers his relations in the supply chain. The best practices of SCM can be sights as "virtual" in opposite to the vertical integration. With a series of connected process through different business units, operating as a simple entity, the objective is going to obtain the benefits of the vertical integration avoiding his typical costs. Some authors (VOLLMANN et al., 1996; SLACK et al., 1998; SPEKMAN et al., 1998) summarize the objectives of the SCM in: to focus in the satisfaction of final consumers; maximize the synergies between all the parts of supply chain with the purpose to serve the final consumer, be reducing cost or increasing value; formulate and implement strategies based in the capture and retention.

Several authors (CHRISTOPHER, 1992; JOGGING and ELLRAM, 1993; BIDAULT and BUTLER, 1995; POIRIER and REITER, 1996; DYER, 1996; VOLLMANN et al., 1996; VOLLMANN and CORDON, 1996; COLLINS et al., 1997; SPEKMAN et al.

1998) relate one or more of the following characteristics in companies that carried out activities planning an efficient SCM: Restructure and consolidation of the number of suppliers and clients; Improvement of the flows of information by the use of EDI (Electronic Data Interchange); Full time representatives in the suppliers/customers (in plant representatives); Early participation of suppliers since the first product development phases (Early Supplier Involvement - ESI); Reduction of the logistic costs of transport and storage; Improvements obtained of a collective mapping analysis of the activities.

#### **4. Methodological approach**

For the field and analyses results, was used the methodological approach of qualitative research. To preserve the information's involved in this research, were not identified the companies objects of this study. In the approach of qualitative research, is utilized case study, where, from internal fonts, raised in loco, are raised detailed information about the companies participants of the sample. The size of sample in case studies is always, to a certain arbitrary extent, not object to a statistic, but to an analytic generalization of the conclusions. In case of this work, was opted, arbitrarily by a sample of the companies that composes the supply network analyzed. Initially, was established the choice criteria for the participants of the research, as a supplier network whose operations were modified by innovation. To identify the series of events occurred by in the supply network until the innovation, was utilized the methodology developed by the MIRP - Minnesota Innovation Research Program (Van de Ven, 2000). The MIRP is a research program which objective is to investigate the categories or variables that describe the innovation, the actions taken to encourage innovation and the

forces that influence the development of the innovation. For such design, the MIRP established a model of inquiry based in concepts related to the definition of the "process of innovation". Accordingly to that concept, the process of innovation refers to the sequence of events that occur when persons interact among themselves for develop and implement the innovative ideas inside an institutional context (Van of Ven, 2000). The event represents a change in one or more of the following key concepts: ideas, persons, transactions (or relationships), context and results. Through the systematic mapping of events in elapse of the time seeks to identify the road mapping to arrive the innovation. The focal company delimited the network object of this study. This company is a representative element of the metallurgic sector in Latin America. It was developed a protocol of research, a structured questionnaire based in the existing literature, for guarantee reliability of the research. The objective of the topics as follows is to relate and discuss basic aspects of the process of innovation in the operations of the studied supply network, enabled by the cooperation between the companies participants through three basic phases, that include: A profile of the steel-industry sector and of the companies involved; the description of the previous configuration and the new configuration of the supply network operations; the description of the steps that conduced to innovation in the operations.

## **5. Case study: the steel-industry sector and the plant of thick steel plates blanks**

### **5.1 Steel-industry sector**

In 2004, the Brazilian output of rough steel was of 32,9 millions of tons, maintaining Brazil in the eighth place in the world output (IBS, 2005). In 2002, 23% of the 12

millions tons of flat steels produced in Brazil were produced by the focal company. The focal company was founded in the 50 decade and other phases of expansion happened, and the company went privatized in 1993, when began the administrative restructuration and reorganization of the management process. With the privatization the focal company passed to be part of a conglomerate, lead by another steel-industry 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, hot and cold laminated– for the most diverse economic segments. The revenue tripled 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), was the main responsible for the economic performance. The focal company trades their products in all of the sectors of consumption of laminated flat plates. 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 participations in the external sales: cold rolled laminated, 19%; thick plates, 13%; hot rolled laminated, 5%; and blanks, 3%. In exportation, the majority of the clients are trading companies. The trading companies act as intermediates between the effective client and the focal company. The trading companies prospects 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 market of thick plates is the matrix company, indicating that in the domestic market doesn't have strong competition, because the companies are of the same group. The matrix company and the focal company do not compete, but in case of thick steel blanks, the competition is direct,

with the branch office of the matrix company producing blanks, stamped and metallic structures. The operational unit of the focal company locates around 70 km of the metropolitan region of São Paulo (the largest market in Latin America). To serve the domestic market the company utilizes the road system and a railway terminal with the capacity of 4 millions of tons to the year. To guarantee the logistics of exportations and to receive raw materials, the focal company utilizes a private maritime terminal that can receive boarding's with loading capacity to move 12 millions of steel tons yearly. The main inputs used in the production by the focal company are the iron ore, coke, coal and iron-alloys. They are 5, the main iron ore suppliers, all of them located in Brazil. The main coke supplier is a Chinese company, whereas the mineral coal count with a supplier of Australia, two of U.S.A. and one of South Africa. The iron ore is supplied exclusively by a Brazilian company.

