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THE INFLUENCE OF THE SUPPLY CHAIN AGENTS ON THE NEW PRODUCT DEVELOPMENT'S PERFORMANCE: an analysis based on the multi-group moderation

Ph.D Dissertation

by

LUCIANO CASTRO DE CARVALHO

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Advisor: Prof. Ely Laureano Paiva, Ph.D

Co-Advisor: Prof. Barbara Bechler Flynn, Ph.D

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Ph.D Examination Committee:

Professor Ely Laureano Paiva, Ph.D (Advisor) – EAESP/FGV

Professor Barbara Bechler Flynn, Ph.D (Co-Advisor) – Indiana University – IUPUI

Professor Luiz Artur Ledur de Brito, Ph.D - EAESP/FGV

Professor Susana Carla Farias Pereira, Ph.D - EAESP/FGV

Professor Rafael Teixeira, Ph.D – UNISINOS

Professor Eliciane Maria da Silva, Ph.D - UNIMEP

DEDICATION

My dedication goes to all those people who, in somehow, contributed to this process of professional and personal growth.

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EPIGRAPH

“It is only through prudent strategic decisions that a firm is able to translate the opportunities into advantages for itself” (Chung, 1991, p. 14)

ABSTRACT

This study aimed to verify the influence of the supply chain agents on the new product development's performance when those agents are analyzed jointly. The motivation for this goal rose up from some studies that claimed for the consideration of the supply chain integration as a multi-dimensional construct, encompassing manufacturing, supplier and customer involvement into NPD; and due to the lack of information about the individual influences of those agents on new product development's performance. Under these considerations, we built an analytical model based on Social Capital and Absorptive Capacity Theory, raising hypotheses from the literature review and connecting constructs as cooperation, supplier involvement into NPD, customer involvement into NPD, manufacturing involvement into NPD, anticipation of new technologies, continuous improvement, NPD's operational performance, NPD's marketing performance and NPD's business performance. To test the hypotheses we also considered three moderating variables, as environmental turbulence (low, medium and high levels), industry (electronics, machinery and transport equipment) and location (American, European and Asian countries). To run the model, we used the data from High Performance Manufacturing (HPM)'s project that covers 339 companies from electronics, machinery and transport equipment industries placed in eleven countries. We tested the hypotheses through confirmatory factor analysis (CFA) including multi-group moderation for the three moderating variables mentioned previously. The main results pointed out that the hypotheses regard to cooperation were confirmed in environments with medium level of turbulence while the hypotheses related to NPD performance was not rejected in electronics and machinery industry, in low levels of environmental turbulence and in Asian countries. Moreover, we found out that, under the same conditions, suppliers, customers and manufacturing influence differently on new product development performance. Thus, supplier involvement influences directly the operational performance and influences indirectly the marketing and business performance in low levels of environmental turbulence, in transport equipment industry and in American and European countries. Likewise, customer involvement influenced directly the operational performance and indirectly the marketing and business performance in medium and high levels of environmental turbulence, in the machinery industry and in Asian countries. Suppliers and customers don't influence directly the marketing and business performance and don't influence indirectly the operational performance. Surprisingly, manufacturing involvement didn't influence any kind of new product development's performance in all scenarios presented.

Keywords: supplier involvement; customer involvement; manufacturing involvement; new product development's performance.

RESUMO

Este estudo buscou verificar a influencia dos agentes da cadeia de suprimentos no desempenho do desenvolvimento de novos produtos quando os agentes são analisados em conjunto. A motivação desta pesquisa veio de estudos que alertaram para a consideração da integração da cadeia de suprimentos como um constructo multidimensional, englobando o envolvimento da manufatura, fornecedores e clientes no desenvolvimento de novos produtos; e devido à falta de informação sobre as influencias individuais destes agentes no desenvolvimento de novos produtos. Sob essas considerações, buscou-se construir um modelo analítico baseado na Teoria do Capital Social e Capacidade Absortiva, construir hipóteses a partir da revisão da literatura e conectar constructos como cooperação, envolvimento do fornecedor no desenvolvimento de novos produtos (DNP), envolvimento do cliente no DNP, envolvimento da manufatura no DNP, antecipação de novas tecnologias, melhoria contínua, desempenho operacional do DNP, desempenho de mercado do NPD e desempenho de negócio do DNP. Para testar as hipóteses foram consideradas três variáveis moderadoras, tais como turbulência ambiental (baixa, média e alta), indústria (eletrônicos, maquinários e equipamentos de transporte) e localização (América, Europa e Ásia). Para testar o modelo foram usados dados do projeto High Performance Manufacturing que contém 339 empresas das indústrias de eletrônicos, maquinários e equipamentos de transporte, localizadas em onze países. As hipóteses foram testadas por meio da Análise Fatorial Confirmatória (AFC) incluindo a moderação muti-grupo para as três variáveis moderadoras mencionadas anteriormente. Os principais resultados apontaram que as hipóteses relacionadas com cooperação foram confirmadas em ambientes de média turbulência, enquanto as hipóteses relacionadas ao desempenho no DNP foram confirmadas em ambientes de baixa turbulência ambiental e em países asiáticos. Adicionalmente, sob as mesmas condições, fornecedores, clientes e manufatura influenciam diferentemente no desempenho de novos produtos. Assim, o envolvimento de fornecedores influencia diretamente no desempenho operacional e indiretamente no desempenho de mercado e de negócio em baixos níveis de turbulência ambiental, na indústria de equipamentos de transporte em países da Americanos e Europeus. De igual forma, o envolvimento do cliente influenciou diretamente no desempenho operacional e indiretamente no desempenho de mercado e do negócio em médio nível de turbulência ambiental, na indústria de maquinários e em países Asiáticos. Fornecedores e clientes não influenciam diretamente no desempenho de mercado e do negócio e não influenciam indiretamente no desempenho operacional. O envolvimento da manufatura não influenciou nenhum tipo de desempenho do desenvolvimento de novos produtos em todos os cenários testados.

Palavras-chave: envolvimento com fornecedor, envolvimento com cliente, envolvimento com a manufatura, desempenho do desenvolvimento de novos produtos.

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LIST OF ABBREVIATIONS

AC	Absorptive Capacity
ANT	Anticipation of new technologies
BSR	Buyer-Supplier Relationship
CI	Continuous Improvement
HBR	Harvard Business Review
IJOPM	International Journal of Operations and Production Management
IJPE	International Journal of Production Economics
IJPR	International Journal of Production Research
IPT	Information Processing Theory
MS	Management Science
MMI	Marketing-Manufacturing Integration
NPD	New Product Development
OS	Organization Science
QFD	Quality Function Deployment
R&D	Research and Development
ROI	Return on Investments
SMJ	Strategic Management Journal
TQM	Total Quality Management
UI	University-Industry interaction

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1 INTRODUCTION

Market orientation has been the focus of many organizational strategies and has been considered as a source of competitive advantage (Filippini, Salmaso, & Tessarolo, 2004; Koufteros, Vonderembse, & Jayaram, 2005). High competition and several changes on customer preferences have been blamed for that organizational choice since they force the manufacturers to work as fast innovators and act proactively at the marketplace (Powell & Grodal, 2005) .

This context seems to be more strained in industries with higher levels of technological changes, wherein the shrinking of a product launch interval (high clockspeed) and the decrease of product life time lead the manufacturers to accelerate their production process (Fine, 2000). Thus, being a fast innovator benefits the manufacturer by keeping its competitiveness and survival at the marketplace, responding rapidly to the market changes and offering products that are suited to the customer's needs (Lambert & Slater, 1999; Rothwell, 1994).

This scenario instigates the manufacturer to decrease the time-to-market (Filippini et al., 2004; Griffin, 1993; Prašnikar & Škerlj, 2006) and to offer products with quality, flexibility, cost and delivery (Feng, Sun, & Zhang, 2010; Handfield, Ragatz, Petersen, & Monczka, 1999; Hongyi, Keung, & Ming, 2010; Koufteros, Vonderembse, & Doll, 2001). In spite of those indexes reflect the manufacturing performance (Ferdows & De Meyer, 1990), a success product also demands customer acceptance, customer satisfaction, increased sales and return on investments (Souder, Buisson, & Garrett, 1997). Thus, new product development's success seems to play an important role in the organizational strategy once it encompasses measures related to marketing, manufacturing and business performance.

Based on these considerations, internal cross-functioning, as manufacturing, design and marketing teams working jointly, was recognized as a tool to optimize the internal process to match market needs with operational capacity (Calantone, Droge, & Vickery, 2002; Pinto, Pinto, & Prescott, 1993; Song & Swink, 2009; Swink & Song, 2007). However, firms have recognized their limitation to reach out such performance due to the environmental turbulence and scarcity of internal resources to perform the activities (Petersen, Handfield, & Ragatz, 2003; Souder, Sherman, & Davies-Cooper, 1998; Van de Ven, 1976b). This scenario

awoke the sense of external dependence and led the manufacturers to involve customers and suppliers into new product development to get the needed resources to outperform (Das, Narasimhan, & Talluri, 2006; Koufteros et al., 2005). While, customer involvement into NPD provides insights from the market that will guide the manufacturer in the product conception (Flynn, Huo, & Zhao, 2010; Gales & Mansour-Cole, 1995; Zhao, Huo, Sun, & Zhao, 2013), supplier's involvement offers components and alternative technologies to make the product conception come true (Ragatz, Handfield, & Scannell, 1997).

Since the late 1970's customer and supplier involvement into NPD has been identified as a resource to enhance the competitiveness (Cooper, 1979), nevertheless only in 1990's that manufacturers started updating their operational practices from vertical to horizontal integration, treating the external agents not only with links in the supply chain, but also partners in the business (Ghoshal & Barlett, 1995; Wisner & Tan, 2000).

Due to the novelty of the topic, few studies were performed considering the influence of such horizontal integration on the performance, and the existing ones provide inconclusive results (Terpend, Tyler, Krause, & Handfield, 2008). It's because the involvement of internal and external agents (supply chain integration) has been treated under different ways. While most of studies have treated supply chain integration as a single construct or tested separately the impact of each supply chain's agent on the performance (Campbell & Cooper, 1999; Haartman, 2013; Jayaram, 2008; Lengnick-Hall, 1996; Ragatz, Handfield, & Petersen, 2002; Svendsen, Haugland, Grønhaug, & Hammervoll, 2011), few studies have considered the supply chain integration as a multidimensional construct (Feng & Wang, 2013; Flynn et al., 2010). Similarly, studies on product development performance have also considered it as one-dimensional construct or tested its performance measures (market, manufacturing and business performance) individually (Filippini et al., 2004; He, Keung Lai, Sun, & Chen, in press; Lau, Tang, & Yam, 2010).

Moreover, there is a lack of studies that considers the mediating factors between supply chain integration and NPD performance (Campbell & Cooper, 1999), as for instance, the manufacturer capacity of acquiring, assimilating and exploiting the information and resources that come from external agents (Haartman, 2013).

Thus, this dissertation seeks for covering a gap in the Operation Management literature by proposing an analytical model to assess the individual influence of agents of supply chain from industries of rapid technological advances (electronics, machinery and

transport equipment) on the new product development's performance. The model starts from the manufacturer willing to cooperate internally and externally, moderated by the environmental uncertainties, industry and location. It also considers the manufacturer capacity to anticipate new technologies and improve its internal process as mediating factors between the supply chain agents and the product performance.

Considering that the manufacturer becomes involved with the supplier and customer to reach out upper performance and that in absence of this involvement the upper performance would not be possible to achieve (Bourdieu, 1980; Coleman, 1988); and that upper performance depends on the manufacturer capacity to acquire, assimilate and exploit the information that come from external agents (Cohen & Levinthal, 1990; Zahra & George, 2002), the model is supported by Social Capital Theory and Absorptive Capacity Theory, respectively.

Empirically, we seek insights offering the effect of supply chain integration on new product development. More specifically, we search to know the influence of each supply chain agent on the product performance to provide more accurate information that will aid in the targeting of investments to the relationship where the returns are more likely to come.

Finally, this study is part of the global project High Performance Manufacturing (HPM) coordinated by Prof. Barbara Bechler Flynn (Indiana University – USA) and Prof. Roger Schroeder (Minnesota University) which aims to evaluate the operational practices in manufactures around the world. This study was funded by Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) in Brazil and by Coordenação de Aperfeiçoamento Pessoal de Nível Superior (CAPES) during the internship in United States of America.

1.1 PROBLEM DISCUSSION

Changes in the economy in the last five years have affected the performance of manufacturers around the world by declining industrial production. Reports provided by World Economic Outlook (WEO) inform that manufacturers have faced this decrease since 2008 and until this far a slight increase on industrial production was noticed. This scenario seems to be worse in countries where there is a growing number of imports that hamper the recovery of local manufacturers (WEO, 2013).

Besides the economic issues, manufacturers from industries of high technological changes, as electronics, machinery and transport equipment, are forced to be constantly updated about the market trends, competitors' approach, customers' needs and new technologies to adjust their internal process to respond proactively to the market expectations and preserve their competitiveness. Therefore, economic crisis and the high competition come up as barriers to be overcome by manufacturers to keep them alive at marketplace.

To face this situation manufacturers have involved internal and external agents, as manufacturing, suppliers and customers, into new product development. The rationality behind this strategy lay on the capacity of supply chain's agents of providing accurate information about the market, new technologies and firm's capacity that, in turn, minimize the uncertainty caused by the environmental turbulence and aid in the design of products that are suited to the customer' needs (Gales & Mansour-Cole, 1995; Hung & Chou, 2013).

Although there is evidence of improvements in the new product development's performance promoted by such involvement, there is a lack of information about the individual contribution of each supply chain's agent when they are evaluated jointly. (Flynn et al., 2010). Moreover, there is no consistent evidence about which index of NPD's performance (manufacturing, marketing and business performance) the involved agents have more influence (Bajaj, Kekre, & Srinivasan, 2004).

Thus, investigating the big picture provides a broader information about the supply chain agents' behavior in new product development's performance that is valuable to managers to support the targeting of investments on areas where are more likely to generate better results. Hence, the proposition of a model to provide such information sounds necessary.

Through the proposition of the model described in the introduction of this dissertation we seek to respond the following research questions:

a) What extend does each supply chain's agent, in fast technological changes' environment, influence on new product development when they are analyzed jointly?
b) What is the direct and ripple influence exerted by supply chain' agents on new product development's performance?

1.2 OBJECTIVES

1.2.1 General Objective

Analyze the influence of supply chain agents on new product development performance when they are analyzed jointly.

1.2.2 Specifics Objectives

a) Verify the relationship between firm's guidance to cooperate and manufacturing, supplier and customer involvement (supply chain integration) into new product development;
b) Verify the influence of the supply chain agents on the anticipation of new technologies and continuous improvement;
c) Verify the influence of anticipation of new technologies and continuous improvement on the new product performance;
d) Verify the direct and indirect effect of the supply chain agents on new product development under the moderation of the environmental turbulence, industry and location;
e) Elucidate the conditions wherein supplier chain agents act differently on new product development's performance.

1.3 BACKGROUND

Results from the supply chain's agents involvement in NPD are still inconclusive since the number of existing studies are not sufficient to establish a solid relationship between supply chain integration and upper performance, even with evidence of mutual benefits among the partners (Frohlich & Westbrook, 2001; Terpend et al., 2008). The existing results reflect a partial view of supply chain integration by considering just an agent of the supply chain (Campbell & Cooper, 1999; Sandmeier, Morrison, & Gassmann, 2010) or the dyad supplier-buyer (Carey, Lawson, & Krause, 2011; Handfield et al., 1999) or yet as a one-dimensional construct.

Hence the proposition of an analytical model based on Operations Strategy to assess the supply chain's agents behave when they are called to integrate into new product development may offer more accurate information about their individuals influences on new product development's performance and the ways to get there. This approach is rooted in the conception that each agent may have different influences on the new product development and in turn, on the performance. In addition, as alerted by Flynn, Huo and Zhao (2010), the misrepresentation of supply chain collaboration, as a single construct or focusing on a single agent, may lead to unreliable results about its influence on the performance.

Because this study is guided by the analysis of manufacturers which belong to fast technological change-industries, with high clock speed and high competition, an analytical model may also be used to evaluate the supply chain's competitiveness. Moreover, such analytical model might provide insights about the manufacturers' behavior around the world, which in turn allows us to identify the level of involvement with supply chain's agents performed in different countries and their impact on performance. Consequently, a rationale of best practices is established, offering both to the surveyed manufacturers and to others manufacturers from same industry the opportunity to compare their cooperation practices with international standards and get practical benefits from the reality in which they are embedded.

2 THEORETICAL FRAMEWORK

This chapter presents the theories, variables under study and hypotheses that will be tested over this dissertation. Thus, while the first section depicts the theories that support the rationale of the study; the second section provides the variables that will operationalize the theories and the argumentation to support the hypothesis construction. Finally, the third section offers the structure that synthesizes the first and second section through the hypotheses definition.

2.1 SUPPORTIVE THEORIES

This topic presents the theories that support this study and clarifies the terminologies related to them. As mentioned previously, we assume that the involvement of agents in the supply chain is characterized by the manufacturer's ability to establish strategically intended-relationships to achieve mutual benefits among partners. In addition, we also posit that the influence of such partners on new product performance is not direct, yet it is mediated by the firm's capacity to acquire, assimilate and exploit the information received from partners. Under these considerations, we understand that Social Capital and Absorptive Capacity are theories that are suited to this context and hence, sustain the model construction.

2.1.1 Social Capital Theory

Social Capital is a topic from sociology field that has been used to support studies from the most diverse disciplines. Despite its origin coming from the eighteenth and nineteenth century, its concept was widely spread in social sciences in the second half of twentieth century (Bankston & Zhou, 2002).

Thus, scholars have pointed out that Social Capital is an old idea connected to previous studies such as *Democracy in America*, performed by Tocqueville, who analyzed the American associative life in 1830. Although this study did not present definitions or contexts that could be used to describe clearly the concept of Social Capital, it provides insights of free association that are considered, somehow, as precursors of Social Capital Theory

(Tocqueville, 1990). Beyond that, a great amount of studies were run by J.S Mill, Toennies, Marx, Durkheim, Weber and Simmel among others, which are also considered as contributors to the growing of the Social Capital Theory (Newton, 1999; Watson & Papamarcos, 2002; Whiteley, 1999)

Due to the volume of solid sociological studies that bases the concept, Social Capital does not belong to the group of buzzwords or trendy concepts of the contemporary literature, but because it recaptures and adapts old insights, it is an invention of tradition (Adam & Roncevic, 2003).

The first mention of the term Social Capital in studies has controversial acceptance among authors, but most of them agree that its very first time was used by Hanifan in 1916, when he aimed explaining how the community participation can help in the enhancement of school performance. The community participation at this point was represented by a set of attributes belonging to the relationship among a group of individuals and families, as goodwill, fellowship, mutual sympathy and social intercourse, which were synthesized by Hanifan as Social Capital (Bankston & Zhou, 2002; Woolcock & Narayan, 2000).

Although the term Social Capital has been coined by Hanifan in 1916, it's noticed that it was not his concern to define or present arguments to create a new terminology or theory. So, the term kept discrete, without expression on sociologic literature until 1980 when it started becoming embodied and get popularity through the studies of three authors that introduced the concept based on distinct contexts.

The first definition of Social Capital is rooted in the Pierre Bourdieu's studies, a French sociologist, who was concerned about understanding the way that the society grows and how the dominant classes hold their position in the social scale. For Bourdieu, the social position is not grounded only on the economic status, but it is also on the cultural knowledge, that in turn, it is used to undergird the people place in the hierarchy. Due to the need to hold the social position, people tend to recognize themselves with those above them in the social scale and prove their dissimilarity from those bellow them using the cultural knowledge as parameter (Bourdieu, 1979, 1985).

Considering both economic and cultural attributes inherent to the way that the social relations happen in the society, the concept of Social Capital came out as a manner to describe how the social effects impact the singular agents. Therefore, Social Capital is defined as a

"*set of resources, effectives or potentials, related to possession of durable networks, in some extent institutionalized, of inter-knowledge and knowledge* (Bourdieu, 1980, p. 2 - translated)".

The amount of Social Capital held by an agent relies on the extent of his networking and the volume of both economic and cultural capital possessed by its partners in the network. Consequently, it is assumed that social networks are not a natural event, but rather the fruit of strategic investments that can be used as a source of benefits (Bourdieu, 1980).

The operationalization of the Social Capital's concept can be exemplified by the creation of a club with the intention of promoting and concentrating on Social Capital to take advantage from the relationships established with other clubs or partners, offering since material to symbolic benefits (as the inclusion in a prestigious and rare club, reputation, status) to its members (Bourdieu, 1980, 1985; Burt, 1992; D'Aveni & Kesner, 1993) . Each member of the club has limits that are equal for all other members and that are controlled internally to minimize the risks of misappropriation of the collective benefits (Bourdieu, 1980). In this sense, it´s implicit that the Bourdieu's definition presents two basics features: the social relationship promotes access of an agent to the collective resources and defines the extent and excellence of those resources (Portes, 1998).

The Social Capital's concept developed for Pierre Bourdieu is considered the most theoretically polished among other concepts developed for contemporary researchers (Portes, 1998), but because it was written in French, his article was not widespread in English-speaking countries and after translated to English, it was published with no expression on texts of sociology of education (Bourdieu, 1985; Portes, 1998).

The second definition of Social Capital was delineated by James Samuel Coleman, an American sociologist, who published studies on sociology of education and public policy. Coleman's definition introduces Social Capital Theory with its origin grounded on criticisms upraised from both sociological and economic view of social action.

According to the sociologists, the social action is a result of the actor´s behavior that is driven by interpersonal trust, social networks, norms, laws and conventions that regulate the society. Under these considerations, the actor is seen as a being without engine of action, socialized and without self-interested actions (Watson & Papamarcos, 2002).

On the other hand, economists believe that the action is derived from the goal of the actor, as wholly self-interested and directed to the maximizing utility. In this sense, the actor has a principle of action and his attitude has a purpose. Due to this view, the Neoclassical Economic Theory has been grounded and the Political Philosophy has grown (Adam & Roncevic, 2003; Watson & Papamarcos, 2002).

The criticisms about both streams were raised by the researchers in their own areas, which lay on the difficulties that one stream has to recognize aspects from the other. In sociology, the main criticism was made by Dennis Wrong (1961) that explicated the misrepresenting of sociologists about the view of man.

> "*Sociological theory originates in the asking of general questions about man and society. The answers lose their meaning if there are elaborated without reference to the questions, as has been the case in much contemporary theory"* (Wrong, 1961, p. 183).

The forgetfulness of the questions that drive the inquiries has led researches to entomb the fundamental assumptions of the sociology and conducted them to a partial or one-side view of reality. This one-side view is related to the over socialized concept of man, that internalizes the society norms and act according to the expectation of others, having the sense of conformity and does not suffer guilt-feelings. Wrong's view differs by considering that socialization is a process of becoming human in which man acquires by interaction features with others. Wrong also ponders that man is not tailor-made, disembodied, conscience-driven and shaped by conventions and rules of his culture (Woolcock & Narayan, 2000; Wrong, 1961).

In economics, in turn, Williamson (1973) attempted to contemplate insights from sociological view in market transactions by submitting that some of factors that explain the market failures can also explain problems of internal organization. It is assumed that some economic organizations' failures are credited to a set of human features that are connected to the transactions factors. The human factors mentioned by Williamson are described as bounded rationality, opportunism and atmosphere, while the transaction factors associated to these features are environment uncertainty, number of traders and information impactedness (D'Aveni & Kesner, 1993; Williamson, 1973).

More specifically, Ben-Porath (1980) endeavored to consider the role of actor's identity in transactions. This approach describes some similarities between market and

nonmarket transactions, as the relationship among members of a family and friends. The family is accepted as a social institution when the rights and obligations are defined and a list of activities that it accommodates is run by members that perform different roles in the contracts (husband-wife, parent-children, etc.), in as much market transactions involve several buyers and suppliers that adopt the replicable family transactions' model. This study's perspective was called F-Connection (families, friends and firms) and was used to demonstrate how the ways of social organization can influence the economic exchange (Weber, 1981).

Later, supported by Williamson's studies, Granovetter (1985) emphasized the critique about the under socialized view of man carried out by economists, but deliberates that both under and over socialization have comparable inconsistencies due to inattention of ongoing structures of social relations and the contempt about the embeddedness of economic actions in these structures. Granovetter's argument considers that most behavior is incorporated in networks of interpersonal relations that support and drive the actions of the man without losing the sense of personal interest. Avoiding extremes, like under and over socialized concept, man is possible having a better understanding about man action (Granovetter, 1985; Tocqueville, 1990).

In 1986, James S. Coleman pointed out the need of a social theory that mixes both streams. Coleman justified his argument questioning why theorist as Max Weber, Alfred Marshal, Vilfredo Pareto and Talcott Parsons used the Theory of Action to ground their studies when, in fact, they were concerned about the macro social phenomena and the functioning of political and economic system (Coleman, 1986). The answer for this question is about the attempt to connect man`s personal intentions with macro social consequences, whereupon the changes in social system could be explained by the actors' purposive actions to achieve their interests that can be influenced by the institutional rules of the socials structures (Newton, 1999).

Based on the need of the new social theory, Coleman (1988) introduces the concept of Social Capital for development of human capital. In this study, Coleman (1988) acknowledges contributions from Ben-Porath and Granovetter, but does not mention Bourdieu, despite his possibility of the term's usage is strictly close to that presented by the French sociologist (Portes, 1998). Thus, Coleman (1988), describes Social Capital as the relation between actors, built according to the actor's goal and the social structure rules that

they belong to, wherein this relation can facilitate some achievements that in its absence cannot be possible (Coleman, 1988). Therefore, Social Capital is considered a resource owing to its capacity to produce results that satisfy the actors' interest that are involved (Watson & Papamarcos, 2002). So, in other words, Social Capital represents a conceptual innovation upon inter and trans disciplines as sociology and economics (Adam & Roncevic, 2003).

Social Capital's concept can be comparable with other terminologies as Physical Capital and Human Capital. While Physical Capital refers to changes in materials to form tools to facilitate the production and Human Capital refers to changes in persons to acquire skills and capabilities to perform activities in new ways, the Social Capital refers to changes in the relations between actors to facilitate the action (Coleman, 1988). Although the Human Capital is considered a requirement to get success, in the absenteeism of Social Capital and the opportunities that come with, its use can be unpractical (Burt, 1997).

Exemplifying, a manager can add value to the firm by his/her abilities of leadership, coordination, capacity of motivating the employees, identifying in the market opportunities that generates returns to the firm and choosing the right person to perform each task, but it's his/her Social Capital that will offer resources to identify who and where are those persons (Burt, 1997).

Although the concept of Social Capital was built as a resource for persons, its application can be used for organizations that work as actors, just like people are, that seek for benefits to improve their outcomes and operational performance; as for example, information sharing between partners companies to develop new products or to fix the prices at the market. Social Capital between partners allows combining different resources that are available in each partner to produce different results for the individual partners (Watson & Papamarcos, 2002).

Social Capital also promotes a sense of obligations and expectations between actors. That sense it's realized when an individual perform something to another individual, generating a future reciprocity, wherein the action performed awakens a sense of expectation in who performed that action and generates a sense of obligation in who got the action (Bourdieu, 1979, 1980, 1985; Watson & Papamarcos, 2002; Weber, 1981). The well-functioning of the relation depends on the high degree of trustworthiness between actors, transparency, information sharing and the existence of norms and effective sanctions to regulate the interest of each member. These attributes are necessary to facilitate the action and

guarantee that this kind of relation will be satisfactory instead of harmful for the actors (Bourdieu, 1979, 1980; Watson & Papamarcos, 2002).

The third definition of Social Capital was presented by Putnam (1993), a political scientist that, inspired by Coleman's studies, expanded the concept of Social Capital to other level of analysis. Putnam highlights that he is not intended to recreate or contribute for the Social Capital Theory' development, instead his concern is prospecting trends in Social Capital starting from insights of social connections and civility (Putnam, 1993, 1995).

Robert Putnam popularized the concept of Social Capital through studies on civic engagement in Italy, which shows that democracy and civic engagement are supported by civil associations and relations of reciprocity (Putnam, 1993). Social organizations supported by civil associations and based on both shared rules and reciprocal trust are expected to present well-performed institutions and a system socially and economically efficient. (Frey, 2003; Putnam, 1993). Therefore, the concept of Social Capital adopted by Putnam refers to the composition of social organizations, as norms, networks and social trust, that makes easier the coordination and cooperation to achieve reciprocal benefits (Nahapiet & Ghoshal, 1998; Putnam, 1993, 1995).

The approach developed for Putnam discusses the notion of value embedded in networks norms and reciprocity. The value is noticeable for individuals that belong to the social networks and, in some extent, demonstrates externalities that affect the collectivism. Hence, the value carried out by social connections brings returns that are both private (for individuals) and public (for groups) (Putnam, 1993). The Putnam's studies focus on public returns derived from social connections, what explains his researches about civic engagement in Italy (Putnam, 1993) and the America's decline social capital (Putnam, 1995).

Moreover, Putnam (1995) distinguishes the types of Social Capital considering the ambiguity of dealing with its conception. For Putnam (1995) the kind of Social Capital that strengths the own group, makes the internal relationships stronger and generates internal loyalty is termed Bonding Social Capital, while the Social Capital that seeks for new ties with people that are out of the group, from different social sector, in order to connect, generate reciprocity and create wide identities is termed Bridging Social Capital (Frey, 2003; Putnam, 1995). This distinguishing does not contribute or increment the Social Capital's concept, but it establishes a new level of analysis that might show different results when it considers attributes that are specifics to each context (internal or external).

To summarize, although the three definitions are considered similar in terms of elements that drive the Social Capital, different level of analysis can be noticed in the main studies upon the topic. At this point, it is worth the comparison among concepts, backgrounds, level of analysis and application in the seminal studies, which are depicted in the Chart 1.

Main Author	Motivation	Definition	Level of Analysis	Type of study	Scope
Pierre Bourdieu (1980), French sociologist.	Concern about how the society grows and how the dominant classes hold their position in the social scale.	Set of resources, effectives or potentials, related to possession of durable networks, in some extent institutionalized, of inter-knowledge and knowledge.	Individual; class faction.	Theoretical	Internal
James Samuel Coleman (1988), American sociologist.	Critique about the over and under socialized concept of man and the searching for a Theory that could encompass both sociological and economic view of man.	The relation between actors built according to the actor's goal and the social structure rules that they belong to, wherein this relation can facilitate some achievements that in its absence cannot be possible.	Family; organization	Empirical	Internal and External
Robert Putnam (1993), American Political Scientist.	Based on James Coleman' studies, Putnam focus on collective returns derived from Social Capital.	Social Capital refers to the composition of social organizations, as norms, networks and social trust, that make easier the coordination and cooperation to achieve reciprocal benefits.	Community; region	Empirical	External

Chart 1 – Traditional Social Capital's definitions
Source: elaborated by the author

By the Chart 1, it's manifest that the reasons that led the Social Capital's concept creation diverge according to authors' intention. While Bourdieu termed Social Capital as a set of attributes that were related to social position, such as cultural knowledge and economic status; and Putnam sought to find out what comes after the Social Capital Theory's creation, as trends and new applications; Coleman was the only one that aimed creating and defining a theory that could put together elements that satisfied both economic and sociological streams. Due to the intention of Coleman and Putnam, their studies had a character more empirical, while Bourdieu's studies had a theoretical one.

Beyond the dissimilarities mentioned previously, there is a difference on the concept's focus that defines the Social Capital. Bourdieu and Putnam define Social Capital as the resources or elements that drive and guarantee a lasting relationship between actors, as norms, rules, trust, cultural knowledge and economic status; and Coleman defends that Social Capital is the relationship, by itself, that works as a resource to obtain collective benefits for the actors involved in the partnership (Bourdieu, 1979, 1980; Newton, 1999; Putnam, 1993, 1995; Watson & Papamarcos, 2002)

The distinctions among authors' perspective enabled the use of Social Capital concept in different contexts, becoming the topic wider and applicable to different levels of analysis. In doing so, the Social Capital concept has been used to support studies in its original areas, such as Economics and Sociology, but also in disciplines as Business that is the major discipline that covers this dissertation.

In business literature, it's possible to identify that Social Capital has worked as a resource that, by interaction with partners, promotes, develops or brings to the firms capabilities or expertise that can place them in a privileged position In the market. In this major area, Burt (1992) was one of the first authors to consider Social Capital as a theory that could explain the relationships within and beyond the firm borders. Firms that look for alternatives trading and remain competitive at the market exploit the social structural holes through the creation of strict relationships with potential partners, which can provide relevant information to lead them to reach out their goals (Burt, 1992)

Later, in Burt (1997), Social Capital was taken as a resource for managers that desire putting in touch otherwise disconnected agents that do the same work. This bridging role generates a power function to the manager, varying according to the number of people that was put in touch. By filling the gap in the social structure, favorable conditions to build the manager's human capital are provided and, in consequence, more rewarding opportunities are generated. This social approach gives access to the information flow that comes from agents from opposite sides, enabling the manager to act early in the market.

From Burt's studies on, others authors exploited the topic to sustain their presumptions and theories. As in Nahapiet & Ghoshal (1998), Social Capital is the mechanism by which others forms of capital happen, for instance, Intellectual Capital. According to the authors, the firms are leaded to cultivate high levels of Social Capital that, in contingence of its density, creates value in terms of production and intellectual capital transfer. Other forms of

capital, as Human Capital, is considered as accruing of Social Capital as well, wherein the membership in a social organizations influence positively the Human Capital's development through the enhancing of generalized cooperation, synergistic relations and social welfare (Christoforou, 2010).

In Operations Management, Social Capital has been taken to substantiate the creation of linkages between individuals, within and outside of firm's borders that promote information sharing and knowledge creation, which in turn drive the firms to upper performance.

Considering intraorganizational linkages, Social Capital has been considered as a tool that supports creative employees in process of ideation by the interaction with fellow individuals that promotes higher-quality ideas (Bjoerk, Di Vincenzo, Magnusson, & Mascia, 2011). The interaction between colleagues to create high-quality ideas is sustained by studies that reveal that the quality of the relationships are more important than the quantity of that which means that interpersonal relations' strength has a higher marginal effect on ideation, intellectual capital and knowledge creation than the number of relations that each individual possesses (Maurer, Bartsch, & Ebers, 2011; McFadyen & Cannella, 2004; Wu & Tsai, 2005). Other study has shown that a dense networks with weak ties among individuals is likely to afford valuable knowledge, even considering the information loss and the cost of knowledge transfer, but the value of dense networks declines as the information loss increases (Bae & Koo, 2008).

In other perspective, Social Capital is associated with turnover rates and its impact on firms' performance as well. Thus, firms that present disruption at networks density by voluntary turnover, as the loss of key employees and all their network, are more likely to lower perform than others that don´t (Dess & Jason, 2001; Jason, Duffy, Johnson, & Lockhart, 2005). On the other hand, employees that have a sense of group orientation and shared trust perform combined tasks that create value for the company and help it to reach out the collective goal (Leana & Buren, 1999).

For managers and entrepreneurs, social skills, face-to-face interaction and high level of Social Capital built on positive reputation can assist them to have access to ventures capitalists, potential customers (Baron & Markman, 2000), influence on investment process decisions (Batjargal & Liu, 2004), assist in new venture internationalization (Prashantham &

Dhanaraj, 2010), increase the firm growth (Bratkovic, Antoncic, & Ruzzier, 2009) and provide competitive advantage (Florin, Lubatkin, & Schulze, 2003).

Moreover, studies suggest that the influence of Social Capital on organization performance is related to the strategic orientation and managers' networks. Thus, firms that have established competitive strategies, as low-cost, differentiation or both together, and Social Capital built on the managerial networks with top managers from others firms, government officials and community leadership, can reach out upper organizational performance (Acquaah, 2007).

In terms of performance, Tsai and Ghoshal (1998) sought to identify relations between the Social Capital's dimensions (structural, relational and cognitive) and the internal functioning of the firm regarding to the product innovation. While relational dimension is associated with trust, identification and obligation; and the cognitive dimension is related to shared ambition, vision and values; the structural dimension refers to the strength and number of ties between actors. Thus, studies have showed that social interaction (structural dimension) and trust (relational dimension) are the most significant attribute that encourage the intrafirm networks, which in turn has a positive effect on product innovation (Tsai & Ghoshal, 1998).

Social Capital Theory is also related to the way that new and existing units get along to exchange resources (Tsai, 2000); organizational citizenship behavior for the enhancing of organizational functioning (Bolino, Turnley, & Bloodgood, 2002; Leana & Pil, 2006), internal networks' contribution for strategic complexity of firms (Houghton, Smith, & Hood, 2009), strategic alliances (Koka & Prescott, 2002), innovation (Tsai & Ghoshal, 1998) and firms performance (Acquaah, 2007; Leana & Pil, 2006; Maurer & Ebers, 2006; Yang, Alejandro, & Boles, 2011).

Looking at a different level of analysis, interorganizational linkages are supported by Social Capital Theory in the buyer-supplier relationship and in others external agents' relationships that provide benefits for all involved in the relationship. The main studies about external linkages mention that the Social Capital enables technical exchanges between partners, brings functional synergy, enhances the supplier and buyer performance (Lawson, Tyler, & Cousins, 2008; Villena, Revilla, & Choi, 2011) and innovation performance (Carey et al., 2011; Perez-Luno, Cabello Medina, Carmona Lavado, & Cuevas Rodriguez, 2011).

Once the relationship between partners is established, the social capital suffers changes along the way due to the relationship maturity. In others words, the social capital dimensions become significantly more interacted through the sharing of vision about goals (cognitive dimension), trust (relational dimension) and social interaction (structural dimension), which get in tune between partners (Hughes & Perrons, 2011). At this level, firms that have scattered networks with strong ties seems to be supreme to foster knowledge transfer via social relations (Bae & Koo, 2008).

In this sense, networks that are geographically close, as in an industrial district, are expected to have upper innovation performance and trustful relationships due to the frequency of social interaction between them (Molina-Morales & Martinez-Fernandez, 2010). The effect of Social Capital on innovation performance can be even boosted when the tacit knowledge is taking account in the social interaction. The knowledge that comes from the work experience is a relevant factor that must be considered in buyer-supplier relationships, but it per se is not enough to guarantee a successful innovation performance. Thus, the combination of tacit knowledge and high levels of Social Capital maximize the social interaction's results by working as antecedent of radical innovations (Perez-Luno et al., 2011).

Although most of studies have demonstrated a positive correlation between Social Capital (buyer-supplier relationships – BSR's) and upper performance, studies alert about the degree of Social Capital that maximizes the profits. In doing so, the BSR's and performance's correlation is meant by an inverted curvilinear, wherein the extremes symbolize that too little and too much Social Capital can lower the performance. It's because the extremes drop the aptitude of an agent of being objective and making effective decisions, while generate opportunistic behavior to the other (Villena et al., 2011).

At country level, Social Capital has been associated with other types of capital and skills to explain the innovation performance and growth. Thus, a study performed with 102 Europeans regions depicts that Social Capital plays an indirect role on the country's growth by fostering innovation that leads to per capita income growth (Akcomak & ter Weel, 2009).

Even though Social Capital is a latent variable derived from a set of attributes inherent to the relationship, its use as a unique index has not demonstrated its explaining power on country innovation when it is measured by patenting intensity and technology-related activities. Thus, Social Capital has been divided into dimensions that present dissimilar effects on innovation, demonstrating that the positive effect of some of them is counteracted

by the negative effect of others. These arguments were supported by statistical analysis, which indicated that social features as civic participation and institutional trust, associated with human capital, have strongest effect on innovation, while norms of civic behavior, the weakest (Dakhli & De Clercq, 2004; Doh & Acs, 2010; Kaasa, 2009).

In terms of theory, Social Capital is related to Absorptive Capacity due to the later is a result of the functioning of earlier. Thus, the firms Absorptive Capacity relies on the firm`s ability to absorb new knowledge from partners of its Social Capital that somehow matches with the firm`s expectations for future benefits. Due to the capacity of the Social Capital in create and accumulate knowledge, the Social Capital is related to the aptitude of fostering the firm`s Absorptive Capacity (Valdaliso, Elola, Aranguren, & Lopez, 2011).

2.1.2 Absorptive Capacity Theory

Absorptive Capacity is a theory from both Strategic Management and Organizational Behavioral field that was begun through Cohen and Levinthal' study in 1990, taking in account researches from a Psychology field related to cognitive structures for learning and the ways that it happens.

According to Psychologists, the learning happens by associative linkages with pre-existing related concepts (cognitive structure) that enhances the memory development and become the new knowledge readily when it is necessary to recall it. In addition, the memory development is self-reinforcing, wherein the more information is stored in the memory, the more readily it becomes and the more facile is its use in new scenerios (Bower & Hilgard, 1981). Hence, the effort dedicated to process the prior knowledge and the deep over exposition on it may guarantee that it is readily in the memory to be used when it is called to associate to the new knowledge (Cohen & Levinthal, 1990).

This statement may be examined in a set of studies from Psychology field that used the same mental model for explaining the learning process based on prior-related knowledge; as for instance the context of learning a language (Lindsay & Norman, 1977), development of learning skills (Ellis, 1965; Estes, 1970), learning mathematics (Ellis, 1965), learning a programming language for computers (Anderson, Farrell, & Sauers, 1984) and development of problem-solving skills (Pirolli & Anderson, 1985).

In Operations Management, the same mental model may be seen in an adoption of new manufacturing practices by firms that have past related experiences, technical skills and an effective communication infrastructure, as they work as a base where the new knowledge is laid up. Thus, as higher is the set of related knowledge possessed by the firm, the higher are the chances of being successful in new manufacturing practices implementation (Boer, Hill, & Krabbendam, 1990; Boynton, Zmud, & Jacobs, 1994).

For all those examples, having a prior related knowledge is crucial to perform a new task or learn something new, becoming possible applying the new knowledge on situations never experienced before. It represents the creativity power of the knowledge adaptation (Cohen & Levinthal, 1990).

Based on these arguments, past experience assumes a decisive influence on the learning process and on the knowledge that will be acquired, since people were exposed to contexts or situations that generated knowledge, that somehow, will be related to the knowledge that will be acquired in future situations (Cohen & Levinthal, 1990; Kogut & Zander, 1992; Zahra & George, 2002). In association, the diversity of knowledge that each person possesses, the organization forms, employees' reward systems and human resource management's practices and policies may also amplify the capacity to absorb new knowledge (Cohen & Levinthal, 1990; Lindsay & Norman, 1977; Nonaka, 1994; Van den Bosch, Volberda, & de Boer, 1999; Volberda, Foss, & Lyles, 2010).

Thus, at organizational level, the Absorptive Capacity presumption emerges from the ability of the firm to acquire new knowledge that, in somewhat, is related to a prior existing one. Prior knowledge works as facilitator to absorb and assimilate new information, since part of acquired knowledge is similar to the existing one and part is completely new (Cohen & Levinthal, 1990; Kogut & Zander, 1992).

In spite of the main Absorptive Capacity's presumption is based on learning new things from prior related knowledge and bearing in mind the people' role in this process, the firm's Absorptive Capacity is not only a sum of people's knowledge or the capacity to acquire or assimilate it, but it is also the ability of using or exploit it. Under such circumstances, the firm's Absorptive Capacity is defined as "*the ability of the firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends"* (Cohen & Levinthal, 1990, p. 128).

This Absorptive Capacity's concept has been widespread and applied in several contexts in the Business literature, but due to the growth of popular areas such as organizational learning, strategic alliances, dynamic capabilities, knowledge management and the resource-based view, scholars have broadened the original concept afforded by Cohen & Levinthal (1990) in order to adjust it to their studies' purpose (Lane, Koka, & Pathak, 2006; Volberda et al., 2010); as for instance in Mowery, Oxley & Silverman (1996) wherein Absorptive Capacity is a set of required abilities to deal with standing tacit component of knowledge transfer and the competences to modify the knowledge to match with the firm's expectations (Mowery, Oxley, & Silverman, 1996) .

In general, scholars who have been devoted to re-conceptualizing and detailing the Absorptive Capacity's definition have kept the core idea, but have introduced new stages and shown its importance to the firm's competitive advantage. (Lane et al., 2006; Van den Bosch et al., 1999; Volberda et al., 2010; Zahra & George, 2002). In addition to the stages implicit in Cohen & Levinthal (1990)'s Absorptive Capacity definition (acquisition, assimilation and exploitation), Zahra & George (2002) have categorized this concept into four stages (knowledge acquisition, assimilation, transformation and exploitation) that are no longer from that presented by Cohen and Levinthal (1990). In this line, Lane et al (2006) have split the Absorptive Capacity into three stages (exploratory learning, transformative learning and exploitative learning), while Todorova and Durisin (2007) split it into four (recognition, acquisition, assimilation or transformation and exploitation).

After Cohen & Levinthal (1990)' study, Zahra & George (2002)' study is among the most cited articles when the topic is related to Absorptive Capacity. It's owed to their proposal of detailing the original concept and analyze it under the dynamic capabilities' view. According to the authors, the dynamic capability's interpretation provides understandings about the firm's resources adaptation in view of changes at market, with the aim of reaching out the competitive advantage (Zahra & George, 2002). Hence, for Zahra & George (2002), Absorptive Capacity is "*a dynamic capability pertaining to knowledge creation and utilization that enhances a firm's ability to gain and sustain a competitive advantage* (Zahra & George,2002; p. 185).

Tordova & Durisin (2007) in turn, disagree in some aspects from the Zahra & George (2002)'s perspective by reintroducing the recognition of the value of new knowledge, proposed by Cohen & Levinthal (1990), as a dimension or stage before the acquisition of new

knowledge (Todorova & Durisin, 2007). According to the authors, a firm cannot acquire new knowledge without discussing the needed cognitive structures of individuals and organizations that will receive the new knowledge. In others words, the essential prior related knowledge must be available on those structures in order to evaluate the new knowledge and optimize the gains derived from it (Todorova & Durisin, 2007).

Surely, Zahra and George (2002) didn´t consider the recognition of new knowledge's value as one of the stages of Absorptive Capacity, but for them, just like prior-related knowledge, past experiences and trigger activation (event that motivates the company to look for new knowledge), the recognition of new knowledge's value comes before the Absorptive Capacity's process starts. This is akin to say that instead of being considered as Absorptive Capacity's stages, all those elements work as an antecedent that will incite the beginning of Absorptive Capacity (Zahra & George, 2002).

Even with some disagreements or critiques between authors which strove to re-conceptualize or rejuvenate the Absorptive Capacity's concept, most of them agree that the stages that leads the company to upper performance is not far from what was suggested by Cohen & Levinthal (1990). Thus, the Absorptive Capacity's first stage, the knowledge acquisition, is related to the firm's competence to recognize and obtain outside of its boundaries, from external linkages derived from its Social Capital, the needed knowledge that match with its expectations. It is also a function of the speed and intensity of firm's struggle to gather the demanded knowledge and take the company to the competitive advantage, in which the faster and deeper is the firm's struggle to get the new knowledge, the greater is the quality of competences that will aid in the building of the Absorptive Capacity (Yli-Renko, Autio, & Sapienza, 2001; Zahra & George, 2002).

Understanding the Absorptive Capacity as a source of knowledge, the close relationship with consumers (Szulanski, 1996; von Hippel, 1978), buyers, suppliers (Dyer & Singh, 1998; Petersen, Handfield, & Ragatz, 2005a; Szulanski, 1996; von Hippel, 1988), partners in strategic alliance (Hult, Ketchen, & Arrfelt, 2007; Mowery et al., 1996; Vasudeva & Anand, 2011) and clusters (Valdaliso et al., 2011), have been considered essential for the companies' awareness about the capabilities that others possess and, in turn, for the discovery of the specific knowledge that will support the activities for a new exploitation or potential innovation.

Thus, the knowledge transfer performance gains importance to those firms which desire increase their Absorptive Capacity and reach out their goals, since the kind of relationship that is established between partners may affect the knowledge transfer performance and the type of knowledge that will be transferred. In the case of equity-based alliances, for instance, the tacit knowledge may be easier to be transferred than between partners that have established contract-based alliance, which are abler to transfer the explicit knowledge. The difference between the types of knowledge transferred in those alliances is a function of the trust level that partners possess on each other, wherein the higher is the trust level between partners, the deeper is the knowledge transferred between them (Chen, 2004).

Likewise, firms that keep connected to University's labs, wide scientific community and make use of publication in the open literature as sources of promotion and ideation have demonstrated highest levels of Absorptive Capacity and are significantly more productive than the others that don´t do (Bishop, D'Este, & Neely, 2011; Henderson & Cockburn, 1994; Szulanski, 1996).

In addition, recent studies have shown that the higher is the firm's Absorptive Capacity, the higher is the interaction between University-Industry (UI), that in turn potentiate the knowledge transfer between partners, mainly when common resources are utilized in this process. Thus, UI interaction plays a mediating role between the firm's Absorptive Capacity and knowledge transfer performance when there is resources' alignment between partners (Tsai & Wu, 2011).

The fact that the knowledge may come from several sources does not no guarantee that the knowledge transfer will happen successfully. To analyze this relation, studies have elucidated that the cultural differences may influence the knowledge transfer performance in multinationals corporations. However, there is no consensus between the scholars if the cultural differences, measured by organizational values, collaboration, legal systems, national cultures and regulatory hurdles, have a positive or negative effect on the knowledge transfer. It means that its analyze is complex and more accurate studies must be run to enlighten the real influence of the cultural difference on knowledge acquisition (Bjorkman, Stahl, & Vaara, 2007; Olie, 1994; Shimizu, Hitt, Vaidyanath, & Pisano, 2004; Vaara, 2002).

After the knowledge acquisition's stage, comes the stage that is represented by the company's ability to process, interpret and analyze the new acquired knowledge based on prior-related knowledge. The assimilation of new knowledge leads the company to update its

cognitive structure to understand new contexts and decide the best strategy and skills to deal with them (Todorova & Durisin, 2007; Zahra & George, 2002).

The assimilation stage may be symbolized by the identification of an individual that works as a gatekeeper, who stands at firm boundary and/or makes interface between subunits within the firm in order to spread and transfer information to staff. Firms that invest on gatekeeper's development stimulate the information exchange between individuals and are more likely to outperform than companies that don´t target investments for that (Henderson & Cockburn, 1994; von Hippel, 1988). Nonetheless, the Absorptive Capacity of firm is not only constituted by the Absorptive Capacity of the gatekeeper, but it is also the staff's capability to absorb and exploit the information transmitted by the gatekeeper (Cohen & Levinthal, 1990).

Likewise, Cohen and Levinthal (1990) considered the role of Research and Development (R&D) to transfer knowledge and support the firm's assimilation, since it works as a knowledge multiplier within the firm. According to the authors, the assimilation process happens when the captured information is processed and adapted by R&D in order to be appreciated by managers and employees that will use it. The more similar the information captured from external environment to the firm's prior related knowledge, the less the importance of the R&D in the firm's assimilation (Lane & Lubatkin, 1998). Therefore, R&D/gatekeeper performs a critical role in firm's learning process when the sort of information afforded by external linkages is far from the firm's prior related knowledge or when it is difficult to be learned by internal staff. In short, R&D/gatekeeper will work on the acquired information to convert it into a clear and understandable language for internal staff, that in turn, enhances the firm's Absorptive Capacity (Cohen & Levinthal, 1990; Volberda et al., 2010).

Once the R&D is related to the firm's Absorptive Capacity, investments on R&D may potentiate the extent of assimilation and exploitation of the acquired knowledge that reflects on the firm's capacity to act proactively, exploit market opportunities and assist the company in its strategic planning (Cohen & Levinthal, 1990; Volberda et al., 2010).

Otherwise, the lack of investments on R&D, and consequently on Absorptive Capacity, may lead the company to obsolescence as regards to technological skills, product development and innovation. Since the company is focused only in the operation of technological domain, it becomes less competitive at the market and even with late investments on R&D, the new ideas from market may be too distant from the firm's prior-

related knowledge that the firm's competitive position gets hard to get back on. So, no investment on R&D is seen as an organizational behavior of neglect the ideas that come from external environments, leading the company to assume a reactive posture against the competitors' strategy (Cohen & Levinthal, 1990).

Under other perspective, the assimilation process may be influenced by mechanisms that are inherent to the relational context, such in customer-supplier dyad. According to Knoppen, Sáenz and Johnston (2011), the structural mechanism (social integration and the ways that the knowledge is acquired) to support the assimilation and consecutively the Absorptive Capacity is reliant on cultural (norms, rules and how the firm approaches its partners), policy (how the managers will handle with the inter and intra-organizational learning process) and psychological (how the involved individuals will act during the assimilation process) mechanisms that assume different intensities according to the kind of relationship that is established between partners and the kind of knowledge that's acquired (Knoppen, Saenz, & Johnston, 2011). In this line, firms that establish a supplier-customer relationship towards to product development tend to be more interactive, demanding trust and good interpersonal relationship to cooperate than firms that are in touch just to update their market knowledge (Fang, Palmatier, Scheer, & Li, 2008; Johnston, McCutcheon, Stuart, & Kerwood, 2004).

In terms of knowledge spreading between employees and units within the company to facilitate the staff's assimilation, a set of variables has been considered critical to get efficiency in this process. Studies have depicted that, contrary to conventional wisdom that blames the lack of motivation from both sides (source and recipient) as the main barrier to transfer the knowledge, the recipient's lack of absorptive capacity, causal ambiguity and arduous relationship between the source and the recipient have negative influence on the knowledge assimilation (Szulanski, 1996).

Under other perspective, a central position in the internal network is considered beneficial for the organizational units/employees by having access to the new knowledge produced by other units (Tsai, 2001). In this line, the organization' social context and the ways that units and employees interact between them may affect positively the assimilation once the employees are involved in the transformation of the knowledge (Dhanaraj, Lyles, Steensma, & Tihanyi, 2004; Hotho, Becker-Ritterspach, & Saka-Helmhout, 2012; Kogut &

Zander, 1992; Lenox & King, 2004; Tsai, 2001; Vega-Jurado, Gutierrez-Gracia, & Fernandez-de-Lucio, 2008).

In the assimilation process, managers can also contribute to the assimilation by providing managerial information to agents, units or employees (recipients) that might potentially adopt the new knowledge in their new practices. However, even with the managerial contribution, the assimilation process is dependent on the past experiences and the extend of information acquired from other sources by the recipient. The greater the agent's information from others sources, the lesser the managerial information provision's effectiveness; and the greater the agents' past experience, the greater the managerial information provision's effectiveness (Lenox & King, 2004).

Yet at this stage, the firm is able to use the new knowledge to solve new and unexpected problems or act on new markets opportunities, inefficiently in the beginning, featuring the knowledge's ramp-up. The use and reuse the new knowledge, facilitate the integration of it on the company's routine that consecutively become skills, abilities and practices institutionalized that lose progressively their novelty and convert it into part of the goal (Szulanski, 1996; Todorova & Durisin, 2007; Zahra & George, 2002).