## **5.2 The production plant of thick steel plates blanks**

The initial incentive for the installation of a plant to cut blanks of steel thick plates was the safeguard 201 that reduced the entrance of steel thick plates in the American market; however, did not tax the blanks. In 1999, the American government imposed restrictive tariffs to the importing of thick steel plates, but the blanks (made-to-measure steel parts) of thick steel plates were not included in the restrictive measures. With the protectionism of U.S.A., the focal company had an incentive to seek alternative markets for their products. The focal company projected the implementation of a plant to produce blanks of thick steel plates, and of cold rolled laminated, with the objective to be transformed in an exporting base. The focal company did not have the interest to attend clients in the domestic market with blanks, because that would not enable the

aggregation of volume with new sells. Or happen that, the internal clients would replace the plates by blanks, what would aggregate value, but not volume. And that was the main objective of the focal company: increase the output. The branch of the focal company (a distributor) was attributed the function to cut the blanks of cold rolled laminated. For the company distributor, the blanks were high standardized products and with high volume. The products were covers of drums, with 3 thousand tons exported by month. Those covers also were not taxed by the safeguard 201. Beyond the worthy aggregation, the covers enable the focal company to attend markets that were not reached previously. 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 exportations; therefore there was not interest in the domestic market, since that would not bring new sells of thick plates of steel. There are the following objectives that the focal company pursues with the installation of the industrial unit of blanks inside their plant: satisfaction of clients by the cost reduction to final client, enabled by the improved efficiency and the value aggregation to the products supplied; Interest in the implementation of new industries (consumers of steel) inside the plant of the focal company; "Get around" to trade barriers tariffs in the exportations; Increase in the range of available products.

Some companies already were clients of the focal company, other passed to be in function of the offering of more customized products. The companies that shortly will be described above are intermediate clients, not the final consumers of the products. We refer to these companies without identify-them, being that some of them perform a paper in more of a network. As it follows, will be described the main clients of the focal company in the market of blanks of thick steel plates.

Company 1 - Company has like clients the majority of the construction and earthmoving equipment manufacturers in Brazil. The annual revenue of the company 1 is of approximately US\$ 100 million, in form that 80% originates in the sale of tractor parts to the manufactures, and the remainders 20% in the commercialization of others products.

Company 2 - Company 2 produces more of 40 models of products between retro-diggers, bulldozers, front-loaders, tractors and hydraulic diggers.

Company 3 - Company 3 has as main activities for his products the construction of large infra-structures construction, hydro electrics, highways, railroads and airports, as also, projects of reforestation, mining, agriculture and energy generation.

Company 4 - Company 4 is a division of a large American Corporation that has more than 10.000 locomotives operating around the world and has been leader in the production of diesel-electric locomotives since the 80's.

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

The cut of thick steel plates is a necessary process for the blanks production. The focal company associated to the companies 1 and 2 and to the steel distributor of the group, seen that the focal company did not pursued the necessary competences for the service. The focal company concentrates in sales of high volumes, but, is going to be less agile than that market requires in a low volume and high variety. Being the fact that company 1 is one of the small-scale companies that is pioneering in the utilization of the computerized cut systems, that permitted, with that the domain of that internal process,

obtain advantages regarding the competition. The situation of the network relationships of the focal company in the thick steel plates supply chain is represented in the Figure 1.