Last, the exploitation stage refers both to the application of knowledge and the adapted routines to obtain competitive advantage at market or to approach the new opportunities. In other words, the exploitation stage is related to the use of both existing and new knowledge for commercial ends (Cohen & Levinthal, 1990; Kogut & Zander, 1992; Zahra & George, 2002). The exploitation stage may also be associated with the company's innovative process since the acquired knowledge serves as a platform that enables the company to innovate and satisfy the market requirements (Van den Bosch et al., 1999).

Considering that the exploitation of knowledge can be converted into technologies, services or products that will be used for commercial ends, the indication of this stage underpins the idea of the reification of Absorptive Capacity proposed by Lane, Koka & Pathak (2006). The reification is allied to the course of give contour to the knowledge by producing objects that solidify this knowledge, as the tangible results coming from the abstract concept of work (Lane et al., 2006; Lukacs, 1971; Wenger, 1998). Further, the solidification of the Absorptive Capacity aids the learning since it happens primarily in practice, that consecutively will feedback the earlier stages of Absorptive Capacity through insights about the refining of the acquired knowledge and routines (Lane et al., 2006). In

general, the results derived from Absorptive Capacity's firm is operationalized at the exploitation stage by innovations that drive the firm to upper performance, as for instance the new product development (Abecassis-Moedas & Ben Mahmoud-Jouini, 2008; Newey & Verreynne, 2011).

Following those stages that are implicit on Cohen & Levinthal (1990)'s concept, the Absorptive Capacity may also be represented by the combination of terminologies that drive the Operations Managements' studies. In Henderson & Cockburn (1994), although Cohen & Levinthal (1990) were not cited and the term Absorptive Capacity was not mentioned, the definition of Absorptive Capacity can be identified by the composition of terminologies that represent the three Absorptive Capacity's stages, such as Component Competences and Architectural Competence. While Component Competences is related to new knowledge, tacit knowledge, skills and abilities that are crucial to the company functioning; Architectural Competence is targeted to the strategies to exploit the Component Competence (Henderson & Cockburn, 1994).

Thus, by the unfolding of the Absorptive Capacity into two components it is possible to recognize in the literature others terms that are similar to what was proposed by Henderson & Cockburn (1994). A list of those terms is depicted on Chart 6.

Acquisition	(+)	Assimilation and Exploitation	(=)	Absorptive Capacity
Component Competence (Henderson & Cockburn, 1994); Resources (Amit & Schoemaker, 1993); Knowledge and skills (Leonard-Barton, 1992; Teece, Pisano, & Shuen, 1997) Technical System (Leonard-Barton, 1992; Teece et al., 1997) Potential Capacities (Lev, Fiegenbaum, & Shoham, 2009; Zahra & George, 2002) External Capabilities (Lewin, Massini, & Peeters, 2011)	+	Architectural Competence (Henderson & Cockburn, 1994); Capabilities (Amit & Schoemaker, 1993); Integrative Capabilities (Lawrence & Lorsch, 1967); Dynamic Capabilities (Teece et al., 1997); Organizational Structure (Nelson, 1991); Combinative Capabilities (Kogut & Zander, 1992); Managerial Systems (Leonard-Barton, 1992); Invisible Assets (Itami & Roehl, 1987). Realized Capacities (Lev et al., 2009; Zahra & George, 2002) Internal Capabilities (Lewin et al., 2011)	=	Absorptive Capacity

Chart 2 - Absorptive Capacity's Components
Source: Adapted from Henderson & Cockburn (1994)'s review

According to the Chart 6, some of the listed studies were written before the Absorptive Capacity's theory was built, and in spite of that, they were not considered by Cohen & Levinthal (1990) as inspiration for the Absorptive Capacity theory's building. Ceteris paribus, some studies that came after the theory building did not cite the Absorptive Capacity as a theory.

Regardless the terminologies used in the studies to express the Absorptive Capacity's idea and based on studies where the firm's Absorptive Capacity was the central core, the use of the construct have been applied as an exogenous variable to explain changes in the firm's innovativeness (Cepeda-Carrion, Cegarra-Navarro, & Jimenez-Jimenez, 2012), to achieve superior innovation (Kostopoulos, Papalexandris, Papachroni, & Ioannou, 2011; Tseng, Pai, & Hung, 2011; Wang & Han, 2011), to facilitate the search for innovation (Fabrizio, 2009), to facilitate the open innovation (Hughes & Wareham, 2010; Lichtenthaler & Lichtenthaler,

2009; Pedrosa, Valling, & Boyd, 2013; Spithoven, Clarysse, & Knockaert, 2010) and to determine the innovation strategy (Gebauer, Worch, & Truffer, 2012).

Studies on Absorptive Capacity are also related to prediction of adoption of multiple process technologies (del Carmen Haro-Dominguez, Arias-Aranda, Javier Llorens-Montes, & Ruiz Moreno, 2007; Gomez & Vargas, 2009), explanation of interfirm divergences in benefiting from external knowledge (Lichtenthaler, 2009; Ritala & Hurmelinna-Laukkanen, 2013) and to enhancements of the manufacturing flexibility (Patel, Terjesen, & Li, 2012).

Because of the wide usage of the Absorptive Capacity concept in several areas, the broadening of its definition and the lack of clear understanding of the complexity that involves the construct, there is a shortage of studies that have dedicated to measure it. For a long time the few studies that worked on Absorptive Capacity measure have operationalized it as R&D intensity (Cohen & Levinthal, 1990; Mowery et al., 1996; Stock, Greis, & Fischer, 2001; Tsai, 2001), number of patents (Ahuja & Katila, 2001; Mowery et al., 1996), number of academic publications (Cockburn & Henderson, 1998), level of education of employees involved in R&D activities and full-time staff at R&D department (Muscio, 2007). Due to this gap in the literature and the reductionist view given to the Absorptive Capacity's measure, Tu, Vonderembse, Ragu-Nathan and Sharkey (2006) developed scales that represent each stage contained in the Absorptive Capacity concept, encompassing the complexities embedded in the original definition (Tu, Vonderembse, Ragu-Nathan, & Sharkey, 2006).

The scales were defined as Knowledge Scanning (recognition of new and valuables knowledge that stand outside of firm's boundaries); Worker knowledge and Manager Knowledge (previous related knowledge that each one possess); Communication Climate (employees willingness to learn something new, feelings about belonging to the firm, trust on each other and freedom to express ideas) and communication network (employees interaction, communication between managers and employees, communication between internal units or departments)(Tu et al., 2006).

Tu et al (2006)'s study brought a contribution for the Absorptive Capacity literature, mainly with respect to measures development. However, their intention to encompass the complexities involved in the Absorptive Capacity definition still missing the stage that represents the embodiment of the process: the exploitation stage. According to Cohen and Levinthal (1990), Absorptive Capacity is not only the firm's capacity to transfer and

assimilate knowledge, it's also its potential to exploit it for commercial ends (Cohen & Levinthal, 1990).

Later, Absorptive Capacity was measured by four scales, such as knowledge acquisition, assimilation, transformation and exploitation, wherein the first two scales were grouped in Potential Absorptive Capacity and the last two in Realized Absorptive Capacity, following what was proposed by Zhara and George (2002) (Camison & Fores, 2010; Magdalena Jimenez-Barrionuevo, Garcia-Morales, & Miguel Molina, 2011). Thus, as well as the number of stages that define the Absorptive Capacity, there is no consensus between authors about a measure instrument that may be applied and represent the complexity of the construct.

In terms of theories, besides the Social Capital, the Absorptive Capacity is also related to theories that span learning, innovation, managerial cognition and knowledge-based view, such as Dynamic Capabilities Theory (Barney, 1991; Eisenhardt & Martin, 2000; Teece et al., 1997), Information Processing Theory (Miller, 1956), Transactive Memory Theory (Wegner, 1987) and Organizational Information Processing Theory (Galbraith, 1973, 1974). This multi-connection with others theories has taken the scholars to develop new approaches to understand the phenomena under different points of views, contributing for the bridging between areas (Volberda et al., 2010).

2.2 OPERATIONAL VARIABLES

This topic refers to the operationalization of the theories described in the section 2.1. Thus, Social Capital Theory was associated with the manufacturer orientation to cooperate and with supplier, customer and manufacturing involvement into new product development (NPD)'s. Likewise, Absorptive Capacity Theory was represented by anticipation of new technologies as a source of knowledge, continuous improvement as a process of constant learning and assimilation, and the new product development's performance as the results of exploitation.

The literature review is based on Operations Management studies which support the argumentation that creates the relationship between those variables. From the argumentation, hypotheses were raised and presented in the section 2.3.

2.2.1 Cooperation towards to Manufacturing, Suppliers and Customers' involvement into New Product Development (NPD)

Competitive advantage at the marketplace has been taken as the main goal of organizations. To reach out this goal the development of products that look better than those produced by competitors and possess value exceeding upon the product's cost is needed (Ruekert & Walker, 1987).

However, some necessary resources to design a potential successful product may not in the design team's possess or inside the firms boundaries. This context seems to be aggravated in environments of swift technological change, where the research breakthroughs are out of the organization domains. For this, the internal and external cooperation, under tolerable levels of hazards, may be the swiftest way to update the organization skills to produce a competitive product and get upper performance (Powell, Koput, & Smith-Doerr, 1996), inasmuch as the consumer loyalty may be won or lost according to the product availability (Mason-Jones & Towill, 1997).

Thus, besides Social Capital Theory, cooperation has a great background on Information Processing Theory (IPT) due to the acknowledgement that companies which have an efficient system of gathering and processing information are more prepared to act on uncertainties. Uncertainty, in turn, represents the gap between the amount of information possessed by the organization and the needed information to perform the tasks (Daft & Lengel, 1986; Tushman & Nadler, 1978).

Frohlich and Westbrook (2001) support the cooperative relationship by considering that successful manufacturers are able to integrate their internal process with both suppliers and consumers to obtain improvements on performance. The authors provide evidence that the greater the supplier and consumer cooperation into new product development, the greater the marketing, operational and business performance (Frohlich & Westbrook, 2001). Reinforcing the Frolich and Westerbrook (1991)'s study, Schoenherr and Swink (2012) found out that high levels of internal integration in manufacturers moderate the effects of customer and supplier integration on both delivery and flexibility performance (Schoenherr & Swink, 2012). Hence, members of the cooperation must work flawlessly together in order to respond quickly the consumers demand and maximize the competitive advantage (Towill, 1997).

In the literature several terminologies are used to describe the cooperation between partners. Among the terminologies are collaboration (Dyer, 1997; Kesting, Mueller, Jorgensen, & Ulhoi, 2011), coordination (Majumder & Srinivasan, 2006), interface (Chen, Calantone, & Chung, 1992), collaborative competences (Mishra & Shah, 2009) and supply chain integration (Flynn et al., 2010; Frohlich & Westbrook, 2001; Schoenherr & Swink, 2012).

In general, there are two reasons that incite the organizations to get into cooperation. The first is related to scarcity of resources to perform the activities, and the second is associated with the exploration of an external opportunity (Van de Ven, 1976b). The former is a byproduct of internal planning, generally related to the project or product development (Pinto et al., 1993) and the latter is a result of external planning that is more correlated with priorities' changes (Van de Ven, 1976b). Both reasons motivate the organizations to cooperate with each other given the recognition of interdependency between them (Das et al., 2006).

Thus, cooperation has been a recurrent topic at decision making's table of organizations which strive for innovations that can lead them to competitive advantage (Jap, 1999). Due to its importance to the firms, cooperation has been assuming the most diverse levels of complexity, ranging from a relatively simple research between firm's R&D to joint ventures to collaborative manufacturing (Powell et al., 1996).

Basically, cooperation happens when two or more organizations or departments transact resources, strive to attain collective and self-interest goals and divide task and functions among members (Borys & Jemison, 1989; Pinto et al., 1993; Swink & Song, 2007). When the relationship is established, a social action system is created, that's imbued of structures and process that regulate the transactions, defining each one's role in the cooperation and directing the flow of activities that will be performed (Tomes, Armstrong, & Clark, 1996; Van de Ven, 1976a, b).

Those structures are represented by five dimensions: formalization, centralization, complexity, process and ends. All of them are related to the policies and procedures that drive the relationship, as the level of individual's decision making in the cooperation, his/her position in the network, the number of members involved in the cooperation, the flow of resources and information that transit between members and the perceived effectiveness of the cooperation (Pinto et al., 1993; Van de Ven, 1976a, b).

Once the ultimatum of organizations that are involved in cooperation is reaching out the individual goals that somehow is related to the strategy to obtain competitive advantage, it is understood that the cooperation's relationship works as mediating between the organization and its goals, wherein in the absence of that social interaction wouldn't be possible to achieve them (Coleman, 1988; Van de Ven, 1976b). This is in agreement with what was postulated by Bourdieu in Social Capital Theory, in which the relationships are not a natural event, but they are, in fact, long-term investments that aids the organizations to conquer their interests (Bourdieu, 1980).

Thus, seeing the relationships as investments, the choice of partners to cooperate with must be taken into details. To do so, attributes as trust, autonomy, willingness to share resources, overlap of technological skills and information, physical proximity and accessibility must be considered in order to get a more readily relationship when is necessary to call for it (Johnston et al., 2004; McCutcheon & Stuart, 2000; Pinto et al., 1993; Powell et al., 1996; Van de Ven, 1976b).

Between those attributes, trust has been considered one the most important factors that influence the relationship and, consecutively, the learning that is resultant from it (Ganesan, 1994; Johnston et al., 2004). Once the cooperation involves risks and uncertainty of tangible results (Jap, 1999; Song, Ming, & Xu, 2013; Zsidisin & Ellram, 2003), the lack of trust may work as barrier to share information, resources and learn new skills, fostering an ineffective cooperation (Bensaou & Venkatraman, 1995; Doney & Cannon, 1997; Powell et al., 1996). On the other hand, when the organization starts cooperating, it gets experience at cooperation and cultivates reputation as a partner, where the trust is built. Firms that possess high level of trust in the network are more able to get into new informal relationships, which in turn, perfects the organizational procedures for cooperation (Love & Roper, 2009; McCutcheon & Stuart, 2000; Powell et al., 1996; Smith & Barclay, 1997).

Autonomy, in sequence, refers to the extent of power decision that organizations have on their course of action in the cooperation. This is because the social interaction leads the organizations to lose some of their self-determination to adjust their roles and activities that will benefit the members as a whole. (Clark & Wilson, 1961; Levine & White, 1961). Hence, thinking in the benefits, organizations must also be willing to invest and share scarce resources with other organizations under expectation of future returns, even when the potential results are unclear and intangible (Van de Ven, 1976b).

Other aspect considered in choosing a partner for cooperation is the similarity of information and technological skills that each one possesses. Studies have shown that having a very similar information or having nothing in common may be harmful to the relationship, one time that the very similarity information incites the competition between organizations and having nothing in common make the organizations not aware about the resources or skills of a potential partner (Ruekert & Walker, 1987; Van de Ven, 1976b). Thus, intermediate degree of similarity between partners seems to be more effective when organizations realize complementary resources in a potential partner that may lead them to reach out their objectives, raising a stable and motivating condition to emerge the relationship for cooperation (Van de Ven, 1976b).

In this line, physical proximity and accessibility play an important role in cooperation's partner choice as well. Although there is no consensus about the direct influence that physical proximity has on the outcomes, studies have shown that it is essential for communication performance between partners and knowledge transfer that may be useful to the project success (Fernandez, Luisa Del Rio, Varela, & Bande, 2010; Ganesan, Malter, & Rindfleisch, 2005; Pinto et al., 1993). However, physical proximity does not guarantee that employees, departments or organization will interact among them, since each one has his/her own schedules or out-of-office commitment that, in somehow, may hamper their interaction. So, complementary, the accessibility seems to be more decisive in the cooperation's relationship given that the players may be physically close, but not able to communicate (Pinto et al., 1993).

The observation of those attributes in the partner choice may act as an informal safeguard to avoid high transaction costs and maximize the value of the cooperation. Thus, Dyer (1997) pointed out that low transaction cost and, consecutively, the maximization of the cooperation value is influenced by those attributes, which aid in the reduction of the number of suppliers, asymmetric information and goodwill trust's development (Dyer, 1997).

In spite of sufficient reasons to cooperate in the competitive scenario, an organization is not capable to cooperate without a management policy towards to it. Thus, managers must develop mechanisms to stimulate the cooperation and avoid disharmonies between cooperating partners (Souder, 1988), promoting the increase of productivity, the encouragement of employees to listen to each other's ideas, the communication about tasks, the mutual assistance and reliance on division of labor (Laughlin, 1978). Therefore,

cooperation-oriented organizations are more willing to integrate activities both internally and externally in order to reach outs benefits that satisfy their individuals' goals.

Internally, the cooperation occurs when there are interpersonal relationships among members of multiple functional areas to performance activities that will result in common goal's achievement (Pinto et al., 1993; Swink & Song, 2007). Although there is a stream of researchers that have focused on conflicts and disagreements between functions that arise from the divergent view that each function possesses (Dougherty, 1992; Maltz & Kohli, 2000; Michael Song, Montoya-Weiss, & Schmidt, 1997; Xie, Song, & Stringfellow, 2003), the benefits as accruing from the internal cooperation has been largely studied and depicted positive effects on firm's performances, as for instance the competitive advantage (Swink & Song, 2007) financial and market performance (Paiva, 2010) and new product development (Calantone et al., 2002; de Visser et al., 2010; Fernandez et al., 2010; Garcia, Sanzo, & Trespalacios, 2008; Gregory & Sohal, 2002; Kim & Kang, 2008; Swink & Song, 2007).

Considering the positive effects on new product development, the internal cooperation may act as a mechanism to decrease the uncertainty that is intrinsic in the NPD process (Fredericks, 2005), bringing new perspective, skills and expertise, overcoming the limitations of the work division (Fernandez et al., 2010), sharing information and bringing insights from the customer's view (Keller, 2001).

The consequences of those effects on NPD process may act directly on superior product design, quality, speed to market and on the reduction of development cost (Fredericks, 2005; Garcia et al., 2008; Lee & Chen, 2007; Love & Roper, 2009; Olson, Walker Jr, Ruekert, & Bonner, 2001). Hence, the manufacturing involvement in new products development seems to play an essential role in the meantime that the desirable mentioned results are accruing from its cumulative capabilities (Ferdows & De Meyer, 1990).

Thus, since Shapiro (1977), several efforts have been dedicated to justify the manufacturing integration with others functional areas, like design and marketing, in order to obtain upper-performance (Calantone et al., 2002; Gerwin, 1993; Hausman, Montgomery, & Roth, 2002; Liker, Collins, & Hull, 1999; Paiva, 2010; Rusinko, 1999; Shapiro, 1977; Song & Swink, 2009; Swink & Song, 2007; Swink & Calantone, 2004), due to its capacity to be interiorly focused and dedicate to perfect the process efficiency, technical details, competence development and capacity concerns (Gerwin, 1993).

Analyzing in dyads, the upper-performance that comes from manufacturing-marketing collaboration for NPD are better evidenced when the level of knowledge about each other and communication is high, stimulating the functional synergy and the optimization of the process (Calantone et al., 2002) that empirically results in grater commercialization, market success (Song & Swink, 2009) and high return on investments (Swink & Song, 2007). Manufacturing-design collaboration, in turn, is associated with the effectiveness in the NPD, in terms of time, performance (Rusinko, 1999) and design quality, mainly in environments of technology novelty and project complexity (Swink & Calantone, 2004). On the other hand, cooperating with partners that are placed outside of firm's boundaries, as suppliers and customers, may bring to the organization the understanding about consumer's needs, competitors offerings, suppliers resources and new technologies availability (Swink & Song, 2007).

Historically, involving suppliers in NPD process has brought several benefits for cooperation-oriented organizations (Eisenhardt & Tabrizi, 1995; Littler, Leverick, & Bruce, 1995), as upper performance in speed, flexibility, quality, productivity and high rate of innovation, as registered by Imai et al.,(1985) and Takeuchi & Nonaka (1986) when Japanese industries were analyzed (Imai, Nonaka, & Takeuchi, 1985; Takeuchi & Nonaka, 1986). After that, other researchers who dedicated to analyze the Japanese industries also reached out to similar results (Clark, 1989; Cusumano & Takeishi, 1991; Kamath & Liker, 1994).

Considering industries from all over the world, studies have also shown that beyond the same benefits got in Japanese organizations, as speed, flexibility, quality and productivity (Primo & Amundson, 2002; Ragatz et al., 2002), the cooperation with suppliers into NPD process results in the shortening of product cycle, increased rate of successful new product programs (Bonaccorsi & Lipparini, 1994) and greater information sharing ((Petersen et al., 2003; Ragatz et al., 2002).

The explanation for the results derived from the supplier involvement draws on the suppliers' capacity to provide specific components, tools and new technologies that match with the product design, as well investments in equipment and training to outperform the activities related to it (Petersen et al., 2003; Ragatz et al., 2002; Song & Di Benedetto, 2008). Therefore, supplier involvement in the early stages of the product design has been emphasized by researchers due to its capacity to minimize the possibility of errors and reduce the risks of

costly changes in the NPD process in later stages (Hartley, Zirger, & Kamath, 1997; Petersen, Handfield, & Ragatz, 2005b).

In this line, external cooperation may also be typified by customer involvement, which is considered as a greater information provider for new product development and innovation (Song et al., 2013), being a successful strategy to improve the NPD process (Brockhoff, 2003). The cooperation with consumers happens when cooperation-oriented organizations invite potential consumers to participate to the NPD process in order to get ideas and insights from the market that will benefit them (Alam, 2006; Campbell & Cooper, 1999).

The benefits raised from this cooperation are wide open and encompass the establishment of good relationship with the consumer, the increase and diversify of consumer-based knowledge, the feedback of new products prototypes (Prahalad & Ramaswamy, 2004) and the reduction of product development cycle time (Sherman, Souder, & Jenssen, 2000). Thus, as in supplier involvement, the early integration of customers in NPD's process seems to be desirable since it might potentiate the benefits that come from the cooperation (Chien & Chen, 2010; Millson & Wilemon, 2002; Souder et al., 1998; Zhao, Chen, & Du, 2012).

In general, once the companies get cooperation experiences and the level of intimacy is in tune, mutual values, goals, trust and willingness to help each other are spread among partners, fostering the solidification of cooperation (Van de Ven, 1976b).

2.2.2 Manufacturing Involvement into New Product Development (NPD)

The involvement with manufacturing for upper performance has been a recurrent topic in Operations Management since the seminal article performed by Shapiro (1977) highlighting the organizational problems that appeal for cooperating with marketing personnel even with historical conflicts between those areas (Shapiro, 1977). After Shapiro (1977), several researches has dedicated to reveal returns, conflicts and strategies when others functional areas opt for integrating with the manufacturing (Calantone et al., 2002; Gerwin, 1993; Hausman et al., 2002; Liker et al., 1999; Paiva, 2010; Rusinko, 1999; Shapiro, 1977; Song & Swink, 2009; Swink & Song, 2007; Swink & Calantone, 2004).

The outcomes from manufacturing-other functional areas interface range from very simple to complex conflicts and from symbolic to high returns. Thus, to overview the

nuances of incomes and conflicts from manufacturing involvement with different partners as well as the strategies to deal with them, the Chart 2 depicts evidences based on influent articles published in Operations Management and Marketing's journals.

Functional Area	Proposal	Main Contribution	Authors
Marketing	Identify the organizational areas where the cooperation is needed and their potential conflicts.	Suggest ways of managing the conflicts by increasing cooperation and minimizing antagonism between the marketing and manufacturing functions.	(Shapiro, 1977)
Marketing	Investigated the relationship among use of various co-ordinating mechanisms, degree of consensus between marketing and manufacturing groups, and marketplace performance reputation	Consensus between departments was strongly related to marketplace performance reputation.	(Caron & Rue, 1991)
Marketing	Propose solutions for coordination problems implied by products variety and flexibility.	Marketing should not be evaluated only by revenues and market share, but also for indirect operations criteria. Changes in marketing and manufacturing strategy must be done jointly.	(De Groote, 1994)
Marketing	Discuss the interdependence between marketing and manufacturing.	Marketing and manufacturing must coordinate both the initial lead-time as well as any changes in the product or planning that influence the lead-time. The integration between marketing and manufacturing is moderately associated with firm's success.	(Deane, McDougall, & Gargeya, 1991; Konijnendijk, 1994)
Marketing	Examine the impact of manufacturing and marketing decisions on the firm's profitability.	It reveals a set of prepositions and strategies that, under varying conditions, maximize profit-impact.	(Crittenden & Crittenden, 1995)
Marketing	Develop a generic classification framework for interfunctional research, and apply it specifically to the research on the manufacturing-marketing interface.	It reveals gaps in the literature and, accordingly, gaps in knowledge	(Parente, 1998)
Marketing	Provide a multidisciplinary view of innovation by integrating operations and marketing perspectives of product development.	Organizational process factors are associated with achievement of operational outcome targets for product quality, unit cost, and time-to-market; achievement of operational outcomes aids the achievement of market outcomes, in turn suggesting that development capabilities are indeed valuable firm resources; and these relationships are robust under conditions of technological, market, and environmental uncertainty.	(Tatikonda & Montoya-Weiss, 2001)
Marketing	Study the extent of agreement/disagreement between manufacturing and marketing managers on	It shows that manufacturing managers operate under a wider range of strategic priorities than marketing managers, and that manufacturing managers participate less	(Swamidass, Baines, & Darlow, 2001)

Functional Area	Proposal	Main Contribution	Authors
	strategy content and process.	than marketing managers in the strategy development process.	
Marketing	Evaluate and summarize papers to understand how the study of marketing-manufacturing interface has methodologically evolved over the course of years.	Delineate broad areas of mutual interest and integration between marketing and manufacturing.	(Malhotra & Sharma, 2002)
Marketing	Explore the nature of the relationships characterizing the marketing-manufacturing interface in new product development (NPD)	The more marketing knows about manufacturing and the more marketing is able to communicate credibly with manufacturing, better relationships and functional relationships will result with a variety of contingencies notwithstanding	(Calantone et al., 2002)
Marketing	Propose a path model for assessing the mediating impact of the Marketing-Manufacturing interface harmony.	Provides new empirical evidence that the M/M interface harmony, as expressed by the functions' ability to work together, matters significantly to business outcomes directly and indirectly.	(Hausman et al., 2002)
Marketing	Examine the moderating effects of business strategy and demand uncertainty on the relationship between the integration of manufacturing and marketing	the impact of the integration of manufacturing and marketing/sales decision on organizational performance is moderated by a firm's business strategy and demand uncertainty	(O'Leary-Kelly & Flores, 2002)
Marketing	Model the impact of the management levers relating to oversight, the intensity of specialization in design and the level of interaction with the customer.	Recommends appropriate managerial strategies based on the relative resources required in the design and manufacturing phases and highlights the necessity of leveraging the interdependency between the design and manufacturing phases to achieve superior performance	(Bajaj et al., 2004)
Marketing	Develop an integrated operations–marketing model for a profit-maximizing firm dealing with an innovative product or service.	It shows how attribute-sensitivity and randomness of demand affect the firm’s optimal decision.	(Ray, 2005)
Marketing	Suggest conflicting incentives to maximize perform the marketing-manufacturing interfaces	Offers a new interpretation of manufacturing-marketing conflict as a strategic tool that can enhance firm profits	(Balasubramanian & Bhardwaj, 2004)
Marketing	Present a study of the co-evolution of manufacturing and marketing strategies as resource and capability building processes.	Manufacturing resources and capabilities act as hinge capabilities for developing marketing resources and capabilities, and vice versa.	(Adamides & Voutsina, 2006)
Marketing	Establish the relationship between Information System and marketing-manufacturing integration.	Interdependence between functions is one factor that influences the degree to which organizations reap benefits from their ERP investments.	(Gattiker, 2007)
Marketing	Examine the influences of marketing-manufacturing integration (MMI) in each of four stages of new product development (NPD), on new product time and success	MMI in each stage of product development is respectively associated with greater product competitive advantage, which in turn is associated with higher project return on investment (ROI).	(Swink & Song, 2007)

Functional Area	Proposal	Main Contribution	Authors
Marketing	Evaluate the relationship between manufacturing and marketing integration, managerial priorities and business performance	Manufacturing and marketing integration and managerial priorities positively influence business performance (profitability, sales increasment and rate of exports/total sales	(Paiva, 2010)
Marketing	Investigate the effect of senior management policies on the effectiveness of the marketing-manufacturing interface.	Formal cross-functional integration policies was found to promote marketing-manufacturing involvement. Team leader autonomy, team rewards, and job rotation were found to promote marketing involvement in the United States but not in Japan.	(Song, Kawakami, & Stringfellow, 2010)
Design	Analyze the interdependence between manufacturing and design in project development.	The choice of interaction mode within each project phase is hypothesized to depend on the novelty of the product/process fit problem, and the relative importance of coordination effort across the three project phases is hypothesized to depend on the analyzability of the product/process fit problem.	(Adler, 1995)
R&D	Analyze the influence of R&D intensity on manufacturing improvements	R&D investments are highly associated with market share improvements and high levels of computerization in manufacturing.	(Ettlie, 1998)

Chart 3 – Benefits, conflicts and strategies from Manufacturing-others functional areas' involvement.
Source: elaborated by the author.