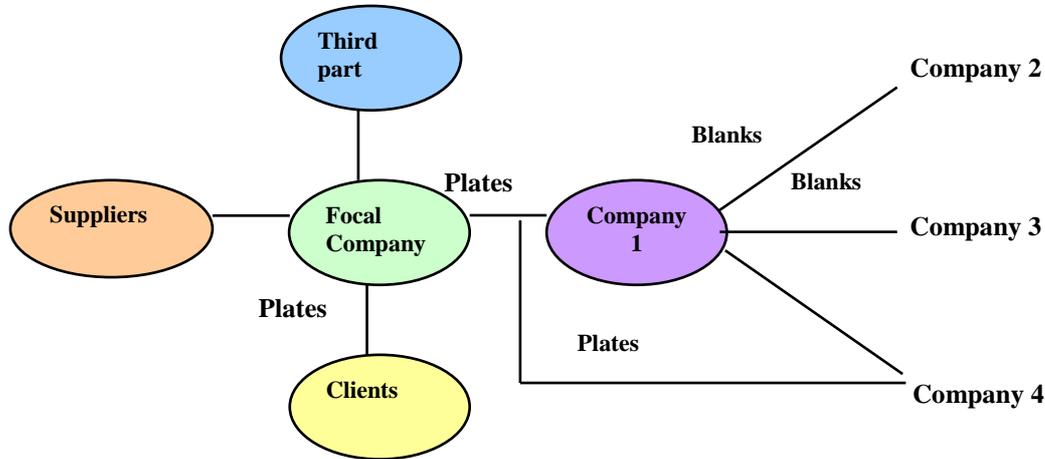


Figure 1 – Business Network of the market of thick plates of steel (previous situation)

The focal company proposed to company 1 cut the plates of thick steel in "tailored blanks" (pieces cut according to the specifications of the clients) inside its plant. That enabled a spin-off, or, that the domain of that competence (part of an internal process of the company 1) transformed itself in a new company.

The problem for the focal company was that that the new business would cause the company to face competition in a market already established, of the companies that cut thick plates do steel under contract. However, some advantages would enable a better competitive position for all the companies involved in the partnership. The motivations in common between the companies for the business model change were: Increase in the number of clients and of markets reached by the companies involved; the economy enabled by the logistics of the business, as the utilization of the waste for recycling in the own factory, enabling reduction of the transport of wastes for recycling, and the

utilization of the logistics structure of the focal company for exportation; the possibility of sharing investments in infrastructure.

The initial project consisted of an agreement between the focal company and the companies 1 and 2. The project initially had the intention 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, installed 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, being the operations driven by the company 1, with equipment that was disposed by the company 2. In that plant, the pieces are cut and receive other operations (as weld and assembly), according to the clients specifications. The waste generated in the process is of 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 service of industrialization performed. That partnership permitted the service of the specific needs of the clients, producing a new configuration of the supply network in the steel-industry sector (Figure 2).

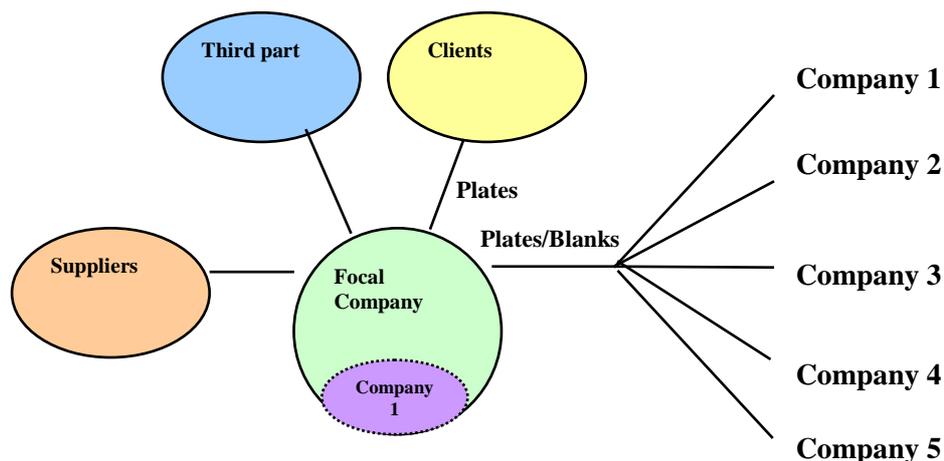


Figure 2 – Business network in the market of thick steel plates (present situation)

The configuration change of the supply network for the present configuration enabled the focal company to innovate. That occurs through the presentation to the market of a new model of network organization, which enabled cost reduction and value improvement, as well as to generate a new demand for the focal company as for the other companies involved. The costs were limited through the drastic reduction of the waste in transport of wastes, increase in the efficiency of cut and smaller costs of transaction. The increase of the perceived value occurred through the customization of products supplied by the focal company, as well as a new relationship channels (as the B2B). However threats exist for both partners, as the copy of the model by competitors or the incorporation of the competences of the company 1 by the focal company.

**6. Analysis of the events that generated the innovation in the supply network operations** Despite of the innovation occurred in the supply network not have been planned, it was the result of a series of events that stimulated the configuration of the innovative operations of the supply network. An event is understood as "changes in ideas, persons involved, transactions, relationships and context; or still results observed to the long of time".