According to the Chart 2, in spite of several contexts where manufacturing involvement was called to attention, few of them were dedicated to analyze its performance when the NPD's process was the central subject. The explanation for this scenario lies on the understanding that managers had about the manufacturing role and its minor contribution in NPD's process (Pisano & Wheelright, 1995).

Thus, for a long time the manufacturing involvement in NPD process was taken as coadjutant, with no expression, while marketing, design and R&D had the great voice on the decision making (Calantone et al., 2002), so that managers of high-technology companies were more willing to target investments to R&D, as the true source of advantage and innovation, than face the hazards of investing in a manufacturing plant and become interiorly focused (Pisano & Wheelright, 1995). The manufacturing' secondary role in NPD's process was most due to its process' inward view that, according to others functional areas, could hamper the ideation (Gerwin, 1993).

Hence, conflicts were evidenced between manufacturing and other functional areas once they have different approaches, understandings and goals; as for instance the stormy historic relationship with marketing personnel. In this relationship, manufacturing staff usually offers information about the existing resources and capabilities and how the new product would fit into the current production mix. Marketing staff, in turn, are more concerned upon the market potential, creation of new features and functionalities to the products and communication with customers (Swink & Song, 2007). This is akin to say that manufacturing staff would prefer to produce long batches with few design changes, few different models that are easy to manufacture and with little customization, since manufacturing is recompensed by its efficiency, while the marketing staff would prefer the opposite, once its recompense comes, basically, from increased sales (Calantone et al., 2002).

In spite of those conflicts, scholars have pointed out that the manufacturing's inward view, as the focus on techniques, efficiency, capabilities and production details (Gerwin, 1993), is in fact a resource that overcomes the conflicts since it fosters returns that satisfy not only itself, but also its partners (Hausman et al., 2002) and the business as a whole (Hausman et al., 2002; Paiva, 2010; Swink & Song, 2007). This statement is in line with the Social Capital Theory's presumptions once the distribution of benefits that were acquired from the involvement with partners represents the results of investments in social relationships that work as mediating between members and upper results (Bourdieu, 1980; Coleman, 1988). Taking in mind the results accrued from that involvement, the misrepresentation of the manufacturing in NPD's process is recognized as a missing link in the cross-functional integration (Calantone et al., 2002).

Anecdotal evidences have shown that involving manufacturing become the NPD's process faster, more efficient and more effective, which in turn influence on the product cost that will put that company at some advantage over competitors. Consequently, the products' launch happens more smoothly and its commercialization more easily (Pisano & Wheelright, 1995).

Studies have also shown that because other functional areas don't know much about the manufacturing's process, they tend to create functionalities and features for the new product that are not viable to be produced in the current manufacturing process, causing the waste of resources in the product's design. Thus, involving the manufacturing in NPD's process may avoid the waste of resources deployed by other functional areas in products

design that are not feasible to manufacture (Clark & Fujimoto, 1991; Clark & Wheelwright, 1993).

In addition, manufacturing involvement speeds the NPD's process by aiding in the product prototype development and its test. The sooner the prototype is tested and approved, the sooner the production ramps up, implicating on costs, productivity, quality, market penetration, customer's satisfaction and sales (Calantone et al., 2002).

Thus, the manufacturing involvement in NPD's process seems to be critical for companies that desire keeping competitive at market place once the global competition and the consumer's requirements have suggested that companies must keep improving their production process to deliver quality and functionality at low cost to preserve their competitive advantage (Tse, 1991).

In this line, the production process' improvement is an outcome of the demand of products that require superior process and that are appropriately targeted to the customers' requirements, leading the company to deliver quality and function, since the products features are narrowly associated with process improvements (Pisano & Wheelright, 1995). Consecutively, when the manufacturing enhance its practices, routines and methods of production in order to adjust to the market requirements, it starts a process of continuous improvement (Tse, 1991; Zangwill & Kantor, 1998).

As continuous improvement may be understood as an organizational orientation to a sustainable focus on incremental innovation, it has been widely recognized as a potential source of competitive advantage by involving complex organizational changes that may be difficult to imitate by competitors (Bessant, Burnell, Harding, & Webb, 1993).

2.2.3 Supplier Involvement into New Product Development (NPD)

Supplier Involvement is a topic that has got the attention of scholars over the past several years (Lockström, Schadel, Harrison, Moser, & Malhotra, 2010). The research evolution about this topic started in the mid-eighties after evidence of superior performance in the automobile industry in Asian manufactures over the Western ones, mainly when it comes to product development cycle time, engineering expenses and product quality (Bidault, Despres, & Butler, 1998).

Previously, superior performance was understood as spillover of practices of quality management that were evidenced in Japanese manufacturers from early eighties on (Garvin, 1988). In spite of some reluctance about the adoption of quality management's practices by American manufacturers (Anderson, Ungtusanatham, & Schroeder, 1994; Cole, 1998; Garvin, 1988), the entry of Japanese companies at American market forced the local companies to adopt those practices in order to respond the pressure of competition (Crosby, 1988).

In the early nineties, results from Clark and Fujimoto's studies came out showing significant differences in supplier involvement for new product development in twenty companies in Europe, North America and Japan. The results pointed out that suppliers were involved in 30% of the new product development´s process in Japanese automobile manufactures, while that involvement was evidenced in 16% and 7% in Europe and North American manufactures, respectively (Clark & Fujimoto, 1991).

Because Western manufactures had already adopted some Japanese manufacturing practices, as Quality Function Deployment (QFD), Kanban and Kaizen, the upper performance of Asian manufacturers was credited to the supplier involvement in early stages of the new product development. Those findings leverage North American and European companies to consider early supplier involvement in their new product development to reach out similar results as verified in the Japanese manufacturers (Bidault et al., 1998).

From this understanding, a body of scholars strove to investigate outcomes accruing from the early supplier involvement (ESI) in new product development, mainly as regards to product development time. Studies that were conducted from this intention demonstrated that even with ESI adoption in American and European manufacturers the results were not close to what was expected, instigating investigation about the factors that surround the supplier integration and that may influence the manufacturer performance (Eisenhardt & Tabrizi, 1995; Zirger & Hartley, 1996).

Due to the expected results as accruing from supplier integration, it was characterized as a mechanism whereby it is possible to reach better results, and for this reason, it has been seen as one of the forms to operationalize the Social Capital Theory (Adler & Kwon, 2002; Carey et al., 2011; Lawson et al., 2008). Following the principles of Social Capital Theory, the relationship established between the manufacturer and the supplier is a spillover of long-term investments that become a resource to both involved companies to achieve their goals (Bourdieu, 1980; Coleman, 1988).

Matching Social Capital Theory's perspective and the concept adopted in Operations Management literature, supplier involvement is defined as a new or existing relationship between the buyer and the supplier to strive benefits for both through collaborative activities (Ellram, 1995), or the extend of responsibilities that the manufacturing company shares with the supplier to develop subsystems (components) or new products (Takeishi, 2001), or less specifically, as a division of supply chain integration that's related to upstream part of supply chain (Lockström, Schadel, Harrison, Moser, & Malhotra, 2010). Others definitions about supplier involvement follow in the chart 3.

Authors	**Definition**	**Journal**
(Das et al., 2006)	Supplier integration is a state of syncretism among the supplier, purchasing and manufacturing constituents of an organization.	Journal of Operations Management
(Narasimhan, Swink, & Viswanathan, 2010)	Supplier integration is the process of acquiring and sharing operational, technical, and financial information and related knowledge with the supplier and vice versa.	Decision Sciences
Koufteros et al., 2005)	Supplier integration refers to the supplier involvement into manufacturer's innovation process, as well the execution of general innovation tasks as the development of components and subassemblies.	Decision Sciences

Chart 4 – Supplier Integration's definitions
Source: based on literature review

Attending the research call implicit in Eisenhard and Tabrizi (1995) and Zirger and Hartley (1996)'s studies, a body of researchers have struggled to elucidate factors that could favor or hamper the supplier integration, as for instance the antecedents of supplier integration, supplier selection's process and moderating factors, that in turn, might offer explanations about the results dissimilarities between Japanese and worldwide manufacturers.

In this line, antecedents of integration are represented by the reasons that incite the manufacturers and suppliers to get integrated into new product development in order to get superior performance. Studies that were performed about it highlighted the buyer's technological uncertainty about product's components, supplier's in-house technical capabilities (Petersen et al., 2003), supplier base initiatives, high proportion of parts purchased (Bidault & Despres, 1998), manufactures' capabilities to manage various internal and external activities (Takeishi, 2001), supplier's increased knowledge about technologies and buyer-side leadership (Lockström et al., 2010) as the mains reason that takes the manufacturer to get integrated. From the suppliers' view, the expectance of highest benefits accruing from the membership in the new product development' team is a strategy to outperform (Petersen et al., 2003).

In general, the factors that incite the organizations to get integrated demonstrate the sense of interdependence that each organization possesses due to the inability to perform its activities by itself (Das et al., 2006). As mentioned previously, getting integrated is an organizational decision based on the scarcity of internal resources and the opportunity to explore market demands (Van de Ven, 1976b). Once again, these factors reinforce aspects of Social Capital Theory that are embodied in the involvement between organizations (Bourdieu, 1980; Coleman, 1988).

Integration process starts when manufacturers adopt criteria to choose suppliers that will perform collaboratively activities, matching with individual expectances and intended results (Heide & John, 1990). According to Petersen, Handfield and Ragatz (2005), a detailed supplier assessment, technical assessment and business assessment are criteria that influence the NPD team's effectiveness and, in turn enhances the design and financial performance (Petersen et al., 2005b). Detailed supplier assessment comprehends the degree of familiarity with the supplier, supplier' skills, potential to conduct entrepreneurial marketing, involvement in innovation and interest in committing financial resources (Lettice, Wyatt, & Evans, 2010; Monczka, Petersen, Handfield, & Ragatz, 1998). Detailed supplier assessment was named by Song and Di Benedetto (2008) as qualification of supplier's abilities and willing to invest on specific assets to support the integration (Song & Di Benedetto, 2008).

Technical assessment refers to the supplier's capabilities to fill the existing gap between the manufacturer's current technologies and the new ones available on the market. In others words, technical assessment is related to supplier ability to get technologies that update the manufacturer's competences to be applied in new products development, aiding to meet the consumers' needs and lower the uncertainty as accruing from the environmental turbulence (Petersen et al., 2003; Petersen et al., 2005b; Ragatz et al., 2002). Last, business assessment is associated to the agreement between parties about the expected results from supplier integration, in terms of cost, quality, scheduling, roles and responsibilities (Petersen et al., 2005b).

Supplier assessment plays a critical role on supplier selection due to risks incurred in the relationship. Although the assessment does not guarantee that supplier will not have opportunistic behavior, a detailed selection may minimize the chances of it occurring, mostly

when the compatible production process that impacts on product quality, delivery capability and cost is threatened by the flossy use of suppliers abilities (Stump & Heide, 1996).

Because integration involves sharing information, the development of formal trust, formalization of risk/reward contracts, establishment of performance measurement and engagement of top management in the relationship as a way to mature and strength relationship are needed (Gundlach, Achrol, & Mentzer, 1995; Ragatz et al., 2002).

Risks of opportunistic behavior get minimized when investments are addressed to specific assets that will guide the operations (Dyer, 1997). The specificity of those assets, under the Transaction Cost Theory (TCT)'s approach, acts as safeguards that avoid opportunistic behavior in both companies, once those assets are not feasible to be applied in other relationships with other companies (Williamson, 1975). Thus, studies have revealed that because of the high cost of transaction between supplier-manufacturer, companies work for optimizing the results of the relationship, leveraging them to upper performance in innovation (Ganesan, 1994; Gundlach et al., 1995; Heide & John, 1990; Rindfleisch & Heide, 1997; Song & Di Benedetto, 2008).

In the case of Japanese automakers, Liker and co-authors (1996) identified that the performance monitoring and the development of mutual dependence to keep the suppliers committed to the new product development's process subsidize the success of those companies (Liker, Kamath, Wasti, & Nagamachi, 1996).

Moderating factors that affect the integration performance, mainly when it refers to product development were also focus of some studies. Among those factors, the moment that the supplier is integrated into the project, type and degree of supplier's responsibilities in the project, existence of shared structures, communication between companies, agreements about intellectual property and alignment of organizational goals in relation to the outcomes are highlighted and were considered relevant to comprehend the nuances of supplier integration's performance into new product development (Liker et al., 1996; Primo & Amundson, 2002).

The moment wherein the supplier is integrated is categorized in five generic stages of new product development. These stages are interdependent and overlap in some points, ranging from product's idea generation to product's prototype building. The series of stages follow in the Figure 1.

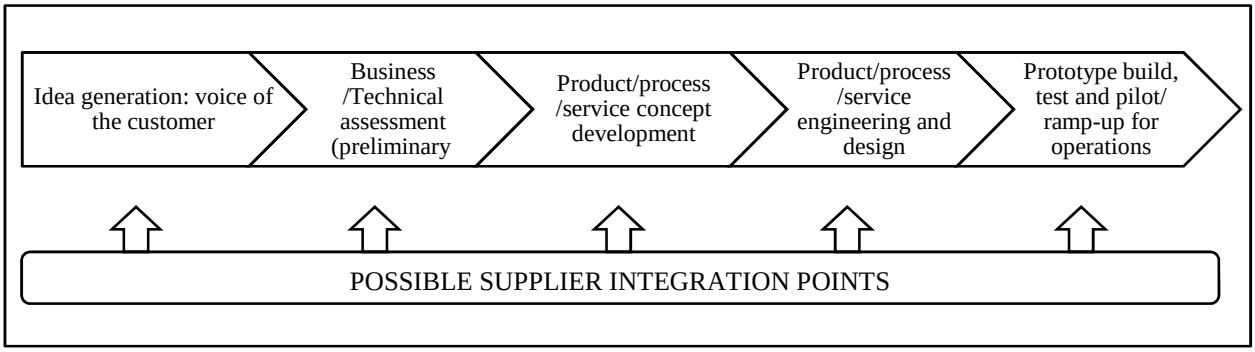

Figure 1 – New Product Development process
Source: (Handfield et al., 1999)

Product development process starts from the gathering of information about customers' needs and product functionalities, calculation of estimated production cost and discovery of technologies that might support the production. This process is followed by the product's business assessment and the sighting of technical solutions to develop product specifications that match with customers' expectations. Then, product concept and its specifications are defined, the design is created and a prototype is tested (Handfield et al., 1999).

Associated with the product development's stage, levels of responsibility are discussed between partners in order to define each one's role in the whole process. The supplier responsibility is a function of the complexity of the activities that are shared and the formality of the integration.

Starting from less complex activities, as the discussion of the product specifications and customers' requirements, suppliers assume an informal integration and don't participate of the design and specifications decisions. The intermediate level of supplier responsibility is related to the information and technology sharing and joint decision about design specifications. Last, with high responsibility, suppliers have a very formal integration and the product design is primarily supplier driven. Those levels of supplier responsibility were termed by Handfield and coauthors (1999) as white, gray and black box, respectively (Handfield et al., 1999).

Empirically, Koufteros, Cheng and Lai (2007) tested the influence of the three levels of responsibility on product innovation. The results showed that only gray-box integration (intermediate level) influences positively the product innovation (Koufteros et al., 2005). In addition, Primo and Amundson (2002) provided insights that the level of supplier's

responsibility in NPD project is related to the technical difficult of the project. Thus, the more difficult technically the NPD project, the greater the supplier's responsibility in the project (Primo & Amundson, 2002). Considering the moment that supplier integrates the NPD project and the level of responsibility assumed by the supplier, evidence points out that the earlier the supplier is involved into new product development, the greater its responsibility for product design (Hartley et al., 1997).

The results of the supplier integration are realized in the short and long-term through the cost reduction, increased productivity, product quality improvements, adherence to product cost targets, adherence to development budgets, adherence to development schedules, increased speed of new product development, innovation capacity, radical innovation and time-to-market (Afuah, 2000; Bonaccorsi & Lipparini, 1994; Clark, 1989; Cousins & Lawson, 2007; Gupta & Souder, 1998; Hoegl & Wagner, 2005; Perols, Zimmermann, & Kortmann, 2013; Primo & Amundson, 2002; Ragatz et al., 1997; Song & Di Benedetto, 2008; Swink, 1999; von Hippel, 1988).

In general, those outcomes, which symbolize improvements on operational, marketing and business' performance (Cousins & Lawson, 2007; Primo & Amundson, 2002; Ragatz et al., 1997; Wasti & Liker, 1997), are taken as fruits of the supplier's experience and information about components and alternative technologies to develop the new product (Ragatz et al., 1997) and are moderated by the factors listed previously. Supplier involvement into new product development is highly correlated to the information exchange and anticipation of new technologies, that in turn, improve the operational performance and increase the speed of new products introduction at the market (Liker et al., 1996).

Information exchange between supplier and manufacturer aids the earlier to understand the latter's needs and provide insights that drive the manufacturer to reorganize its internal resources, optimize and get efficiency on them to adapt to external requirements and respond proactively to the market needs (Handfield et al., 1999). In this process, engineers from both involved companies get into frequent communication to exchange information about product specifications and development of system interfaces (Koufteros, Edwin Cheng, & Lai, 2007; Mahoney, 1992).

As manufacturers that are closely linked to their suppliers into new product development are more susceptible to gather external information about successful technologies which were used, developed, implemented or sold by suppliers, they get aware

about technology industry trends (Corswant & Tunälv, 2002; Gatignon & Robertson, 1989; Perols et al., 2013). In addition, supplier integration and new technologies anticipation are strategies that are closely interlinked, wherein the presence of one takes the manufacturer to get the other one. Supplier integration and new technologies anticipation have positive complementarities on manufacturer results, especially on operational performance that is measured by quality, delivery and process flexibility (Narasimhan et al., 2010).

As in Perols and coauthors (2013), our research considers that supplier integration into NPD does not act directly on the results when it comes to marketing and business performance, yet its influence is mediated by the enhancement on manufacturer's operational process and new technologies adoption. In other words, continuous improvements and anticipation of new technologies work as mediating variables between supplier integration and NPD's performance.

2.2.4 Customer Involvement into New Product Development (NPD)

Customer involvement into NPD is not a new strategic approach. The need to integrate customers into NPD process was perceived after evidences of consecutive failures in the industrial production in the mid-1960`s. Because of this context, several studies were performed in order to elucidate the factors that could both foster or hurt the NPD's success (Cooper, 1979).

From an extensive literature review spanning factors that could influence the NPD performance, Cooper (1979) found out that the consideration of the customer's needs in NPD process provides a unique and superior product that match with their expectations, being the most important factor that drives the NPD to the success. Uniqueness and superiority mean offering an innovative product with inimitable features that satisfy the customer needs, with cost and quality more appealing than the competitor's products (Cooper, 1979).

As customer involvement has been updated from passive audience to active players (Prahalad & Ramaswamy, 2000), listening and integrating customers have been recognized by scholars as potential source of competitive advantage (Campbell & Cooper, 1999; Feng et al., 2010), successful strategy (Brockhoff, 2003) and a best practice in NPD (Dooley, Subra, & Anderson, 2002; Enkel, Kausch, & Gassmann, 2005).

Customer involvement has several overlapping definitions and it may be found under diverse typologies in literature. In a broader sense customer involvement refers to the mediation between customer and the product design process (Kaulio, 1998). More specifically, it is defined as a formalized relationship between a customer and a manufacturer, including the performance of coordinated activities to develop a new product (Campbell & Cooper, 1999) or yet the extent that customers participate into a supplier's NPD from the ideation to prototype testing stage (Eisenhardt & Tabrizi, 1995).

In terms of typologies, customer involvement is found in the marketing, engineering and operations management's literature in different ways, as customer participation (Dong, Evans, & Zou, 2008; Füller & Matzler, 2007; Kelley, Donnelly, & Skinner, 1990; Lin & Huang, 2013), customer co-production (Arvidsson, 2008; Buttgen, Schumann, & Ates, 2012; Hunt, Geiger-Oneto, & Varca, 2012), customer integration (Flynn et al., 2010; Frohlich & Westbrook, 2001; Gassmann, Kausch, & Enkel, 2010; Lau et al., 2010; Song et al., 2013; Voss, 2012), customer involvement (Chien & Chen, 2010; Hongyi et al., 2010; Johnson & Changyue, 2008; Lin & Germain, 2004), customer collaboration(Gemünden, Heydebreck, & Herden, 1992; Tsai, 2009), customer cooperation (Vercauteren, 2009) and customer engagement (Sawhney, Verona, & Prandelli, 2005).

Manufacturers which integrate customers into NPD are concerned about the in-house lack of information to act proactively on the marketplace (Li & Calantone, 1998). Customer involvement updates the manufacturer's information to design a product that satisfies the customers' needs and minimize the environmental uncertainties (Calvert, 2003; Gales & Mansour-Cole, 1995; Mason-Jones & Towill, 1997; Powell et al., 1996). This sense of customers' dependence to perform activities and the expectation of benefits from the involvement with them is supported by the Social Capital Theory, which considers that in absence of this relationship getting better results would not be possible (Bourdieu, 1980; Coleman, 1988; Koufteros, Rawski, & Rupak, 2010).

Thus, manufacturers which belong to industries of high technological turbulence, as complex and sophisticated products, tend to integrate customer to avoid the risks from environmental uncertainties and minimize the costs of production. In association, manufactures which possess less formalized process to gather information from the customer and more formalized process to operationalize that information are also more likely to integrate the customers into NPD (Lin & Germain, 2004).

Besides product complexity and levels of formalization that are considered antecedents of customer involvement (Lin & Germain, 2004), mutual commitment, mutual trust, mutual adaptations and mutual relationship management are also considered enablers of the relationship. In general, mutual commitment and trust support the involved companies (seller and buyer) to avoid long contract negotiations, while mutual adaptations and mutual relationship management lead the partners to linking and matching capabilities that will benefit both involved. The power of those mutual enablers seems to be stronger when seller and customers are located in different regions, what means that more complex relationships require more intensity of mutual enablers (Ritter & Walter, 2003).

On the other hand, low intensity of customer involvement offers risks to the relationship representing a threat to the manufacturer performance. Due to this contingent, scholars have studied the risks that are often in each stage of NPD and have also offered methods to minimize them (Algesheimer, Borle, Dholakia, & Singh, 2010). The illustration of risks and the respective approaches to reduce them are depicted in the Chart 4.

NPD' process	Risks	Methods
Identification of partner	Limitation to mere incremental innovation	Appropriate collaboration method, e.g. IT based or personal
		Selection of the appropriate phase within the innovation process
		Selection according to the qualification for radical innovation
Start	Serving a niche market only	Customer integration in search field process
		Integration of different customers in different stages
		Selection of the right customer group
Design	Dependence of Customers' views	Identification of the right customer
		Use of the appropriate integration method
		Motivating customer to collaborate
		Appropriate collaboration method
Collaboration in production	Dependence of Customers' demand or personality	Cultural fit
		Careful selection of the internal project team
		Attention to the roles played
	Misunderstandings between customers and employees	Using and maintaining long term relationship to customers
		Careful selection which project benefits from customer integration
		Overcome the notinvented-here syndrome
End	Loss of know-how	Management of intelectual property
		Careful selection of the customer

Chart 5 - Risks and methods to minimize them in customer involvement into NPD
Source: Adapted from (Algesheimer et al., 2010; Enkel et al., 2005)

Among those risks, the loss of know-how through disloyal customer sounds to be the most harmful to organizations because customers may take both the ideas and know-how from a manufacturer to a competitor that will be benefited by the enhancement of its innovative power. (Enkel et al., 2005). In this scenario, Enkel and colleagues (2005) argue that worse than all those risks it's the risk of not integrating the customer into NPD, since it leads the manufacturer to offer products that won't be valued or appreciated by the customers due to the lack of information from them (Enkel et al., 2005).

Customer involvement may assume three levels of commitment into NPD process. According to Eason (1992, cited by Kaulio, 1998) the manufactures design for, design with and design by customers. Each of those categories requires different degrees of partaking from the consumer when interacting with the manufacturer's design team. In addition, Kaulio (1998) elucidated seven indirect methods of customer integration into NPD that are suitable to each commitment category proposed by Eason and that are used to assure that the customers' requirements do guide the NPD's process (Kaulio, 1998). The description of the commitment levels and the integration methods is displayed at Chart 4.

Commitment Level	Commitment Level's description	Methods	Phase of the design process
Design for	Products are design on behalf of the customers	Quality Function Deployment (QFD)	Specification, concept development, detailed design, prototyping and final product
Design with	Different solutions/concept are displayed, so the customers can react to different proposed design solutions	User-oriented product development	Specification, concept development, detailed design and prototyping
		Concept Testing	Concept development
		Beta Testing	Prototyping
Design by	Customers are actively involved and partake in the design of their own product.	Lead User Method	Specification, concept development, detailed design and prototyping
		Consumer Idealized Design	Specification and Concept Development
		Participatory/Ergonomics	Specification, concept development, detailed design and prototyping

Chart 6 - Consumer's commitment level and integration methods
Source: Adapted from (Kaulio, 1998)

The study performed by Kaulio (1998) that's summarized in the Chart 4, demonstrates that customer commitment to the NPD process is more related to the degree of action on the design phase that the customer is called to partake than the number of design phases that the consumer partakes effectively. Thus, in design for-commitment, the product design is based on information about customer behavior that is gathered through interviews, focus groups,

clinics or observation techniques. Counteracting, more commitment, as in “design by”, customers act effectively on the design process, but their action are specific to the design stages wherein them were called to participate, as in consumer idealized design’s method (Kaulio, 1998).

After integration some activities are often performed jointly by manufacturer and customer to develop new products. Thus, 34 activities that range from very simple to very complex were listed by Athaide, Meyers and Wilemon (1996) and grouped into eight dimensions as follows: product customization; information gathering on product performance; product education/training; ongoing product support; proactive political involvement; product demonstration/trial; real-time problem solving assistance and clarifying the product’s relative advantage. Based on these dimensions, the authors state that the relationship between manufacturer-consumer, named relationship marketing, is seller-led, but consumer-driven (Athaide, Meyers, & Wilemon, 1996).

Thus, a market-orientation relationship enhances the accuracy of demand information, reduces the manufacturer’s uncertainty caused by the environmental turbulence (Gales & Mansour-Cole, 1995; Hung & Chou, 2013; Jaworski & Kohli, 1993), enables a faster and more efficient reaction to market changes, promotes innovation (Sandmeier et al., 2010), impacts on production planning’s time reduction (Rothwell, 1994), product quality (Hongyi et al., 2010; Lengnick-Hall, 1996), delivery reliability and process flexibility (Feng et al., 2010), decrease the time-to-market (Feng, Sun, Zhu, & Sohal, 2012; Filippini et al., 2004) and consequently impacts on cost reduction, responsiveness of demand changes and customer satisfaction (Flynn et al., 2010; Zhao et al., 2013). Therefore, customer involvement has a significant positive influence on NPD performance, mainly when it comes to marketing and manufacturing performance (Chien & Chen, 2010).

The reason for those potential benefits lies on the fact that customers are the better channels in the supply chain to translate insights from the market into specifications and conformities that will aggregate value to the product. Due to this reason, customers assume the most powerful position in the supply chain integration (Gemünden et al., 1992).

The upper performance is better evidenced when customers are integrated in early and late stages of NPD, during the ideation and prototype stage. During the early stages customers provide insights that are useful to the product conception and that will guide all production process. In late stages, as the prototype testing stage, major changes are not

possible to be made, but gathering information about the prototype functioning enables the manufacturer to make some adjustments that will aggregate the value to the product (Gruner & Homburg, 2000).

The explanation why customer involvement in middle NPD stages does not impact on the performance is related to the existing gap between the customers' expectations about the product and the professional view of designers and engineering's about what is feasible to produce (Magnusson, 2003). Due to this context, manufacturers are suggested to use external information as a source of inspiration, but use their own internal resource during the design and production stage to conciliate the customers' requirements with the manufacturer operational capacity (Gruner & Homburg, 2000; Magnusson, 2003) .

Potential benefits from manufacturer-customer's relationship are optimized (besides the level of commitment and the stage in which the customer was involved) when the customer is financially attractive and when the manufacturer controls the degree of integration with customer. Financially-attractive customers are more willing to invest on shared structures, share information, developing trust and commitment that potentiate the gains from the relationship (Gruner & Homburg, 2000). Conversely, manufacturers must control the customer integration due to the delay in the design of new products promoted by the excess of information exchange between partners (Bajaj et al., 2004). This statement confirms the Villena, Revilla and Choi (2011)'s approach, which considers that too much and too little interaction with consumer (social capital) awakes the dark-side of the relationship that hurts the performance (Villena et al., 2011).

On the other hand, increased customer integration has a positive ripple influence on the manufacturing performance. Thus, while project managers seek for reduced customer integration to mitigate the negative results from its direct influence on design performance, manufacturing managers seek for increased customer integration to exploited its ripple influence on manufacturing performance (Bajaj et al., 2004).

Under these considerations, customer involvement into NPD seems to be a very complex relationship due to the set of variables that must be managed and that affect the progress of the relationship and the expected results. Thus, putting in touch the findings of scholars which were mentioned previously, we claim that integrating customers in NPD's stages sounds like a good strategy to reduce the environmental uncertainties (Gales & Mansour-Cole, 1995) and to enhance the NPD' success when it comes to marketing and

manufacturing performance (Feng et al., 2010). Results from the relationship might be even better when customers are committed in all NPD's process Eason (1992, cited by Kaulio, 1998). Although integrating customers in all NPD' stages is desirable, performing activities that are customer-driven offers risks that might hurt the performance (Kaulio, 1998). Hence, manufacturers must perform those activities controlling the level of customer interaction (Villena, Revilla and Choi (2011), balancing its negative direct influence in some NPD' stages with its positive ripple influence on others (Bajaj et al., 2004).

Regardless the degree of interaction between partners, evidence of cost reduction in NPD process were not found by Feng, Sun and Zhang (2010). Although integrating customers in early stages of the NPD may be helpful to detect flaws, minimize the redesign and the cost of rework (Feng et al., 2012), the mechanisms to sustain the customer involved into NPD are costly and technologically intense, which counteract with the benefits generated from the relationship (Feng et al., 2010).

In this line, in spite of what has been said about the benefits as accruing from customer relationship, as its ripple influence on manufacturing and marketing performance, little attention has been given to its influence on financial performance (Campbell & Cooper, 1999). After running a study that sought to compare results between partnership projects and in-house projects, Campbell and Cooper (1999) found out that partnership projects have no improved results on financial performance by involving customer into NPD when this relationship is treated directly. Hence, the authors called attention for the development of further researches in order to unveil the mediating factors between consumer involvement and NPD performance that lead the manufacturer to upper results (Campbell & Cooper, 1999; Haartman, 2013).

Thus, considering that the end user demands prices, quality, shorter delivery cycles and creates pressure for innovation, the customer involvement forces the manufacturer to increase the process efficiency (Gemünden et al., 1992) by learning about technological issues (Gatignon & Xuereb, 1997) and mobilizing the manufacturer to acquire resources and technologies that are helpful to satisfy the customer' needs (Calvert, 2003).

New technologies, in this sense, have been recognized as a tool to increase the manufacturer's information processing capacity that results in choosing a strategy that is suited to the environmental pressures(Gemünden et al., 1992). Manufacturers that are able to adjust their organizational strategy to match with adopted technologies seem to present upper

performance when compared with manufacturers that don't do it (Dean Jr & Snell, 1996; Skinner, 1984; Wiiliams & Novak, 1990). The alignment between organizational strategy and manufacturing technologies as a function of customer involvement into NPD it's a source of competitive advantage that might increase the customer's satisfaction index (Skinner, 1969; Tracey, Vonderembse, & Lim, 1999).

Based on these comments and according to Campbell and Cooper (1999) and Bajaj and colleagues (2004), this study considers that customer involvement has no direct influence on financial, marketing and manufacturing performance, yet it has a ripple influence on them via anticipation of new technologies.

2.2.5 Anticipation of new technologies

In previous sections we have discussed the reasons that lead the manufacturer to get involved with external and internal agents of supply chain. All those reasons are related to the manufacturer' scarcity of resources to get better results in terms of operational, marketing and business performance (Van de Ven, 1976b).

In general, scarcity of resources represents the lack of information and technologies that are crucial to update the manufacturer competences to attend more precisely the customers' expectations and keep it competitive at marketplace. Because scarcity of resources impedes the organizations to realize the environmental changes, it promotes a gap between the manufacturer's existing knowledge and the knowledge available in the external environmental, increasing the uncertainty and hurting the performance (Daft & Lengel, 1986; Tushman & Nadler, 1978).

Thus, involving customers and supplier into new product development has been considered a strategic way to modernize the manufacturer competences (Handfield et al., 1999; Powell et al., 1996), since such involvement provides accuracy of information about the environment (Flynn et al., 2010) and awareness on technologies to improve the performance (Corswant & Tunälv, 2002; Perols et al., 2013). Therefore, considering that information and new technologies adoption are accruing from the manufacturer involvement with external agents, both of them might be seen as a representation of the acquisition stage of the manufacturer's absorptive capacity (Cohen & Levinthal, 1990; Zahra & George, 2002).

Manufacturing technologies are considered tools that convert insights from the marketplace into exploitable knowledge due its capacity to decrease the uncertainty generated by the environmental turbulence. They gather, process, store information and deliver product or service that are according to the market expectations (Egelhoff, 1988 as cited by Kotha & Swamidass; 2000). More specifically, manufacturing technologies have been defined as a group of computer-based technologies (McDermott & Stock, 1999) which are dedicated to improve the manufacturing operations and thereby the firm's competitiveness (Small & Yasin, 1997).

According to the area of application, manufacturing technologies are classified under different perspectives. Adler (1988) classified the manufacturing technologies into three categories: design, manufacturing and administrative automation. Technologies toward to design automation are represented by computer aided engineering (CAE) with focus on new product development and enhancement of process. Manufacturing automation, in turn, refers to computer-controlled process, automatic storage, automatic manipulation of materials and retrieval system. Finally, administrative automation encompasses the planning of resources to the production, activity-based accounting and others monitoring systems (Adler, 1988; Boyer, Ward, & Leong, 1996; Zhou, Leong, Jonsson, & Sum, 2009).

Kotha (1991), in line, clustered the manufacturing technologies into four groups: product design technologies (PDT), process technologies (PT), logistics/planning technologies (LPT) and information exchange technologies (IET). PDT are related to product definition and the use of computer-aided design (CAD) and computer-aided engineering (CAE) technologies; and PT are related to the monitoring and generation of process associated with factory floor's information, as flexible manufacturing systems (FMS). In sequence, while LPT are associated with both material flow and acquisition of raw materials to the delivery of finished goods, the IET are toward to storage and exchange information among product, process and logistics technologies (Kotha, 1991).

By definition, technologies adoption is associated with improved competitiveness due to its capacity to increase the manufacturing and marketing performance, but the mere adoption of technologies does not guarantee that manufacturers will experience such upper performance (Chen & Small, 1994). Thus, scholars have stressed the importance of linking the manufacturer strategic goals and anticipation of new technologies as a way to

operationalize the actions proposed in the strategic planning and get better results from this integration (Dean Jr & Snell, 1996; Skinner, 1984; Wiiliams & Novak, 1990).

Considering that each firm shapes its strategic goals according to the environment that it faces, and that the strategy, in turn, influence on the technology acquisition (Wiiliams & Novak, 1990), studies demonstrated what technologies seem to be more suited to the manufacturer' strategic choice. Thus, based on the strategy dimensions suggested by Porter (Porter, 1980, 1985), manufacturers that adopt the differentiation strategy and seek for being unique in its industry by attending some features that customers perceived as important, tend to invest in product design, information exchange, planning, low-volume flexible automation and high-volume automation technologies, which consecutively influence positively on both manufacturer's profitability and growth (Kotha & Swamidass, 2000).

On the other hand, there is no evidence of investments in any kind of technology when manufacturers pick the cost leadership strategy (Dean Jr & Snell, 1996; Kotha & Swamidass, 2000). This result sounds interesting once cost reduction is taken as the principal justification to acquire new technologies (Dean Jr, 1987).

In terms of manufacturing strategy, firms that pursue the flexibility strategy are more willing to invest in manufacturing technologies because of potential loss of profits, as accruing from not being able to deliver the product first, than by the increasing of competition at marketplace (Tseng, 2004). Although the risks of loss of profits and the acknowledge that manufacturing technologies allow to combine priorities as flexibility and cost to improve the performance (Goldhar & Jelinek, 1983; Meredith, 1987), Boyer (1998) found out that manufacturers which have focused on flexibility strategy have not invested in manufacturing technologies or in infrastructure to support it (Boyer, 1998).

The paradox between the acknowledgement of potential benefits from the technology acquisition and the lack of investments on it, in association with inconclusive results about the fit between strategy and technologies was justified by Kakati (1997) as the manufacturer's strategic myopia and the distance between customers/key competitive factors and new technologies adoption. According to the same author, firms still misunderstanding the manufacturing's strategic role owing to the narrow perception of the manufacturing competences on the exploitation of opportunities at marketplace. In addition, firms that are not integrated with external agents, specially the customers, are not able to pursue the competitive factors that are required by them (Kakati, 1997).

Additionally, the dissimilarities in the business environment may influence on the manufacturing technologies' success and its impact on firm's performance. This context was exemplified by Zhou and coauthors (2009) by depicting positive influence of manufacturing technologies investments on growth and profitability in Swedish manufacturers, while the same influence was not realized in firms from Singapore (Zhou et al., 2009). An other possibility is regard to the internal process environment and the kind of technology that is applied to each environment. Thus, as the process environment is divided into jobshop and assembly process, the different technologies to attend each process may act differently on the performance, providing results that remain inconclusive (Das & Narasimhan, 2001).

Moderating factors have also been considered when analyzing the anticipation of new technologies on firms' performance. In general, the organizational structure seems to play a crucial role in supporting the new technology success and in the improvement of the firms' results. Thus, lower level of hierarchy (decentralization) with large number of minor decisions coming from a large number of individuals/departments, less mechanist structure (Gupta, Chen, & Chiang, 1997), high integration level of manufacturing managers into firm's strategic planning (Tracey et al., 1999), high level of effort on multi-disciplinary planning team and on developing human factors (Efstathiades, Tassou, Oxinos, & Antoniou, 2000; Small & Yasin, 1997), high efforts on development of educational program for production manager (Ishii, Ichimura, Ikeda, Tsuchiya, & Nakano, 2009), employees' perception about the new technology functioning (Karuppan, 1997), manufacturing manager's personal beliefs about the outcomes from the technology adoption (Dimnik & Johnston, 1993), top managers support (Lewis, Ahlstrom, Yalabik, & Martensson, 2013) and people training (Hofmann & Orr, 2005; Machuca, Diaz, & Gil, 2004), strongly moderate the anticipation of new technologies–performance relationship. On the other hand, high level of formal documents and routine process (formalization), specialization (Gupta et al., 1997) and firm size have demonstrated weak moderation in that relationship (Swamidass & Kotha, 1998).

In short, the combination of strategic decision, process requirements and organizational culture may act as enablers to the new technologies implementation and moderators of the influence of technology adoption on performance (Adler, 1988; Chung, 1991; Das & Narasimhan, 2001; Dean Jr & Snell, 1996; Kotha & Swamidass, 2000; Small & Yasin, 1997; Stock & McDermott, 2001).

Due to the complexities inherent to acquisition of new technologies and the hazards associated with, analytical models to implement new technologies that match with firm' strategy, market expectances and some moderating factors have been provided by a body of scholars in order to elucidate the determinants of manufacturing technologies' success on firms performance. The analytical models deliver information about the current operational system and the kind of technology that might complement the existing resources to get optimal benefits from them (Chen & Small, 1994; Efstathiades et al., 2000; Kakati, 1997; Mohanty & Deshmukh, 1998; Small & Yasin, 1997; Tan, Lim, Platts, & Koay, 2006; Voss, 1988). Since implementation is defined as "*the user process that leads to the successful adoption of an innovation of new technology*" (Voss, 1988, p. 59), it is performed in phases/stages, which are named according to the authors perspective.

A basic analytical model is depicted in the Figure 2.

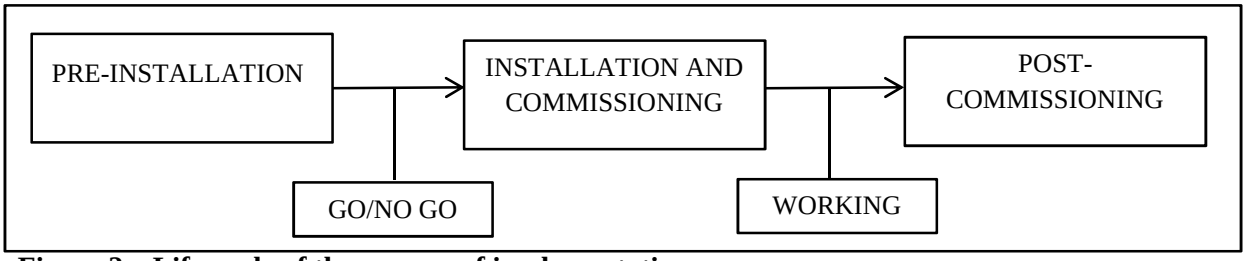

Figure 2 – Life-cycle of the process of implementation
Source: (Voss, 1988)

The implementation model proposed by Voss (1988) starts with the firm's background that may influence the result of technology implementation, involving strategic planning, technical planning, workforce consultation, skills, existing technology and managerial attitudes. The analysis of the firm background is located at pre-installation stage. Sequentially, the installing and commissioning stage is related to the the development of awareness about the available technologies and the matching between firm's background and the new technology. This stage ends when the process is working properly. The last stage is the analysis of the technology functioning and the further activities that are needed to update the technical success to business success (Voss, 1988).

Chen and Small (1994), based on Voss (1988) model, emphasized the pre-installation stage as crucial to the manufaturing technologies performance. Hence, the model porposed by them starts with business planning and evaluation of production process, followed by the monitoring of available technologies and finish with the pre-installation. To Chen and Small (1994) the pre-installation stage compreends the development of both organizational and

operational plans and a financial justification to acquire the new technology. In others words, at pre-installation stage all plant staff is communicated about the changes promoted by the new technology, team group and trainning are emphasized, the products that will be produced are defined, the needed technical skills are defined and the potential financial benefits are analysed (Chen & Small, 1994).

Other models that were proposed after Voss (1988) followed basically the same structure, yet with different termilogies (Ahmed & Sahinidis, 2008; Evans, Lohse, & Summers, 2013; Laosirihongthong & Dangayach, 2005; Naik & Chakravarty, 1992; Ramasesh & Jayakumar, 1993). In Efstathiades, Tassou and Antoniou (2002), the technology implementation model encompass planning stage, selection, transfer, pre-implementation stage and post-implementation stage (Efstathiades, Tassou, & Antoniou, 2002), while in Kakati (1997) the model is formed by business analysis, performance gap analysis, physical performance analysis and cost-benefit analysis (Kakati, 1997). Complementary Tan and coauthors (2006) proposed a model to deliver a decision support system for manufacturing technology investments, but the analysis of such technology on firm's performance was not treated (Tan et al., 2006).

In dynamic business organizations, the process of anticipating, investing and implementing new technologies have presented better results in organization where there is a learning enviroment. Thus, to maximize the chances of success in new tecnologies anticipation, firms should be skilled to acquire and transform the knowledge that comes with the new technologies and apply it in the routines (Mohanty & Deshmukh, 1998). Therefore, analytical models to implement new technologies should include some form of collective learning as part of the process (Rumelt, 1984).

Because of fast changes on the marketplace and the need to sustain the firms' competitiveness, firms must be constantly updated about the new technologies that are available to face and act proactively and, moreover, enjoy the benefits of being the first of introducing the product at market (Tseng, 2004). Thus, learning environments are considered crucial to keep the firm's competitveness due to its capacity to emphasize the continuous improvement process (Chung, 1991; Mohanty & Deshmukh, 1998).

Continuous improvement has been taken in literature as a practice that focuses on process efficiency by searching constantly alternative methods to improve the way that the production is performed. As it is resulting from learning environments, continuous

improvements' practices call for the participation of all staff to analyze regularly their jobs to foster great knowledge about the internal process, firm's capacity and current resources (Adler & Clark, 1991; Mogab & Cole, 2000).

Connecting the arguments above, we posit that anticipation of new technologies works as a new knowledge that must be assimilated by the staff and that this process becomes faster when there is a learning environment to support it. In this process, continuous improvement acts as a way to explore the new technology to optimize its results and get efficiency from it (Ishii et al., 2009).

Once the internal processes are improved by the anticipation of new technologies, upper performance is expected from it. Thus, better results are perceived in work standardization (Laosirihongthong, Paul, & Speece, 2003), cost reduction, product line breadth, delivery, products' quality (Swink & Nair, 2007; Tracey et al., 1999), productivity (Chung, 1991; Slagmulder, Bruggeman, & van Wassenhove, 1995), manufacturing lead time (Tseng, 2004), reliability of operations and flexibility (Mohanty, 1993). Because new technologies translate the insights of marketplace into exploitable goods, the benefits resulting from it is also related to the accuracy of product, company image (Laosirihongthong et al., 2003) and level of customer satisfaction (Tracey et al., 1999).

2.2.6 Continuous Improvement

Continuous Improvement is a very simple concept with wide open application that has been a starting point for companies the look for sustainable competitive advantage through better performance in the production's process.

Its origin is dated about 1950, in Japan, when American occupation forces dedicated efforts to help the country rebuild its industry after a severe economic problem raised after the Second World War. Thus, American experts were brought to Japan to teach the local executives about management training, quality and statistical methods in order to perform scientific methods-based experiences to eliminate waste in the production process and increase the profits (Terziovski & Sohal, 2000; Zangwill & Kantor, 1998).

In this process, Edward Deming, an American statistician, lectured to Japanese executives about manufacturing process emphasizing the importance of collect data, statistical

reasoning and the learning cycle approach, originally conceived by Shewhart in 1920 as Plan-Do-Check-Act (PDCA), to improve the production process and elevate the quality performance (Terziovski & Sohal, 2000; Zangwill & Kantor, 1998). Thus, the combination of this elements gave rise to the sense of constant enhancement on production process, as termed as Continuous Improvement or Kaizen. Continuous improvement is rooted in practices of Total Quality Management (TQM) to constantly organize, enhance and deliver efficiency to the production process (Mogab & Cole, 2000; Zangwill & Kantor, 1998).

Thus, as a direct result of TQM's philosophy, continuous improvement (CI) encompasses the mass participation of the employees (Terziovski & Sohal, 2000). It was best evidenced at Toyota's facilities, when in order to keep the processes efficiency, employees were encouraged to analyses regularly their jobs to find alternatives to improve the way that they were performed (Adler & Clark, 1991; Mogab & Cole, 2000). According to Imai (1986) "*the essence of Kaizen is simple and straightforward: kaizen means improvement. Moreover, Kaizen means ongoing improvement involving everyone, including both managers and workers*" (as cited in Terziovski & Sohal, 2000, p. 540).

Under this considerations, CI's definition relies on the firm's capacity to be constantly focused on perform small improvements on ongoing process, yet in high frequency, which analyzed singly may not impact significantly on the results, but in aggregate mode represent great contributions to performance (Bessant, Caffyn, Gilbert, Harding, & Webb, 1994; Mogab & Cole, 2000).

In spite of CI's origin is widely accepted among scholars, Bessant and coauthors (1993) revealed that continuous improvement was erroneously taken as a Japanese invention, once that practices involving changes in the process were evidenced since the Industrial Revolution in a Scottish shipbuilding company owned by W. Denny and Bros in 1871. At this company, employees were rewarded by improving any tool, machinery or work method to reach out upper performance in quality or low production cost (Bessant et al., 1993; Schroeder & Robinson, 1991).

Continuous Improvement was also evidenced at National Cash Register Corporation in 1894 thought the deployment of a suggestion system that was called "hundred headed brain" due to the amount of ideas got during the year. The goal of the suggestion system was involving the employees in the change process in order to find alternatives that could optimize the productivity and improve the quality (Schroeder & Robinson, 1991).

Regardless to the CI origins (Japanese, Scottish or American) its application in all possible backgrounds highlights changes on routines to upper performance. According to Bessant, Caffyn and Gallagher (2001), routine represents the way that the organization performs its activities or the way that it does better. So, continuous improvement acts on the existing routines changing their process through a modification in the organization behavior to support it (Bessant, Caffyn, & Gallagher, 2001).

Based on this statement, criticisms are raised due to the binary state view of Continuous Improvement and its short term activity instead of a process that it is developed along the time. In other words, the literature fails by considering the CI as an overnight process, wherein the organization has or has not it, neglecting the implementation time (Bessant et al., 2001).

Once CI is based on TQM, studies have strengthened this empirical underpinning by demonstrating the influence of quality management's practices on continuous improvement. Because CI is associated to unceasing small changes in process and products, soft quality management's practices are significantly more influent on continuous improvements than the hard ones(Jung & Wang, 2006). Marler (1998), in turn, found out that TQM training, work design and flexible technology are significantly and positively related to Continuous Improvement (Marler, 1998).

Besides Total Quality Management, the concept of Continuous Improvement allows connections with other constructs from distinct organizational areas. Studies pointed out that Human Resources policies may be related to Continuous Improvement philosophy once CI's practices encourage employees to be creative and committed to the production process in order to get efficiency (Jorgensen, Hyland, & Kofoed, 2008; Langbert, 2000). Zangwill and Kantor (1998), in turn, highlight that CI and Learning Curve (LC) should be handled together, because while the Learning Curve works based on acquired experience from producing an item to forecast when the production cost will drop, CI suggests how to do it on ongoing process, taking into account changes that optimize it, doing it better and faster (Zangwill & Kantor, 1998).

In this line, the Activity Based Costing (ABC) derived from Accounting section, when combined with environments that stimulate the employees to develop new improvements (Moulton, Oakley, & Kremer, 1993) and possess managers that tell employees how to improve (Reid, 1992), may provide information that is useful to get a competitive advantage

through Continuous Improvement's practices. This information includes the provision of process information with indication of priorities, the inspiration for appropriated comportment and the gauging of the outcomes (Böer, 1991; Turney & Stratton, 1992).

Continuous Improvement is also related to innovation. This relation happens mainly in companies which strive for amplify its market share, attending the customer needs and driving its production process and new product development to it (Irani & Sharp, 1997). Thus, although innovation and continuous improvement are relatively close by its definition, scholars have underlined the existence of a tenuous line that delimitates one from other. While Continuous Improvement is a function of ongoing efforts on the status quo to perform small progresses, innovation is the result of investments in new technologies or equipment to step forward the status quo. Thus, investing in Continuous Improvement does not mean spending capital on it, but it does mean investing in people who are going to be committed with it (Terziovski & Sohal, 2000).

Due to the low cost to deploy CI, this philosophy was spread among the companies, large and small ones, since there are no impediments to apply it. Even with the ease to deploy it, Continuous Improvement has been seen as strategy that lead the companies to the Competitive Advantage (Hyland, Mellor, & Sloan, 2007; Mogab & Cole, 2000; Waeytens & Bruggeman, 1994). According to what was mentioned previously, The competitive advantage afforded by the CI does not come from the difficulty of competitors to imitate or copy this strategy, since its concept is quite simple, not claiming by past experience and high investment to implement it (Bessant et al., 1994). Competitive advantage comes, in fact, from the struggle to maintain the CI at the same pace along the years, what creates a barrier to the competitors to go further and get advantage from it (Bessant et al., 1993; Bessant et al., 2001; Bessant et al., 1994; Gieskes, Baudet, Schuring, & Boer, 1997).

Evidences in Jordan manufacturing companies show that the adoption of CI as a practice faced some problems related to measurement performance, time, culture, funding and organizational commitment (Al-Khawaldeh & Sloan, 2007). Hence, to be successful on keeping the Continuous Improvement pace, firms must be willing to develop a culture that provides a friendly environment that stimulates the employees to participate and be committed to it (Irani & Sharp, 1997). In doing so, scholars described a list of organizational and individual characteristics that should work as enablers of continuous improvement's culture creation, as follow:

Organizational Characteristics	Individual Characteristics
- free information flow between managers and employees; - frequent contact between work sections, emphasizing the vertical relationship; - Emphasis on training and education of employees; - working in teams or small-group activities - share credits and recognize worker's CI efforts; - making the workplace a place where employees can pursue goals; - supportive managers who provide necessary resources for innovation, - standardizing the production process; and - managers who make time available for innovation.	- A clear initial view of the expected results; - ability to get support from both managers and colleagues; - courageous employees (take risks); - ability to handle interference or opposition to the project; - Being an informal leader among the workers; - Bringing social life into the workplace as much as practical and - force of character to keep the initial enthusiasm of the project.

Chart 7 – Organizational and Individual characteristics for Continuous Improvement's culture creation
Source: (Irani & Sharp, 1997; Mogab & Cole, 2000; Terziovski & Sohal, 2000)

The list of organizational and individual characteristics that generates the culture for CI's practices reinforces the proximity that other areas possess with CI by providing support to its execution. According to the Chart 6, Human Resources' policies seem to be very helpful to foster a culture for CI, to implement and maintain it, since this processes requires training, communication, interaction, proactivity, rewards and skills to perform it (Langbert, 2000).

Beyond of a culture towards to Continuous Improvement, the standardizing has been appointed by scholars as a critical practice that ensures that employees are in tune, dealing with the same set of information at their work station. Because CI's practices encourage the staff to be creative, take risks and introduce changes, the lack of standardizing causes a disarray in the production process caused by divergences of improvements at different work stations. Thus, standardizing acts as an equalizer so that all employees have the same information to perform the activities (Mogab & Cole, 2000).