*Ideas:* Not a formal process of submission of ideas exists on the part of the staff members of company 1, but the initial idea started from the direction of the company, through the industrial director and of the son of a majority stock holder. The initial idea of the company 1 spread in a series of new ideas on the part of the focal company and of the others partners, as the utilization of their installations, payment by service, and the sharing of the infrastructure. *Persons involved:* Company 1 has their administration shared by four partners. One of the partners has more specific formation in engineering

while the others had formation in other areas. The entrance of the son of the majority stock holder in the company 1 caused to a vision changes regarding the business of the company. In function of this person to be studying master with emphasis in supply chain enabled to have a differentiated vision of the predominant vision in the company. Given the proximity of that member of staff with the direction of the company, facilitated itself the assimilation of the proposed ideas. The industrial director proposed the ideas to a director of the focal company that proposed some changes.

*Relationships/Transactions:* The relationship between the company 1 and the focal company was closer in the four preceding years of the innovation. The relationship between both the companies has more of 20 years, but due to quality requirements of a large client of the company 1 was necessary to increase the relationship with the focal company that passed to be more integrated. Due to the risk that the new change in the operations would bring, the company 1 and the company 2 acted in a gradual form in the implementation of the planned change so that during a certain horizon of time was maintained the two forms of operations.

*Context:* A financial crisis caused to company 1 to seek new alternative forms of survival. In view of the crisis, the company 1 sought support in the focal company for the implementation of the proposed change. The changes in the political context on the part of the U.S.A., traditional market for the steel of the focal company, caused restrictions in the exports of cold and hot laminated steels, and thick steel plates of the focal company.

The identification of the main elements that generated such events is going to identify a series of phases with the objective to plan the innovation through the application of these elements. That methodological approach does not seek to decide to relation of

dependence between the variables involved in the process of innovation. The objective is to describe the series of steps occurred to guide the efforts of innovation in the operations of other supplier's networks. One of the first steps is the awareness of the high direction of the company that has power in the supply network, of that the innovation in the operations could bring results. After that phase the company that leads the net needs to focus their efforts in activities that manage larger impact in the strategic objective of the company and the supply networks. For avoid that the efforts be scattered, the company that has the power in the network should choose an area for the innovation, seen that many simultaneous programs would be able to scatter resources and the attention of the partners involved in the business. They should map the companies participants of the value chain and the competences of the companies involved. On the basis of that mapping should be identified opportunities of value creation or cost reduction in the assembly of activities that are grouped to deliver products or service to the final clients. After that choose the area in which the company should establish objectives of performance in assembly with the partners in supply network. Without specific goals, would be difficult to obtain disruptive innovations. These goals should be ambitious for the result not became incremental improvements. The steps that were taken by the supply networks studied suggest:

- The choice of external experiences of the supply networks in question. Many techniques applied in other productive chains are able to be revealed of great utility;
- The identification and breaks of restrictive paradigms in the supply networks. To happen an innovation in the operations of the supply networks is necessary to challenge the current supposition, of as work should be driven to the long of the supply network;

- The drawing of the details of as the operation is driven in the supply network helps it consider the several phases of value addition by which the products/service are passing. These phases should be rethought to consider which a configuration design of the operations that will deliver better performance.

Implementation in the conventional sense, of a project of that magnitude is uncertain. Given that the innovation is disruptive is difficult have an accuracy vision of the variables involved. But the companies must be prepared for the consequences of the adoption of the new forms of production organization. A helpful tool is the drawing scenarios. The scenarios are an instrument of the strategic planning. They stimulate the debate and the multilateral vision of the problems and help to identify the objectives and strategies that will be adopted for achieve a desirable situation.

## **7. Conclusion**

The research developed in this article has the objective, to propose a descriptive series of steps of how the innovation evolved to the long of the time in the studied supply network. These steps are based in interviews driven in the companies partnering the supply network. With base in the three main events related to the innovation generated in the net of supplies studied, proposal a grave one of paces for accelerate the trial of innovation in the net of companies. The progression of the innovation in the companies, however, is a very complex process that, in certain moments, goes back and advance. That suggests that the steps are not exhaustive, but has the objective to propose a master line to help the decision-making on the parts involved. The main events that motivated the breakthrough in the existing model of operations are related with: the occurrence of

external shocks in the companies (a crisis, by example); the improvement of the original, so that new idea advancements are proposed; the maintenance, during a certain horizon of time, of the previous structure of operation. The steps proposed to accelerate the efforts of innovation pass for the awareness of the high direction of the companies involved; the focus, on the part of the companies involved, in the activities in that the innovation can generate the greatest impact; the establishment of goals for the actors involved in the innovation. Obviously, the preliminary steps identified are subjects to future revisions and improvements to the extent that to research advance in more studies.

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