To minimize the chances of chaos in the production process, interaction among workers through discussion circles and forums results in a brainstorm, wherein each one has the possibility to share with colleagues his/her ideas, problems faced at the work station and technological information of the whole process. Thus, being aware about the big picture, employees are more able to suggest improvements that benefit not only a work station, but the process as a whole, resulting in more agreement among workers and in fast implementation of the new improvement. To summarize, as more agreements about details and opinions of

improvements, the more effortlessly its deployment happens (Allen, 1977; Mogab & Cole, 2000).

As employees and units are able to share information and reuse the existing knowledge about process and products, it is expected to reduce the product development time, tooling and manufacturing costs, time to market, improve the quality performance, increase the productivity, the delivery reliability (Chapman, Hyland, Jenkins, & Sloan, 1997; de Ron, 1998; Gieskes et al., 1997; Jaber, Bonney, & Guiffrida, 2010; Terziovski & Sohal, 2000), customer satisfaction, safety and work conditions, employee commitment towards change, communication, cooperation (Coughlan, Harbison, Dromgoole, & Duff, 2001; Middel, Weegh op de, & Gieskes, 2007) and supplier and customers relation (Al-Khawaldeh & Sloan, 2007; Coughlan et al., 2001).

It is akin to say that Continuous Improvement influence the results of the new product development in terms of marketing and operational performance. Operational performance is related to low inventories, high-quality levels, low production cost and short delivery times, and marketing performance, in turn, is associated to the understanding about the customers' needs, customers' satisfaction and time to market (de Ron, 1998; Turney & Anderson, 1989).

2.2.7 New Product Development (NPD)'s performance

Product development is the rationale by which companies are in constant competition (Clark & Fujimoto, 1991). Once firms are unable to control fully the technical and market changes, product development has been one of the ways to deliver competitiveness due to its capacity to influence on the adaptation and renewal of the firm, matching with the market evolving and technical conditions (Schoonhoven, Eisenhardt, & Lyman, 1990).

Thus, firms which introduce new products at market expect to "*create technically superior products with unique features for emerging markets, with an ultimate goal of becoming the product and market leaders within their respective industries*" (Souder, Buisson & Garret, 1997, p. 439). Under this understanding, a set of meta-analyzes was performed to find out independent variables that are related to the new product development performance's success and, consecutively, the firm's competitiveness (Brown & Eisenhardt, 1995; Montoya-Weiss & Calantone, 1994; Verona, 1999).

In a literature scan, Montoya-Weiss and Calantone (1994) found out eighteen factors, grouped into strategic, development process, market environment and organizational factors, that were appointed as antecedents of NPD performance. Reflecting about other studies, the authors highlighted that in spite of the existing correlation between the results among studies, there is a lack of methodological rigor in measuring NPD performance, mainly in respect of internal validity (Montoya-Weiss & Calantone, 1994).

Brown and Eisenhardt (1995), in turn, mapped past researches on product development and identified three theoretical streams that, although overlap themselves in some points, are distinct by considering agents from different environments. These agents are supposed to have influence on the success of new product performance, which was measured by operational and business/financial performance (Brown & Eisenhardt, 1995).

The first stream is the "product development as rational plan" that focus on internal and external independent variables in product development that might impact on marketing and business performance. The second stream is named "product development as communication" and its main goal is elucidating variables related to external communication to improve the operational performance. Finally, the third stream is entitled "product development as disciplined problem solving" and it is centered in factors inherent to internal communication, learning and cross-functional team's development as antecedents of product's operational performance (Brown & Eisenhardt, 1995).

In addition, Verona (1999) provides a structure to analyze the product development performance supported by the resource based-view. According to the author, technical capabilities, external integrative capabilities, internal integrative capabilities and marketing capabilities, under the managerial support and the firm capacity of learning, may affect the product development performance in terms of process (operational performance) and product effectiveness (marketing performance) (Verona, 1999).

To summarize, the results from these three meta-analyzes upon product development's literature is depicted in the chart 8.

Authors	Independent Variables	Mediating Variables	Dependent variables
(Montoya-Weiss & Calantone, 1994)	Strategic factors; Development process factors; Market Environment factors; Organizational factors		New product performance (indicators not mentioned)
(Brown & Eisenhardt, 1995) – Rational Plan model	Team Composition; Team Organization of work; Senior management support; Product effectiveness; Market characteristics; Customer involvement; Supplier involvement		Product Performance: Profits Revenues Market share
(Brown & Eisenhardt, 1995) – Communication web model	Project leader's power	Team composition; Team internal communication; Team external communication	Product performance Technical performance Team performance Senior management performance Quality Budget Efficiency
(Brown & Eisenhardt, 1995) – Problem-solving model	Supplier involvement; Vision and power of project leader; Senior management control; Team composition	Team organization of work; Team internal communication	Operational performance Speed Productivity Product Concept Effectiveness Product Integrity
(Verona, 1999)	Managerial decisions; Firm's learning capacity	Technological capabilities ;External integrative capabilities; Internal integrative capabilities; Marketing capabilities	Product performance Product effectiveness Process efficiency

Chart 8 – Antecedents of New Product Development's performance
Source: elaborated by the author

As depicted in chart 8, the results of the meta-analysis are consistent among them once provided common antecedents of NPD success. The main difference between the approaches of each author is the rationale behind who comes first in the path analysis. In others words, there is a mismatching about which variables assume the very independent position and which ones assume the mediating role in the path analysis of NPD performance.

More recent studies have strengthened the results shown in those meta-analysis and have also identified other antecedents that could favor or hamper the NPD's performance. Thus, higher level of satisfaction of top-level managers about the NPD efforts, marketing skills, NPD proficiencies, customer-driven NPD (Jeong, Pae, & Zhou, 2006; Kahn, 2001; Souder et al., 1997), knowledge management method implementation, high technologies adoption (Jeong et al., 2006; Liu, Chen, & Tsai, 2005), firm's innovativeness (Holahan,

Sullivan, & Markham, 2013), internal and external communication (Badir, Buechel, & Tucci, 2008), cross-functional coordination (de Visser et al., 2010), information system capability, intelligence quality (Bendoly, Bharadwaj, & Bharadwaj, 2012), inward technology licensing (ITL) (Wang & Li-Ying, 2014), environmental policies (Pujari, Wright, & Peattie, 2003) and concurrent engineering (Koufteros et al., 2001) have been considered as positive antecedents of NPD's performance.

On the other hand, the avoidance of ambiguities, internal department focus, inertia (Adams, Day, & Dougherty, 1998) and open innovation process (Praest Knudsen & Bøtker Mortensen, 2011) have presented negative influences on the same event. Manufacturing practices as quality function deployment (QFD) were not significantly related to NPD success/failures (Griffin, 1992).

In addition, yet according to the chart 8, product development performance has been measured by academics through indicators that represent the overall firm's upper performance, mainly in terms of operational performance. In contrast, Griffin and Page (1993) alerted that the measures used by managers to assess the same event lies on the evaluation of individual product success, which are market share, volume, customer acceptance and customer satisfaction (Griffin & Page, 1993).

Due to the dissimilarities in NPD measures between managers and academics and also between academics, there was a discussion among scholars about the best measure to analyze the product development performance. The idea behind this discussion was minimizing the plurality of results when assessing both the success and failures of product development and make easier the generalizations across the investigations (Burger, 1989).

Hence, during the Product Development and Management Association (PDMA) International Conference, it was agreed that product development performance should be analyzed under operational, marketing and financial/business aspects, which will vary according to the company strategy. Accordingly, while firms that strategically dedicate little focus on innovation put more efforts on measuring the efficiency of new product development; innovative companies evaluate the product development by the increasing of the firm's growth (Griffin & Page, 1996).

Even with such convention among scholars, NPD performance's measure still wide open in the latest literature. Some studies have measured NPD performance as a single

construct, covering indicators of operational, marketing and business performance, while others have chosen only some indicators of those performances to represent the NPD performance's construct. Thereby, NPD performance has been measured by total sales (Wang & Li-Ying, 2014), time-to-market (Liu et al., 2005; Prašnikar & Škerlj, 2006), growth in revenues from the product, growth in profitability of the product (Li, Chu, & Lin, 2010; Liu et al., 2005), process efficiency (Pujari et al., 2003), customer acceptance, technical performance (Jeong et al., 2006), manager perception of perfect performance (Kahn, 2001), low operational cost (Chen, Yeh, & Yang, 2006; Swink, Talluri, & Pandejpong, 2006), speed of product development (Cohen, Eliashberg, & Ho, 1996), flexibility (de Weerd-Nederhof, Visscher, Altena, & Fisscher, 2008), quality (Gomes, de Weerd-Nederhof, Pearson, & Cunha, 2003; Swink et al., 2006), lead time, productivity, fit with market needs, profits, revenues and market share, (Brown & Eisenhardt, 1995; Verona, 1999).

Surprisingly, no studies have considered NPD performance as a multi-dimensional construct that embraces operational, marketing and business performance. Thus, there are few evidences of the relationship between those performances, in consequence, there is a limited theoretical logic to support those relationships (Brown & Eisenhardt, 1995).

2.3 HYPOTHESES CONSTRUCTION

Since the theories and their respective operational variables were discussed in the sections 2.1 and 2.2, this topic is dedicated to connect those variables and elucidate the hypotheses that will guide this research. Based on the literature review previously presented, we'll be building an model to analyze the influence (direct and indirect) of supply chain agents on new product development and, consequently, the supply chain competitiveness.

The model structure starts with the firm's guidance to cooperate with partners and the involvement of such partners into NPD. Involving partners is a form to minimize the uncertainties that hamper the process of new product development. Once environmental turbulence is defined as the degree of changes in the consumer's preferences and needs (Daft & Lengel, 1986); the higher the environmental turbulence, the higher the need to involve partners both internally and externally.

Environmental turbulence generates the lack of information about customers' expectations, components and technologies that might lead the company to offer products that are not according to the market needs and, consequently, lose its competitiveness (Daft & Lengel, 1986; Tushman & Nadler, 1978). Under this point of view, we assume that different levels of environmental turbulence moderates the relationship between the firm's guidance to cooperate and the involvement of partners into new product development.

Before integrating externally, firms must integrate their internal areas, as manufacturing, design, marketing and P&D. As marketing, design and P&D are usually involved into NPD process; we opt for involving manufacturing (as representative of internal integration) as a form of having the right understanding about the firm's knowledge, production capacity and resources to perform the NPD. Considering that manufacturing involvement is interiorly focused, such involvement leads the company to realize the scarcity of resources to perform the NPD's project and the dependence of external linkages to acquire those needed resources (Gerwin, 1993) .

Hypothesis 1a: Firm's guidance to cooperate influences positively the manufacturing involvement into new product development.

External linkages like involving supplier and customers into NPD might be the fastest way to update the firm's capacity to develop new products that are according to the market expectations (Powell et al., 1996). The first reason behind it lays on the supplier ability to provide information about the finest components that are better suited to the product development as well as the new technologies that are available to enhance the production (Handfield et al., 1999; Koufteros et al., 2005; Liker et al., 1996). This process is also complemented by the customer involvement due to its capacity to provide accurate information about the market and the customer's needs (Calvert, 2003; Li & Calantone, 1998). Thus, we posit that:

Hypothesis 1b: Firm's guidance to cooperate influences positively the supplier involvement into new product development.

Hypothesis 1c: Firm's guidance to cooperate influences positively the customer involvement into new product development.

The cooperation between the manufacturer and its partners is supported by the social capital theory by considering that the cooperation is the result of strategic investments on

relationships with partners to overcome the scarcity of resources and the uncertainties generated by the environmental turbulence. Strategic investments on relationships are, basically, focused on outperforming to reach out mutual benefits (Bourdieu, 1980; Coleman, 1988).

Once the supply chain agents are involved into NPD, each one plays specific roles that are according to the agreements made when they were called to integrate with. Simultaneously, the influence of those agents stimulates the manufacturer to move from its status quo and search for alternatives that are suited to the information that was received from them.

Agents, as customer involvement, provide insights from market that pressure the manufacturer to get efficiency in the process to offer low prices, high quality, shorter delivery cycles and innovation. As customer's preferences changes over time, the search for efficiency in process becomes dynamic and hard to get it. Thus, manufacturers are challenged to find alternative new technologies to optimize the process and offer the desirable requirements to the market (Calvert, 2003; Gatignon & Xuereb, 1997; Gruner & Homburg, 2000).

Hypothesis 2a: Customer involvement into new products development influences positively on the anticipation of new technologies.

Hypothesis 2b: Customer involvement into new products development influences positively on the operational performance.

Supplier involvement, in turn, encompasses the plans and technical knowledge that associated with new technologies acquisition enables the plans execution and allows getting benefits from it. Thus, supplier involvement's effectiveness may affect the degree of new technologies adopted by the manufacturer to develop new products and vice versa (Narasimhan et al., 2010).

Hypothesis 3a: Supplier involvement into new products development influences positively on the manufacturer's anticipation of new technologies.

Supplier involvement also promotes the information sharing between partners and excites the organizational learning that is crucial for learning-oriented companies to seek for innovations (Hurley & Hult, 1998). Learning efforts is represented by the acquisition, assimilation and implementation of knowledge on organizational practices through the

reorganization of routines to improve operations (Crossan, Lane, & White, 1999). Internal reorganization based on external information to get better results has been named as continuous improvement, which is defined as the constant learning process to enhance the process, products, schedules, capabilities and technology changes (Bessant et al., 2001). It is akin to say that involving supplier into new product development leads the manufacturer to exercise the continuous improvement and, in turn, enhance the operational performance. Thus, we posit that:

Hypothesis 3b: Supplier integration into new products development influences positively the manufacturer's continuous improvement.

Hypothesis 3c: Supplier integration into new products development influences positively the operational performance.

Finally, through the information got from external partners and bearing in mind that the production process is a reply to the market requirements and that those requirements have changed rapidly, involving the manufacturing into NPD implies on constant enhancement on production process. Constant changes lead the manufacturer to learn from new scenarios and get ready to adapt its internal process according to new demands (Tse, 1991; Zangwill & Kantor, 1998).

Hypothesis 4: Manufacturing involvement into new products development influences positively on the manufacturer's continuous improvement and learning.

Hypothesis 4a: Manufacturing involvement into new products development influences positively on the operational performance.

Anticipation of new technologies (ANT) also plays an important role on continuous improvement. The main reason for that is that manufacturing technologies must be updated at pace of market changes. This fast update seems to be successful in environments where there is a philosophy of constant enhancements and learning (Swink & Nair, 2007; Tracey et al., 1999).

As new technologies are new information from external environments and continuous improvement is related to the processing of external information to improve internal process and get commercial benefits from it, we assume the ANT represents the absorptive capacity's

acquisition stage, while the continuous improvement refers to the assimilation one. Hence, we hypothesized that:

Hypothesis 5a: Anticipation of new technologies influences positively on the manufacturer's continuous improvement.

Once the internal processes are improved by the anticipation of new technologies, upper performance is expected from it. Thus, better results are perceived in work standardization (Laosirihongthong et al., 2003), cost reduction, product line breadth, delivery, products' quality (Swink & Nair, 2007; Tracey et al., 1999), productivity (Chung, 1991; Slagmulder et al., 1995), manufacturing lead time (Tseng, 2004), reliability of operations and flexibility (Mohanty, 1993). Because new technologies translate the insights of marketplace into exploitable goods, the resulting benefits from it is also related to the accuracy of product, company image (Laosirihongthong et al., 2003) and level of satisfaction of customers (Tracey et al., 1999).

In this same line, continuous improvement enhances the efficiency of process resulting in operational performance, that in turn, offers quality, price, delivery and flexibility to customers, affecting their level of satisfaction and acceptance of goods (Chapman et al., 1997; de Ron, 1998; Gieskes et al., 1997; Jaber et al., 2010; Terziovski & Sohal, 2000). In short, we posit that anticipation of new technologies and continuous improvement act complementary providing both operational and marketing performance.

Hypothesis 5b: Anticipation of new technologies influences positively on the NPD's operational performance.

Hypothesis 5c: Anticipation of new technologies influences positively on the NPD's marketing performance.

Hypothesis 6a: Continuous Improvement influences positively on the operational performance of the new product development´s process.

Hypothesis 6b: Continuous Improvement influences positively on the marketing performance of the new product development's process.

Successful operational performance, through productive process, means lower prices that lead to a great product success. Moreover, faster process generates flexibility and time shortening to product launch. Hence, products with high operational performance are more

attractive to customers since they are available faster at market, offering uniqueness and lower prices, that in turn, influences on business performance (Brown & Eisenhardt, 1995). Thus we posit that:

Hypothesis 7a: NPD's operational performance influences positively on the NPD's business performance.

Operational performance may yet have influences on marketing performance. Low-cost, unique benefits, high quality and product specifications according to the market needs are likely to be nice-looking to consumers, impacting on their acceptance and satisfaction and, consequently, on marketing performance (Cooper & Kleinschmidt, 1987, 1993; Kleinschmidt & Cooper, 1991). Hence, we have:

Hypothesis 7b: NPD's operational performance influences positively on the NPD's marketing performance.

Finally, as a result of customer's acceptance and satisfaction, the marketing performance influences on the business performance through the increased sales, profits, returns on investments (ROI) and market share (Zirger & Maidique, 1990).

Hypothesis 8: NPD's marketing performance influences positively on the NPD's business performance.

As mentioned previously, the test of those hypotheses will provide more accurate information about the supply chain agents' influence on NPD, when they are analyzed jointly, without flouting variables that moderate and intermediate such influences. Given the complexity of the proposed analytical model, it offers a big picture view of NPD's process, starting from the firm's guidance to cooperate and ending with the business performance.

The illustration of the arguments presented and the hypotheses created are depicted in the Figure 3

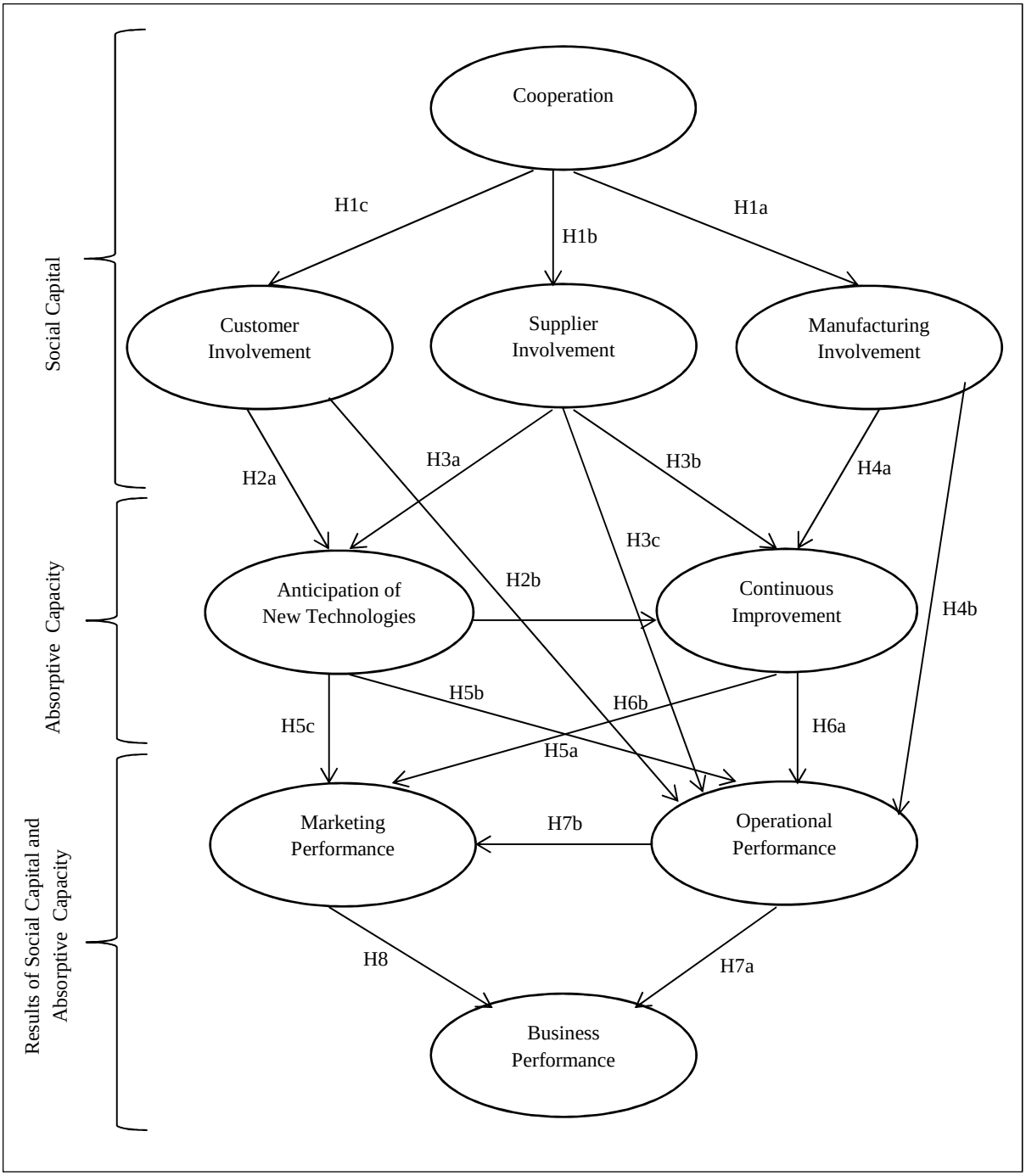

Figure 3 – Supply Chain's proposed analytical model
Source: elaborated by the author

3 METHODOLOGY

This topic is dedicated to the clarify the epistemological framing of this research, as well as providing information about the data collection instrument, data collection, scales validation, sampling and quantitative techniques to analyze the data.

3.1 RESEARCH PARADIGM

The theoretical positioning of this research is lined with the schemes proposed by Burrel and Morgan (1979) to analyze the assumptions about the nature of social science and the paradigms for the analysis of social theory.

In terms of assumptions, Burrel and Morgan (1979) have pointed out that the social sciences must be evaluated under four assumptions (ontology, epistemology, human nature and methodology) which are related to the forms that the inquired phenomenon is seen and understood. Each assumption, in turn, possesses distinct school of thoughts that classify them into subjectivist and objectivist dimension. The Figure 4 depicts those dimensions.

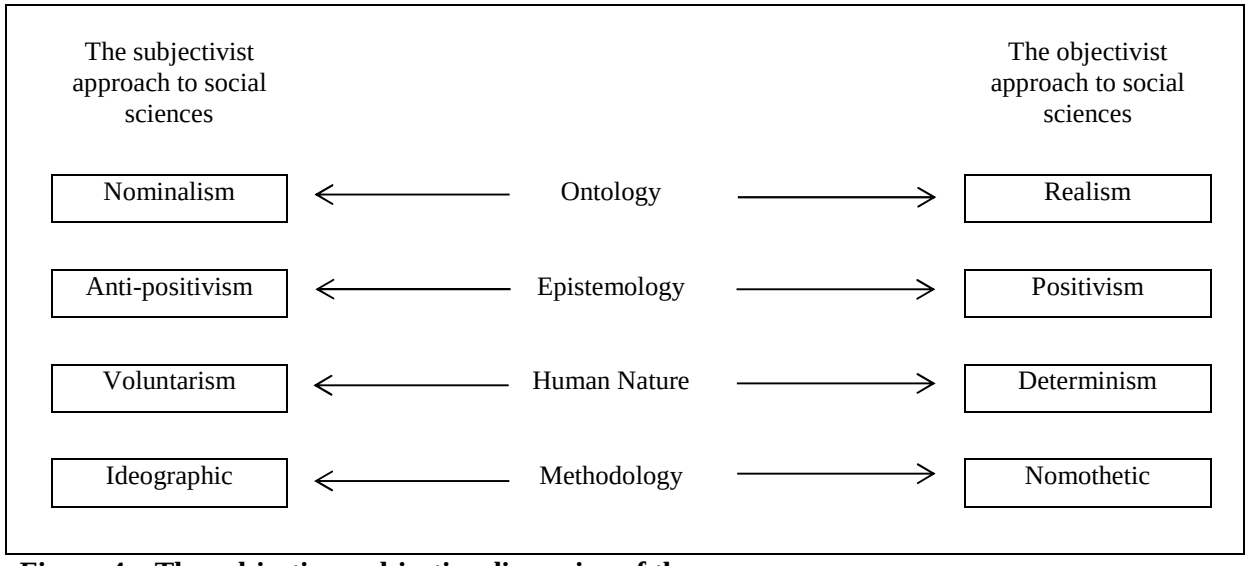

Figure 4 – The subjective – objective dimension of the
Source: (Burrell & Morgan, 1979)

Ontology refers to the discussion about the nature of the reality. Is it external from conscious or a product of individual consciousness? Is it given or it is a product of the mind? The answers to these questions classify the ontology into nominalism and realism.

Nominalism is related to the abstract view of the social world, wherein there is no real structure to described it. Thus, the reality is a set of names, concepts and labels that are used to frame the social world. Realism, oppositely, stands that the social world that is external to the individual cognition is physical, real and tangible. On the word of the realism, the social world has its own existence and it isn't created by the individuals (Burrell & Morgan, 1979).

Sequentially, epistemology is related to the forms that the communication must be established and how the knowledge is received. Thus, epistemology is studied on the basis of the positivism and anti-positivism. Positivism stands that the knowledge is accrued from the regularities and causal relationships between its members. Under this point of view, the knowledge is basically acquired instead of experimented. Counteracting, anti-positivism stands that the knowledge is received when the individuals are straightly connected with the studies' activities and thus, it is experienced instead of acquired. In this line, anti-positivism flouts the idea of objective knowledge as coming from the science (Burrell & Morgan, 1979).

Human nature, in turn, is associated with the model of man that is presented in the social theories and may be understood under the standpoint of the voluntarism and determinism. Voluntarism refers to the autonomy and free-willed of man in regards to the environment whilst the determinism is associated with anonymity of man, with activities totally driven by the environmental in which he is placed. In other words, voluntarism reflects the self-interest activities performed by man, while the determinist reflects the tailored made nature of man (Burrell & Morgan, 1979).

Finally, the methodology is allied to the three perspectives presented previously once each of them has distinct methodological operationalization, which might be ideographic or nomothetic. The ideographic approach is based on the idea of self-exposition in everyday flow of live and getting inside situations of study, what generates subjective knowledge about the environment. On the other side, the nomothetic approach lays on the importance of using protocols and techniques to get measurable knowledge and test hypothesis (Burrell & Morgan, 1979).

Thus, based on the subjective-objective dimension this dissertation is framed in the objectivist approach by considering that the relationship between organizations is strategically thought, self-interested and has a purpose (determinism). Such relationship encompasses information sharing and constant interaction between partners that promotes the knowledge acquisition in both parts (positivism). The relationship, as firms' social capital, result in

benefits that are tangible for them, being realized through the increased competitiveness and successful operational, marketing and business performance (realism). Given this context, this dissertation adopts the nomothetic approach as methodology, using surveys, tests of hypothesis and quantitative techniques with the canons of scientific rigor (Burrell & Morgan, 1979).

In terms of presumption of the nature of society, Burrel and Morgan (1979) have classified it into regulation and radical change. The sociology of regulation stands for explaining the society unity and cohesiveness through the regulation of human affairs. Contrasting, the sociology of radical change seeks to offer explanations about the modes of domination, structural conflict and structural contradiction that are inherent to the modern society (Burrell & Morgan, 1979). The features of each nature are depicted in the Chart 9.

The sociology of REGULATION is concerned with:	The sociology of RADICAL CHANGE is concerned with:
a) The *status quo* b) Social Order c) Consensus d) Social Integration and cohesion e) Solidarity f) Need satisfaction g) Actuality	a) Radical change b) Structural conflict c) Modes of domination d) Contradiction e) Emancipation f) Deprivation g) Potentiality

Chart 9 – The regulation – radical change dimension of the nature of society
Source: (Burrell & Morgan, 1979)

Burrel and Morgan (1979) clarify that although *status quo* is a feature of the sociology of regulation, it doesn't mean that the society is static. The real sense of status quo to this approach is about the goal of such approach in understanding the *status quo*. Further explanations were also target to the term "need satisfaction", which is related to focus on the individual satisfaction in the social world. Need satisfaction is in stark contrast with the term "deprivation", once the later consider that the social system prevents the human fulfilment.

Under the regulation-radical change dimension of the nature of society, this research is rooted in the sociology of regulation due to the features imbued in the social relationship established between firms. By involving partner into internal process, firms are willing to satisfy their own needs through the social integration, cohesion and consensus. Thus, firms are more willing to satisfy their goals that will benefit them than private themselves from get them (Burrell & Morgan, 1979).

Finally, through the combination of the two dimensions (subjective-objective and regulation-radical change), Burrel and Morgan (1979) established four sociological paradigms to analyze the social theory. Those paradigms are shown in the Figure 5.

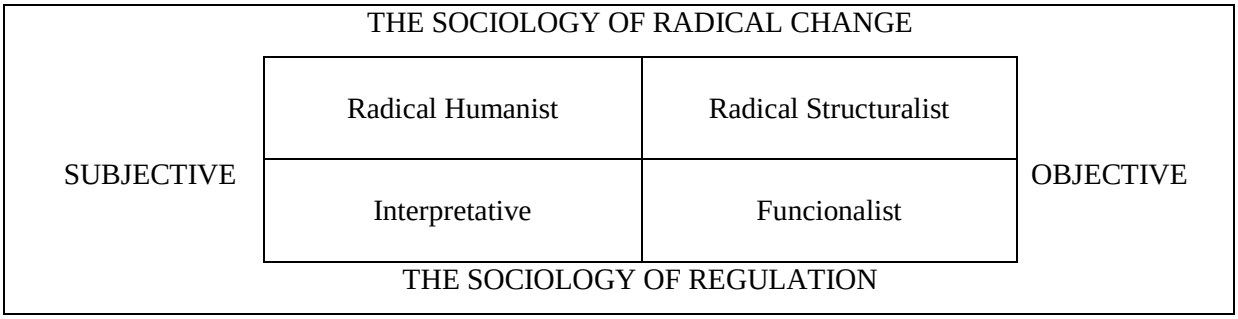

Figura 5 – Four paradigms for the analysis of social theory
Source: (Burrell & Morgan, 1979)

Considering the positioning of this dissertation in the dimensions discussed previously, the course of this study is place in the Functionalist paradigm, which encompasses elements of objective approach and sociology of regulation. In short, this paradigm is highly pragmatic by concerning to generate knowledge that might be put to use (Burrell & Morgan, 1979). Thus, the theory the covers this dissertation is taken with objectivist approach, rooted in the sociology of regulation and analyzed from the functionalist paradigm' standpoint.

3.2 RESEARCH DESIGN

This study is framed as both descriptive and causal research, cross-sectional and with usage of quantitative method. The descriptive research takes into account the description on characteristics of given samples without intention to explain them. Moreover, descriptive research is also concerned about the relationship between variables in order to provide associations and correlations, but not causal evidences (Rubin & Babbie, 2013; Stephen & Bender, 2010). In the context of this research, we seek to describe the influence of supply chain agents on the new product development when they are analyzed jointly. In addition, the establishment of variables connection through the test of hypothesis, although rare in descriptive researches, leads to the understanding of the features of the sample that are significant to establish those connections.

Causal research, in turn, leads to the understanding that changes in the independent variable might cause changes on dependent variables. In this kind of research, four conditions must be taken into account: temporal sequence, covariation, not spurious association and theoretical support. Temporal sequence means that the independent variable (the cause) must happen before the dependent variable (the effect); covariation stands that both variable must be related to each other; not spurious association is related to the veracity of the relationship between variables and that it is not related to others variables else. To do so, others variables must be controlled. Finally, theoretical support presents a logical explanation about the existence of relationship between variables (Hair Jr., Babin, Money, & Samouel, 2003).

As this research considers that the firm's guidance to cooperate is an antecedent of supply chain agents involvement into new product development, and that the intensity of such relationship is moderated by the degree of environmental turbulence, industry and location; and bearing in mind that the involvement of supply chain agents leads to the improved firm's absorptive capacity, we assume that there is a causal relationship between those variables.

This research is also classified as cross-sectional by collecting data in a given point of time, without the need of collecting data again. Cross-sectional descriptive analyses provide an overview about some phenomenon, elucidating the features of such phenomenon. The data is usually collected through surveys which enable the gathering of primary data from the inquired individuals. The data gathered through surveys are about beliefs, opinions, attitudes, life style or even general information about the individual or company, as profits and number of employees (Hair Jr. et al., 2003). Due to the context of this research (described in the section 3.3) the survey procedures are totally appropriated with achievement of the objectives described in the section 1.2.

To test such relationships we used quantitative methods through the use of statistics techniques, which makes feasible test of hypothesis described in the section 2.3. Quantitative methods beyond the test of relationship between variables are also related to the measure of the variables that will be tested. Thus, quantitative methods are suited to test theories through the relationship between variables (Creswell, 2010).

3.3 RESEARCH CONTEXT

This dissertation is part of the global project named High Performance Manufacturing (HPM), which began in 1989 in United States of America with the aim of understanding the emergence of Japanese factories in the United States. At that time, it was believed that the best U.S. plants could match Japanese transplants in practices and performance, but that the average U.S. plants would not compare well. Thus, an initial group of researchers from the University of Minnesota and Iowa State University conducted Round 1 of data collection (Schroeder & Flynn, 2001).

There was soon interest from professors in others countries who also wanted to participate in this project by collecting comparative data in their respective countries. With research funding provided by the National Science Foundation, the McKnight Foundation, the Japan-America Friendship Foundation and other sponsors, the project evolved in breadth and content (Schroeder & Flynn, 2001).

The Round 2 started in 1996 and beyond Japan and USA, Germany, Great Britain and Italy also participated in the data collection. Currently the project is in the Round 3 and involves Japan, USA, Germany, Austria, China, South Korea, Brazil, Italy, Spain, Sweden and Finland.

The project is restricted to productive plants belonging to electronics, machinery and transport equipment industries. The choice of these industries is because their fast product introduction at market, high levels of innovation, high clockspeed and are also considered as transitioning industries. Due to this context, it's expected that plants which belong to these industries may present a range of operational practices and distinct performances.

Thus, the project gathers information about the multiplicity of attributes inherent to the productive plants, raising the state-of-art of operational practices and comparing the results between plants belonging to the same industries from the same country and cross-country. This process establishes a rationale of best practices, allowing manufacturer to update their skills and keep competitive in the marketplace.

In Brazil, this project is conducted by the Professor Ely Laureano Paiva from Fundação Getúlio Vargas (FGV) in partnership with others scholars from different Brazilian universities.

3.4 INSTRUMENT AND DATA COLLECTION

This study did not have a specific instrument of data collection since the scales came from the scales proposed by the HPM project. Those scales have been used for scholars that, in somehow, are associated with some country leader with articles figured in top journals of Operations Management area.

The HPM' scales were built through the contribution of scholars around the world according to their area of interest. Since 1989, over two hundred scales have been built, encompassing thereabout 3,000 items. From this set of scales, this study explores the following ones: cooperation, supplier involvement, customer involvement, manufacturing involvement, anticipation of new technologies, continuous improvement and new product development' success. Those scales, except the new product development' success, were set up with 7 point-Likert scale as: (1) Strongly disagree; (2) Disagree; (3) Disagree somewhat; (4) Neither agree nor disagree; (5) Agree somewhat; (6) Agree; (7) Strongly agree. The scale of new product development' success had different response option as: (1) Significantly better; (2) Better; (3) Somewhat better; (4) About the same; (5) Somewhat worse; (6) Worse; (7) Significantly worse.

The scales related to the same area were converted into questionnaires and were targeted to a specific function in the manufacturer. In the end of the process, twelve questionnaires were built and are referent to accounting, human resources management, information system management, inventory management, direct labor, plant management, plant superintendence, engineering process, product development, production control, quality management and supervision.

3.4.1 Constitutive (CD) and operational definition (OD) of the scales

This section presents the definition and operationalization of the scales used in this study. Such definitions seek to clarify the construct and its form of measurement.

a) Cooperation

CD: Cooperation is the act of integrating partners into routines, transacting resources, striving to attain collective and self-interest goals and dividing task and functions among members (Borys & Jemison, 1989; Pinto et al., 1993; Swink & Song, 2007).

OD: Cooperation was measured through the manager's perception about the company's guidance to integrate partners into internal routines. The operationalization of it follows in the Chart 10.

Code	Items of the scale	Orientation	Reference
COOPN01	We work as a partner with our suppliers, rather than having an adversarial relationship.	Normally scaled	(Benton & Maloni, 2005; Prahinski & Benton, 2004)
COOPN02	We encourage employees to work together to achieve common goals, rather than encourage competition among individuals.	Normally scaled	
COOPN03	We work as a partner with our customers.	Normally scaled	
COOPN04	We believe that cooperative relationships will lead to better performance than adversarial relationships.	Normally scaled	
COOPN05	We believe that the need for cooperative relationships extends to both employees and external partners.	Normally scaled	
COOPN06	We believe than an organization should work as a partner with its surrounding community.	Normally scaled	
COOPR07	Sometimes we encourage competition among employees, in order to improve their performance.	Reverse scaled	

Chart 10 – Cooperation scale's items
Source: High Performance Manufacturing project

b) Supplier Involvement

CD: supplier involvement is a new or existing relationship between the buyer and the supplier to strive benefits for both through collaborative activities (Ellram, 1995).

OD: Supplier involvement was measured in terms of practices of supplier integration into new projects. The items are depicted in the Chart 11.

Code	Items of the scale	Orientation	Reference
SUPPN01	Suppliers were involved early in the design efforts, in this project.	Normally scaled	(Chen & Paulraj, 2004)
SUPPN02	We partnered with suppliers for the design of this product.	Normally scaled	
SUPPN03	Suppliers were frequently consulted about the design of this product.	Normally scaled	
SUPPR04	Suppliers were selected after the design for this product was completed.	Reverse scaled	
SUPPN05	Suppliers were an integral part of the design effort.	Normally scaled	

Chart 11 –Supply Involvement scale's items
Source: High Performance Manufacturing project

c) Customer Involvement

CD: Customer involvement is a formalized working relationship between a customer and a manufacturer which involves performing coordinated development activities to develop a new product (Campbell & Cooper, 1999).

OD: Customer involvement was measured in terms of practices of customer integration into new projects. The items are depicted in the Chart 12.

Code	Items	Orientation	Reference
CUSTN01	We consulted customers early in the design efforts for this product.	Normally scaled	(Cua, McKone, & Schroeder, 2001)
CUSTN02	We partnered with customers for the design of this product.	Normally scaled	
CUSTN03	Customers were frequently consulted about the design of this product.	Normally scaled	
CUSTR04	Customers became involved in this project only after the design was completed.	Reverse scaled	
CUSTN05	Customers were an integral part of the design effort for this project.	Normally scaled	

Chart 12 - Customers Involvement scale's items
Source: High Performance Manufacturing project

d) Manufacturing Involvement

CD: Manufacturing involvement refers to its participation on new product development, once this activity is usually performed by marketing and P&D (Pisano & Wheelright, 1995; Shapiro, 1977).

OD: Manufacturing involvement was measured through items which reflect the manufacturing participation in the product development stages. Its operationalization is depicted in the chart 13.

Code	Items	Orientation	Reference
MANUN01	New product design teams have frequent interaction with the manufacturing function.	Normally scaled	(Ward, Leong, & Boyer, 1994)
MANUN02	Manufacturing is involved at the early stages of new product development.	Normally scaled	
MANUN03	The manufacturing function is key in improving new product concepts.	Normally scaled	
MANUN04	Manufacturing is given challenging tasks in the development of new product concepts.	Normally scaled	

Chart 13 - Manufacturing Involvement scale's items
Source: High Performance Manufacturing project

e) Anticipation of new technologies

CD: Anticipation of new technologies refers to the manufacturer willingness to acquire technologies that convert insights from the marketplace into exploitable knowledge to deliver products or services that are according to the market expectations (Egelhoff, 1988 as cited by Kotha & Swamidass; 2000).

OD: It was operationalized through the manager's perception about the firm's guidance to acquire new manufacturing technologies. Its items are depicted in the chart 14.

Code	Items	Orientation	Reference
TECHN01	We pursue long-range programs, in order to acquire manufacturing capabilities in advance of our needs.	Normally scaled	(Tracey et al., 1999)
TECHN02	We make an effort to anticipate the potential of new manufacturing practices and technologies.	Normally scaled	
TECHN03	Our plant stays on the leading edge of new technology in our industry.	Normally scaled	
TECHN04	We are constantly thinking of the next generation of manufacturing technology.	Normally scaled	

Chart 14 - Anticipation of New Technologies scale's items
Source: High Performance Manufacturing project

f) Continuous Improvement

CD: Continuous Improvement refers to the firm's capacity to be constantly focused on perform small improvements in ongoing process, yet in high frequency, which analyzed singly may not impact significantly on the results, but in aggregate mode represent great contributions to performance (Bessant et al., 1994; Mogab & Cole, 2000).

OD: Continuous Improvement was measure through the manager perception about the firm's guidance to improve internal process to get better results. It is shown in the chart 15.

Code	Items	Orientation	Reference
CONTN01	We strive to continually improve all aspects of products and processes, rather than taking a static approach.	Normally scaled	(Flynn, Schroder, & Flynn, 1999)
CONTN02	If we aren't constantly improving and learning, our performance will suffer in the long term.	Normally scaled	
CONTN03	Continuous improvement makes our performance a moving target, which is difficult for competitors to attack.	Normally scaled	
CONTN04	We believe that improvement of a process is never complete; there is always room for more incremental improvement.	Normally scaled	
CONTN05	Our organization is not a static entity, but engages in dynamically changing itself to better serve its customers.	Normally scaled	

Chart 15 - Continuous Improvement scale's items
Source: High Performance Manufacturing project

g) New product development' success

CD: New product development success is associated with the creation of "*technically superior products with unique features for emerging markets, with ultimate goal of becoming the product and market leaders within their respective industries*" (Souder, Buisson & Garret, 1997, p. 439).

OD: New product development' success was split into three dimensions and were operationalized in terms of manufacturing, marketing and business performance. The operationalizing items are shown in the chart 16.

Code	Items	Type of Performance	Reference
BUSIN01	Market share	Business	(Brown & Eisenhardt, 1995)
BUSIN02	Overall profitability	Business	
BUSIN03	Return on investment	Business	
MARKN1	Customer satisfaction	Marketing	
MARKN2	Overall commercial success	Marketing	
MARKN3	Time to market	Marketing	
OPERN01	Technical performance relative to specifications	Operational	
OPERN02	Ease of manufacturing	Operational	
OPERN03	Unit manufacturing cost	Operational	
OPERN04	R&D budget	Operational	

Chart 16 - New Product development' scale items
Source: High Performance Manufacturing project

As the scales are part of a project which began in 1989, we had no access to the articles that gave rise to the scales used in this study. In spite of that, the articles cited in the column "Reference", from the chart 10 to the chart 16, totally support the items in their respective charts.

3.4.2 Data Collection

Because the global nature of the HPM project, the questionnaires were distributed to eleven countries, as Germany, Austria, China, South Korea, Spain, EUA, Finland, Italy, Japan, Sweden and Brazil. In each country a leader was elected who was responsible to collect data. As the questionnaires were originally developed in English, each country leader translated the questionnaires into their local language to collect the data. Before collecting

data, it was requested to the country leaders to translate the questionnaires back to English and compare the both versions, the original and the translated one. If the sense of the items in each scale was preserved, the data collection was ready to get started; otherwise, a new more accurate translation was requested to adjust the items misunderstood. This approach is taken as a mean to minimize the chances of measuring different items all over the countries.

It was requested to each country leader to collect data in at least twenty companies belonging to the industries of electronics, machinery or transport equipment, with more than one hundred employees each. After the data collection, the country leaders tabulated the data in a spreadsheet and sent it to a database coordinator, which compiled the data and distributed it to the country leaders involved in the HPM project.

3.4.3 Sampling

Sampling is the part of the basic process of research in Administration. Through the sampling is possible to investigate features from population's subset to take conclusions about it. (Hair Jr. et al., 2003).

The choice of companies was based on subjective methods as the country leaders' network and convenience; thus no statistical methods were used. Thus, the sampling method selection of the HPM project is not probabilistic and for convenience. This method allows to pick companies that are more available to be part of the study and provide the needed information (Hair Jr. et al., 2003).

As mentioned previously, each country leader was responsible for collecting data in at least twenty companies. Those companies should belong to the electronics, machinery or transport equipment industries and have as a minimum of 100 employees each. The choice of the industries is related to their high level of innovations, high index of product launch and for being considered as transitioning industries. The number of employees is associated to size of the company that guarantee that it possess the areas under investigation and also advanced practices of production. The number of surveyed companies in the Round 3 is depicted in the Table 1.

Table 1 – Number of surveyed companies by country by industry

Country	Industries			Total
	Electronics	Machinaries	Transport Equipment	
Austria (AUT)	10	7	4	21
Brazil (BRA)	5	8	9	22
China (CHN)	21	16	14	51
Finland (FIN)	14	6	10	30
Germany (GER)	9	13	19	41
Italy (ITL)	10	10	7	27
Japão (JPN)	10	12	13	35
South Korea (KOR)	10	10	11	31
Spain (SPA)	9	9	10	28
Sweden (SWE)	7	10	7	24
United States (USA)	9	11	9	29
TOTAL	114	112	113	339

Source: Elaborated by the author

As Shown in the Table 1, there is homogeneity among the number of companies in terms of industries, wherein 114 belongs to Electronics and 112 and 113 to Machineries and Transport Equipment, respectively. When it comes to locality, there is homogeneity among Central Europe (62), North Europe (54), South Europe (55) and America (51). Except Asia that has 117 companies surveyed.

3.5 PROCEDURES FOR DATA ANALYSIS

In this topic we aim to describe the methods employed in the conversion of data into knowledge. The process starts with a data review in order to inspect the integrity and coherence of the database and ends with the statistical techniques for testing the hypothesis.

We began analyzing the missing values contained in the database. Missing values are understood by a way of any external systematic event to respondent, as mistakes in the data entry or problem in the data collection, or yet the refusal of the respondent to answer certain questions (Corrar, Paulo, & Dias Filho, 2009; Hair Jr. et al., 2003). Although difficult to control those events, the occurrence of missing values reduces the sampling size and, in the case of not probabilistic sampling, the results might get biased (Hair Jr., Black, Babin, Anderson, & Tathan, 2009).

There are several recommendations about the methods to treat the missing values, and in spite of some disagreements between scholars about the best method to do that, they are

unanimous that "*the only really good solution to missing data problem is not to have any*" (Allison, 2002, p. 2). Thus, the main treatments for missing values are described below:

a) Deletion: eliminating the variables which possess a great amount of missing values. Researchers have claimed that 10% of missing values is the limit of the acceptance of the variable, otherwise, it should be deleted (Kline, 2005).
b) Mean substitution: It calls for replacing all the missing data of a given variable by the mean of that variable. It is considered both the most common and conservative methods to treat missing values (Allison, 2002; Meyers, Gamst, & Guarino, 2006).
c) Expectation Maximization Imputation: It uses the maximum likelihood approach to estimate the missing values, that's is very similar to the least squares linear regression' results (Meyers et al., 2006).

In this study we choose the mean substitution as the method for treating the missing values under the argument that while some missing values could be higher than the variable mean, others could be the lower than it. Thus, in absence of the real data, we assume that the missing values should be treated as the mean of the variable (Meyers et al., 2006).

After that, we advanced with the descriptive statistics to better understand the features of the sampling. These features are observed through the analyses of the minimum, maximum, mean, median, standard deviation, kurtosis and skewness. The minimum and maximum represents the amplitude of the responses; mean, mode and median refers to the data trend; standard deviation is related to the dispersion of data; and kurtosis and skewness are associated with the form of data distribution (Hair Jr. et al., 2009; Meyers et al., 2006).

The variables' frequency distributions that compound a sampling may differ in terms of skewness and kurtosis. While skewness is the property that identifies the data trend in regard to the central point, kurtosis refers to degree of flatness of the data. Both are used to analyze the normality that is an assumption of multivariate statistical tests (Hair Jr. et al., 2009; Meyers et al., 2006). Values below 3 for skewness and 10 for kurtosis are desirable to obtain a normal distribution (Kline, 2005).

After the data analyses, we moved to the measurement model purification in order to avoid the possible interactions between the measurement and structural model. Thus, before testing the structural model It is highly recommended to have a measurement model that

presents acceptable levels of validity and reliability (Fornell & Larcker, 1981; Koufteros, 1999).

According to Anderson and Gerbing (1982), the measurement model is concerned with the specification of observed items that form the latent variables, while the structural model is associated with the relationships between latent variables and the establishment of causal effects between them (Anderson & Gerbing, 1982). Thus, the measurement model was assessed through its unidimensionality, discriminant validity, composite of reliability and by the average variance extracted (AVE).

The unidimensionality and convergent validity were performed through the confirmatory factor analysis (CFA) that tests how good the observed variables represent a given construct. (Hair Jr. et al., 2009). To do so, statistics based on t-values, R^2, chi-square (X^2), degree of freedom (df), X^2/df, root mean square error of approximation (RMSEA), normed fit index (NFI), non-normed fit index (NNFI), comparative fit index (CFI) and goodness of fit index (GFI) were run and analyzed.

a) t-values: it is the relationship between the factor loadings and their standard error. As larger is the factor loading compared with its standard error, the higher is the corresponding t-value, providing stronger evidences that the observed variables represent their respective construct. T-values greater than 2 or 2.576 are considered significant at the 0.05 and 0.01 level, respectively (Hair Jr. et al., 2009).
b) R^2: It is the proportion of variance in the observed variables that is referent to the latent variable or free from error. Thus, R^2 lower than 0.50 represents that the observed variable is not a good representative of the construct. In this case, the variable is dropped (Hair Jr. et al., 2009).
c) Chi-square (X^2): It is considered a function of internal and external consistency. When combined with *p*-value there is a probability of getting larger values than the value actually obtained, what provides the idea of true reflection of the reality. It's value is affected by the sample size (Koufteros, 1999).
d) Degree of freedom (df): It refers to the number of values that can vary in a statistical calculation.
e) X^2/df: It provides information about the relative efficiency between the estimated matrix and the observed matrix, wherein the difference between matrixes gets lower

when the relation X^2/df is small. It's value is considered absolute when it is below 5. More recent studies suggest that values below 2 indicate a good fit.

f) Mean square error of approximation (RMSEA): It's used to verifying the trend correction presented through X^2 of rejecting the model from large sample or large number of observed variables. It tends to be acceptable in the interval from 0.03 to 0.08(Hair Jr. et al., 2009).

g) Normed fit index (NFI): It compares the proposed model and the null model, representing an incremental adjusts. Its value is better accepted when it is above 0.9 (Hair Jr. et al., 2009).

h) Non-normed fit index (NNFI): incremental measure of goodness for a statistical model, considering the correlations in the number of parameter in the model. It's not sensitive to the sample size and incorporates the degree of freedom in the model. Values above 0.9 are acceptable (Hair Jr. et al., 2009).

i) Comparative fit index (CFI): It represents the values associated with the model or theory specified by the researcher. In other words, it is the resulting adjust with the degree of freedom. Index above 0.9 is acceptable (Hair Jr. et al., 2009).

j) Goodness of fit index (GFI): It verifies how good the model explains any true covariance between the observed variables. Index above 0.9 is desirable (Hair Jr. et al., 2009).

The discriminant validity, in turn, refers to the uniqueness of the constructs or if the construct is significantly different from others in the same structural model. This analysis aims to avoid the multicolinearity among constructs that may cause false conclusions. The constructs were evaluated through structural equation modeling, in pairs and in two steps. First, the relationship between latent variables was free to correlate and then we fixed to 1 the correlation between them. It was calculated the difference of X^2 between both models, which must be higher than 10.870 to be considered discriminant at 0.01 level (Koufteros, 1999; Stratman & Roth, 2002).

The composite reliability is associated with the degree of goodness that the indicators of a latent variable measure their construct. Highly reliable constructs present indicators highly intercorrelated, which means that they measure the same construct. This measure ranges from 0 to1, wherein values above 0.7 are considered adequate (Kline, 2005). Finally, we calculated the average variance extracted (AVE) that measures the amount of variance for

the specific indicators accounted for by the latent constructs, representing a reliability measure. Values above 0.5 are acceptable to establish the validity of the construct.

Before the test of hypothesis, we also perform the test of common method variance to check if the indicators are influenced for other factors than the construct in which they are allocated. Among those factors there are the factors that are inherent to the respondent and the factors that are related to the questionnaire. The factors associated with the respondents are the lack of verbal ability, education, cognitive sophistication and experience thinking about the topic, and those related to the questionnaire are complex or abstract questions, item ambiguity, double-barreled questions, questions that rely on retrospective recall and auditory only presentation of item (telephone) versus written presentation of item (print or web) (MacKenzie & Podsakoff, 2012; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

The test of common method variance consists of putting all measurement models at once in the same context, linked by covariance. In this context a latent variable is added, named common factor, which is connected with all indicators of the measurement models in the context. Then, the influence is analyzed that the common factor has on each indicator (Lowry, Gaskin, Twyman, Hammer, & Roberts, 2013). Although the literature has not presented a cutoff point for levels of influence of common factors on the indicators, studies have considered influences lower than 0.20 as insignificant, with no need of corrective actions (Lowry et al., 2013).

After the purification and validation of the measurement model, we proceed to analyze the structural model, which is represented by the correlations between latent variables that test the hypothesis built from theoretical support. The analyzing of the structural model was made through structural equation model (SEM) that's the union of confirmatory factor analysis and path analysis; the union of the measurement model and the structural model and also the union of exploratory factorial analysis and multiple regression analysis (Hair Jr. et al., 2009; Meyers et al., 2006).

The structural equation modeling allows that some dependent variables become independent ones in subsequent relations, given the interdependent nature of the structural model. The relationships proposed are translated into a set of structural equations for each dependent variable. Thus, the theory might be confirmed or denied through the test of hypotheses that are represented by the relationships between variables (Hair Jr. et al., 2009; Meyers et al., 2006).

Furthermore, we considered the multi-group moderation to test the hypotheses. Multi-group moderation is a technique that aims to identify how well the structural model is adjusted to the different groups and the main dissimilarities between the groups. The moderating variable is a qualitative or quantitative variable that strength or weakens the influence of one independent variable on a dependent one through the estimative of the regression (Krüll & MacKinnon, 1999; Sharma, Durand, & Gur-Arie, 1981).

In the case of this research, multi-group moderation aided in the observation of the conditions wherein the supply chain's agents will outperform in new product development. The moderating power of the variables was analyzed by the p-value (lower than 0.05) and the path-by-bath chi-square under levels of 90%, 95% and 99% of confidence.

3.6 MODERATING VARIABLES

The relationships between variables, represented by the hypotheses described in the section 2.3, were tested in the general model and with three moderating variables. The general model considered all the respondents (n=339), without distinction between them. Then, we added the moderating variables according to the description below.

The first moderating variable was the environmental turbulence, which is defined as the amount of variation in customer preference and customer demand that leads the company's current knowledge to the obsolescence (Hung & Chou, 2013; Jaworski & Kohli, 1993). This variable was categorized into three groups: low level (n = 117), medium level (n=107) and high level (n=115).

The second moderating variable was the industry. Although the surveyed industries are considered transitioning industries, with high levels of innovation and high clockspeed, we assume that each industry possesses peculiarities that may favor or hamper the involvement of supply chain agents into NPD and their influence on the operational, marketing and business performance. Thus, the moderating variable "industry" was categorized into electronics (n=114), machinery (n=112) and transport equipment industry (n=113).

Finally, we tested the moderation power of the geographical location by considering that factors related to the social structure and macroeconomics environment might also influence on the involvement of partners into NPD and on the NPD's performance. Thus, we grouped the countries into America (n=51), Europe (n=171) and Asia (n=117).

In the America group we are considering Brazilian and U.S companies, even recognizing the different macroeconomic environment between those countries. Our decision in keeping those countries together is about the number of companies that each country possesses that are not enough to run the analytical model

4 RESULTS AND DISCUSSION

The results were divided into four sections. The first one presents the descriptive analyses, showing the characteristics of the sample and its trends. The second section was dedicated to the measurement model refining, the third one to the hypotheses testing and finally, the fourth one analyzed the direct and indirect effects of the supply chain integration on NPD's performance.

4.1 DESCRIPTIVE ANALYSIS

The results of the descriptive analysis are depicted in table 2, and according to it, manufacturers around the world have demonstrated a strong guidance to cooperate with partners. It is verified through the analysis of mean and median that are placed around 6. Median placed in 6 means that 50% of the manufacturers are highly focused on cooperation while the others 50% have low or moderate levels of guidance to cooperate.

In spite of this guidance, firms have only a slight tendency to cooperate with suppliers and customers, which means that the involvement with suppliers and customers are moderate. Data have already shown that such involvement happens in early stages of the new product development. Differently, the involvement with the manufacturing seems to be stronger than with external partners. Manufacturing has also been consulted and early stages of the new product development, with higher intensity than with suppliers and customers, and has been taken as key function in the product concept development.

Under these considerations, we would say that manufacturers are more interiorly focused with more cross-functional integration. These results seem to attend the call of Shapiro (1977) for integration of manufacturing with others functional areas to get upper performance. Others scholars have strengthened the results of studies that emphasize the evidences of benefits when manufacturing is integrated in the organizational strategies (Calantone et al., 2002; Gerwin, 1993; Hausman et al., 2002; Paiva, 2010).

Table 2 – Descriptive Analysis

Scale	Items	Minimum	Maximum	Mean	Median	Std. Dev.	Skewness	Kurtosis
Cooperation	COOPN01	3,00	7,00	5,7021	6,0000	,73160	-,884	1,613
	COOPN02	4,00	7,00	5,8142	6,0000	,65111	-,506	,693
	COOPN03	3,00	7,00	5,6047	6,0000	,75962	-,420	,294
	COOPN04	4,00	7,00	6,0442	6,0000	,66692	-,532	,849
	COOPN05	4,00	7,00	5,8643	6,0000	,64303	-,406	,615
	COOPN06	4,00	7,00	5,7788	6,0000	,67589	-,336	,235
	COOPR07	1,00	6,00	3,7640	4,0000	1,11355	,283	-,440
Supplier Involvement	SUPPN01	1,00	7,00	4,7670	5,0000	1,38311	-,770	-,108
	SUPPN02	1,00	7,00	4,8053	5,0000	1,36216	-,901	,351
	SUPPN03	1,00	7,00	4,8437	5,0000	1,41496	-,837	,167
	SUPPR04	1,00	7,00	4,8820	5,0000	1,48491	-,854	,068
	SUPPN05	1,00	7,00	4,7699	5,0000	1,46765	-,817	,138
Customer Involvement	CUSTN01	1,00	7,00	4,9882	5,0000	1,38456	-,524	-,302
	CUSTN02	1,00	7,00	4,9263	5,0000	1,52023	-,784	,027
	CUSTN03	1,00	7,00	4,8407	5,0000	1,36460	-,609	-,197
	CUSTR04	1,00	7,00	5,0383	5,0000	1,52930	-,879	,209
	CUSTN05	1,00	7,00	4,9764	5,0000	1,40141	-,879	,447
Manufacturing Involvement	MANUN01	2,00	7,00	5,5811	6,0000	1,11009	-1,178	1,557
	MANUN02	1,00	7,00	5,1858	5,0000	1,24189	-,888	,708
	MANUN03	1,00	7,00	5,0767	5,0000	1,18672	-,865	,542
	MANUN04	1,00	7,00	4,6165	5,0000	1,28043	-,614	-,101
Anticipation of New Technology	TECHN01	2,00	7,00	4,9086	5,0000	1,07440	-,537	-,035
	TECHN02	3,00	7,00	5,5251	6,0000	,87120	-,617	,277
	TECHN03	2,00	7,00	5,1180	5,0000	1,06488	-,370	,024
	TECHN04	2,00	7,00	5,2094	5,0000	,98529	-,449	-,020
Continuous Improvement	CONTN01	3,00	7,00	5,6077	6,0000	,75137	-,603	,449
	CONTN02	4,00	7,00	6,1947	6,0000	,55776	-,170	,873
	CONTN03	3,00	7,00	5,2743	5,0000	,92546	-,729	,223
	CONTN04	4,00	7,00	6,0531	6,0000	,57318	-,280	1,155
	CONTN05	4,00	7,00	5,5457	6,0000	,70089	-,190	-,180
Marketing Performance	MARKN01	3,00	7,00	5,5546	6,0000	,99368	-,689	-,229
	MARKN02	2,00	7,00	4,9971	5,0000	1,00736	-,274	,289
	MARKN03	1,00	7,00	4,2920	4,0000	1,33466	,144	-,481
Business Performance	BUSIN01	2,00	7,00	4,8230	5,0000	1,06502	-,573	,346
	BUSIN02	1,00	7,00	4,7817	5,0000	1,20630	-,428	,356
	BUSIN03	1,00	7,00	4,7640	5,0000	1,12938	-,182	,160
Operational Performance	OPERN01	3,00	7,00	5,0826	5,0000	,96643	,170	-,417
	OPERN02	1,00	7,00	4,6313	5,0000	1,14472	-,326	,319
	OPERN03	1,00	7,00	4,5664	5,0000	1,15801	-,122	,013
	OPERN04	1,00	7,00	4,2065	4,0000	1,05688	,305	,803

Source: elaborated by the author

In addition , practitioners seem to change mind in relation of the manufacturing role in the process of new product development, since the inward view of manufacturing was considered for a long time as harmful to the ideation (Gerwin, 1993; Pisano & Wheelright, 1995).

Companies have also presented moderate-high levels of anticipation of new technologies, with dedication of efforts on new technologies' acquisition and thoughts about the next generation of technologies. As manufacturing technologies are considered tools that convert insights from the marketplace into exploitable knowledge, high levels of anticipation of new technologies might deliver product or service that are according to the market expectations (Egelhoff, 1988 as cited by Kotha & Swamidass; 2000).

Associated with the view of future recognized through the focus on the next generation of technologies, companies also presented a high sense of continuous improvement and learning. Specifically, companies pointed out that the lack of investments on continuous improvement might hamper the performance in the long term and that the process of enhancement of practices is never completed, since always there is something to improve. According to scholars, companies which present high levels of continuous improvement, involving employees in the process enhancement, tend to obtain better results in operational, marketing and business performance (Chapman et al., 1997; de Ron, 1998; Gieskes et al., 1997; Jaber et al., 2010; Terziovski & Sohal, 2000). Likewise, companies reported a slight increase in the results in terms of marketing, operational and business performance when compared with others manufacturers from the same industry.

The values for skewness and kurtosis are considered acceptable once the limits suggested by Kline (2005) are 3 and 10, respectively. Thus, the data does not hurt the assumption of the normality, presenting a normal distribution to perform the multivariate statistics (Kline, 2005).

In the sequence, we treated the missing values, which represented 4% of the total data. According to Kline (2005) there is an acceptance of 5% of missing values that allows the researcher to work on them, deploying techniques to replace them for valid responses. As the missing values didn't present a standard, once they occurred randomly and were below the rate indicated by Kline (2005), it was possible to perform corrective actions to replace the missing values. In this case, we replaced the missing values by the mean of the indicators in which they belong to (Hair Jr. et al., 2009).

4.2 MEASUREMENT MODEL'S PURIFICATION

This section is dedicated to the analysis of the measurement model which checks if the observed variables are good representatives of the latent construct (Anderson & Gerbing, 1982) and if the latent variables are distinct enough to form a structural model (Koufteros, 1999).

To get started, we perform the convergent validity through the confirmatory factor analysis (CFA). The convergent validity seeks to analyze if different indicators are correlated enough to represent a single construct. As mentioned previously, the CFA is a statistic technique that allows checking the relationship between indicators, providing factor loadings, fit indexes and square correlation of each indicator with the measurement model in which it is allocated (Hair Jr. et al., 2009; Kline, 2005).

To do so, we put all measurement models (scales) at once under analysis, linked by covariance, using the confirmatory factor analysis as suggested by Koufteros (1999). This method is considered more rigorous if compared with exploratory factor analysis (EFA) and within-block EFA, due to the analysis of all the measurement models at once, in the same context (Anderson, Gerbing, & Hunter, 1987). To analyze the measurement models, this method uses statistics as the unstandardized factor loadings, standardized loadings, t-values, R^2 (square correlation) and fit indexes, which are depicted in the Table 3.

Table 3 – Convergent Validity and parameter estimates for full model

Latent Variable	Items	Unstandard. Loading	Standardized Loadings	Error term	t-Values	p-value	R2
Cooperation	COOPN01	1,00	0,61				0,37
	COOPN02	0,93	0,63	0,11	8,45	***	0,40
	COOPN03	0,86	0,5	0,12	7,15	***	0,25
	COOPN04	0,90	0,6	0,11	8,15	***	0,36
	COOPN05	0,76	0,52	0,1	7,43	***	0,27
	COOPN06	0,89	0,58	0,11	8,03	***	0,34
	COOPR07	0,03	0,01	0,16	0,2	0,84	0,00
Supplier Involvement	SUPPN01	1,00	0,81				0,66
	SUPPN02	0,95	0,78	0,07	13,63	***	0,61
	SUPPN03	0,82	0,65	0,07	11,42	***	0,42
	SUPPR04	0,35	0,27	0,08	4,54	***	0,07
	SUPPN05	0,83	0,63	0,07	11,2	***	0,40
Customer Involvement	CUSTN01	1,00	0,75				0,56
	CUSTN02	1,01	0,69	0,09	11,83	***	0,48
	CUSTN03	0,84	0,64	0,08	10,91	***	0,41
	CUSTR04	0,57	0,39	0,09	6,63	***	0,15
	CUSTN05	1,11	0,82	0,08	13,62	***	0,67
Manufacturing Involvement	MANUN01	1,00	0,64				0,41
	MANUN02	1,33	0,76	0,15	9,13	***	0,58
	MANUN03	0,76	0,46	0,11	6,76	***	0,21
	MANUN04	0,99	0,55	0,13	7,86	***	0,30
Anticipation of New Technologies	TECHN01	1,00	0,61				0,37
	TECHN02	1,09	0,81	0,1	10,81	***	0,66
	TECHN03	1,02	0,62	0,11	9,15	***	0,38
	TECHN04	1,24	0,82	0,11	10,83	***	0,67
Continuous Improvement	CONTN01	1,00	0,73				0,53
	CONTN02	0,42	0,42	0,06	6,78	***	0,18
	CONTN03	1,19	0,71	0,11	10,89	***	0,50
	CONTN04	0,58	0,56	0,07	8,88	***	0,31
	CONTN05	0,86	0,68	0,08	10,53	***	0,46
Business Performance	BUSIN01	1,00	0,65				0,42
	BUSIN02	1,48	0,85	0,12	12,45	***	0,72
	BUSIN03	1,37	0,84	0,11	12,37	***	0,71
Marketing Performance	MARKN02	1,00	0,76				0,58
	MARKN01	0,86	0,66	0,07	11,66	***	0,44
	MARKN03	0,95	0,55	0,1	9,52	***	0,30
Operational Performance	OPERN01	1,00	0,63				0,40
	OPERN02	0,99	0,52	0,12	7,92	***	0,27
	OPERN03	1,01	0,53	0,13	7,97	***	0,28
	OPERN04	1,03	0,59	0,12	8,72	***	0,35

*** indicates that the indicator is significantly different from 0 at 0.01 level
Fit indexes: X^2 = 1678.1, df = 857, X^2/df = 1.95, NNFI = 0.80, CFI = 0.82, RMSEA = 0.05

Table 3 presents all the measurement models and theirs respective indicators. The literature suggests that each indicator should have standardized loadings higher than 0,70 to be considered adjusted to the measurement model. However, Hair Jr. (2009) claims that in exploratory models or complex models or yet, in the absence of other comparable measurement models, factor loadings above 0,5 are acceptable (Hair Jr. et al., 2009). Thus, the higher the standardized loadings when comparable with their respective error terms, the stronger the evidence that the indicators represent the construct (Koufteros, 1999).

The analysis of the indicator is also made through the t-value statistics that is the quotient of the division of the unstandardized factor loading by the error term. Thus, the higher is the t-value, the higher are the chances of the indicator is adjusted to the scale in which it belongs to. T-values greater than 2 or 2.576 are taken as significant at 0.05 and 0.01 level, respectively (Koufteros, 1999). According to the table 3, all t-values were significant at 0.01 level.

In terms of square correlation (R^2), Hair Jr., (2009) suggests that values above 0.5 are acceptable, once it reflects the degree wherein the observed variable is free from error. However, as preconized by Hair Jr (2009), in models where the factor loading was accepted as above 0.50 the correspondent R^2 would be 0.25. In these cases, the decision of cut the indicator off must not be based on a single statistic, but in a set of them. The analysis of this set of statistics lead us to highlight in grey, in the Table 3, the indicators elected to be dropped from the model (Kline, 2005).

Finally, fit indexes were provided at the table's footnote in order to evaluate the set of measurement models when analyzed jointly. Thus, chi-square, degree of freedom, non-normed fit index (NNFI), comparative fit index (CFI) and root mean square error of approximation (RMSEA) was provided.

The quotient of the division of chi-square (X^2) by the degree of freedom (df) provide information about the relative efficiency of the models in accounting for the data. Values below 5 are acceptable and values below 2 are considered as indicators of good fit. In terms of fit index, both CFI and NNFI are expected to be greater than 0.90. In addition, the RMSEA value is expected to be below 0.60 to be considered as a good fit.

The results of the purification of the measurement models are depicted in the table 4.

Table 4 – Measurement models after purification

Latent Variable	Items	Unstandard. Loading	Standardized Loadings	Error term	t-Values	p-value	R2
Cooperation	COOPN01	1,00	0,57				0,32
	COOPN02	1,04	0,66	0,15	6,94	***	0,44
	COOPN04	1,05	0,65	0,15	6,94	***	0,42
Supplier Involvement	SUPPN01	1,00	0,8				0,64
	SUPPN02	0,99	0,8	0,08	12,2	***	0,64
	SUPPN03	0,8	0,63	0,08	10,52	***	0,40
Customer Involvement	CUSTN01	1,00	0,76				0,58
	CUSTN02	0,93	0,65	0,08	10,99	***	0,42
	CUSTN05	1,13	0,85	0,09	12,62	***	0,72
Manufacturing Involvement	MANUN01	1,00	0,68				0,46
	MANUN02	1,24	0,76	0,14	8,63	***	0,58
	MANUN04	0,91	0,54	0,12	7,68	***	0,29
Anticipation of New Technologies	TECHN02	1,00	0,79				0,62
	TECHN03	0,99	0,64	0,09	10,85	***	0,41
	TECHN04	1,19	0,83	0,09	12,68	***	0,69
Continuous Improvement	CONTN01	1,00	0,77				0,59
	CONTN03	1,25	0,78	0,12	10,56	***	0,61
	CONTN05	0,76	0,62	0,08	9,71	***	0,38
Business Performance	BUSIN01	1,00	0,65				0,42
	BUSIN02	1,46	0,84	0,12	12,53	***	0,71
	BUSIN03	1,36	0,84	0,11	12,46	***	0,71
Marketing Performance	MARKN01	1,00	0,66				0,44
	MARKN02	1,17	0,77	0,1	11,91	***	0,59
	MARKN03	1,1	0,54	0,12	8,85	***	0,29
Operational Performance	OPERN01	1,00	0,65				0,42
	OPERN03	0,81	0,44	0,11	7,14	***	0,19
	OPERN04	0,94	0,55	0,11	8,83	***	0,30

*** indicates that the indicator is significantly different from 0 at 0.01 level
Fit indexes: X^2 = 602,9, df = 306, X^2/df = 1.97, NNFI = 0.88, CFI = 0.90, RMSEA = 0.05

Table 4 shows the scales after the purification process. It's shown that some scales presented indicators with factor loading around 0.5, that's acceptable, but not desirable. Thus, some of the square correlation also got below 0.5. Counteracting, all the indicators are significant at 0.01 level and also presented significant t-value at 0.01 level.

To keep the minimum of three indicators by scale, we opt for maintaining some indicators even with factor loadings below 0.5, once the removal of the indicator could derail the test of the structural model presented in the section 2.3. In general terms, the measurement models possesses acceptable fit indexes, as for instance the X^2/df = 1,97, CFI

about 0.90 and RMSEA in 0.05, as preconized by the literature. Only NNFI, that is a fit index sensible to the sample size, didn't get the desirable value. According to the Hair Jr. (2009) and Kline (2005) the analysis of the measurement model must take in account several statistics, and not get based in just one. Thus, we assume the indicators depicted in the table 4 are valid and reliable to represent the construct in which they belong to.

Moreover, we analyzed each measurement model separately in order to check its unidimensionality and reliability. It was made through the composite reliability, average variance extracted (AVE) and Cronbach's alfa. Such analysis is shown in the table 5.

Table 5 – Sacle Unidimensionaly and reliability analyses

Latent Variable	Composite Reliability	AVE	α Cronbach
Cooperation	0.66	0.39	0.673
Supplier Involvement	0.82	0.61	0.782
Customer Involvement	0.78	0.55	0.776
Manufacturing Involvement	0.70	0.44	0.682
Anticipation of New Technologies	0.80	0,57	0.787
Continuous Improvement	0.77	0.53	0.758
Business Performance	0.82	0.61	0.808
Marketing Performance	0.70	0.44	0.660
Operational Performance	0.58	0.32	0.673

Source: elaborated by the author

According to the table 5, the scales presented acceptable composite reliability with values above 0.70 that is in line with is suggested in the literature. Except the Cooperation and Operational Performance scales that had values below 0.7. According to Nunnally (1978) this value is acceptable when it reflects an exploratory study (Nunnally, 1978). Additionally, Marsh, Hau and Wen (2004) stand that high cutoff values may hamper the development of studies by eliminating constructs that, under the theoretical standpoint, are essential for the study model (Marsh, Hau, & Wen, 2004). In line with Marsh, Hau and Wen (2004), Hair Jr. (2009) states that being arbitrary in some cutoff values, neglecting the theoretical support that gave rise to the scales, it might exclude a significant potential research (Hair Jr. et al., 2009).

Moreover, the business, marketing and operational performance are originally, in the HPM project, a single construct named new product development' success. Thus, the test of these new scales is understood as exploratory. Our decision in splitting the new product development' scale came as a way to check the different influences of the supply chain members on each of these types of performance.

Once the scales possess three indictors each, that is the minimum for a scale, it was not possible to get the fit indexes for them, since they are provided when the scale has more than three indicators. Otherwise, the fit indexes get fixed in 1.

After these procedures, we proceed with the discriminant analysis. This analysis aims to check if the two scales which are designed to measure different constructs are not significantly correlated. The correlation between different scales may raise doubts about measurement model and its representation of the construct (Stratman & Roth, 2002).

To do so, the scales were tested in pairs considering a free correlation between them (unconstrained) and then with the correlation fixed to 1 (constrained). The chi-square for both tests were noted and compared. Differences between chi-squares upper than 10.827 for 1 degree of freedom represent significant differences between the latent variables (scales) and are considered discriminant at 0.01 level (Stratman & Roth, 2002). The discriminant validity is depicted in the table 6.

Table 6 – Measurement scale discriminant validity

Construct scales pairs		Unconstrained		Constrained		(*) X^2
		X^2	df	X^2	df	Difference
Cooperation	Supplier Involvement	11.71	8	171.15	9	159.44
	Customer Involvement	5.79	8	197.38	9	191.59
	Manufacturing Involvement	4.77	8	201.31	9	196.54
	Antic of new Technologies	12.94	8	190.28	9	177.34
	Continuous improvement	6.65	8	249.68	9	243.03
	Marketing Performance	17	8	263.29	9	246.29
	Operational Performance	9.54	8	258.42	9	248.88
	Business Performance	14.63	8	274.54	9	259.91
Supplier Involvement	Customer Involvement	32.91	8	52.95	9	20.04
	Manufacturing Involvement	19.22	8	68.03	9	48.81
	Antic of new Technologies	10.51	8	123.33	9	112.82
	Continuous improvement	16.67	8	144.94	9	128.27
	Marketing Performance	8.43	8	78.09	9	69.66
	Operational Performance	8.55	8	93.69	9	85.14
	Business Performance	7.64	8	99.63	9	91.99
Customer Involvement	Manufacturing Involvement	15.51	8	62.30	9	46.79
	Antic of new Technologies	9.40	8	138.7	9	129.30
	Continuous improvement	17.55	8	173.11	9	155.56
	Marketing Performance	14.48	8	106.24	9	91.76
	Operational Performance	13.79	8	93.29	9	79.50
	Business Performance	6.82	8	113.43	9	106.61
Manufacturing Involvement	Antic of new Technologies	4.37	8	121.65	9	117.28
	Continuous improvement	11.32	8	187.70	9	176.38
	Marketing Performance	19.10	8	134.88	9	115.78
	Operational Performance	11.56	8	143.10	9	131.54
	Business Performance	13,49	8	165.92	9	152.43
Antic of new Technologies	Continuous improvement	4.02	8	162.07	9	158.05
	Marketing Performance	7.86	8	176.14	9	168.28
	Operational Performance	8.65	8	192.19	9	183.54
	Business Performance	3.07	8	206.46	9	203.39
Continuous improvement	Marketing Performance	8.42	8	225.43	9	217.01
	Operational Performance	4.32	8	219.55	9	215,23
	Business Performance	16.88	8	259.05	9	242.17
Marketing Performance	Operational Performance	54.34	8	93.37	9	39.03
	Business Performance	81.51	8	134.06	9	52.55
Operational Performance	Business Performance	24.95	8	113.83	9	88.88

Source: elaborated by the author

(*) Critical X^2 for 1 degree of freedom at 0.01 level is 10.827

The table 6 depicts the all the scales are significant different at 0.01 level, which means that they are not correlated enough to characterize them as a single construct or yet, that the different scales measure different constructs. Thus, we assume that the scales are ready to move the next stage, which involves the common method variance's analysis and hypotheses testing.

5.3 COMMOM METHOD VARIANCE

This topic is related to the analysis of the common method variance in the indicators that represent the constructs. The rationale behind this analysis lays on the fact that several factors (associated with respondents or with the questionnaires) might have influenced the responses, offering a false validity of the conclusions about the relationship between constructs (MacKenzie & Podsakoff, 2012).

To avoid such error, the common method variance's test was performed through the confirmatory factor analysis, putting all the measurement models at once in the same context and linked by covariance. Moreover, a latent variable was added symbolizing the common factor connected to the all the indicators. The graphic representation of the common factor variance analysis is illustrated in the figure 5.

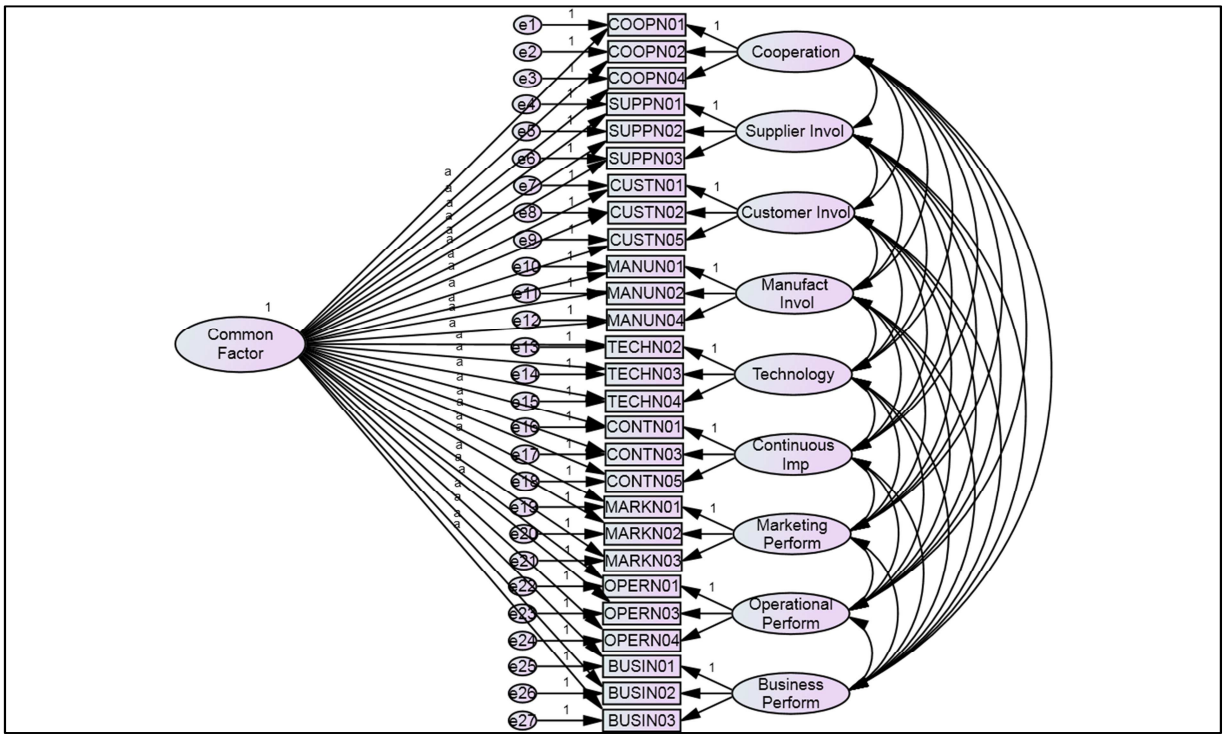

Figure 5 – Commom Method Variance's ilustration
Source: elaborated by the author

The common method variance (CMV)'s test was performed in two steps. First, we run the model without considering the common method variance, observing the loading factors of each indicator. Then the model was run with the new latent variable, named common factor, which was linked with every indicator in the model. It's expected that the factor loadings with the common factor is lower than without it, once the common factor seeks to minimize

the ratio of influence of others factor, besides construct, on the indicators (MacKenzie & Podsakoff, 2012; Podsakoff et al., 2003).

Thus, the comparison between factor loadings in both models is presented in the table 7.

Table 7 – Influence of common method variance on indicators

Measurement Models	Indicators	Without Common Factor	With Commom Factor	Difference (Δ)
Cooperation	COOPN01	0,57	0,40	0,17
	COOPN02	0,66	0,61	0,05
	COOPN04	0,65	0,46	0,19
Supplier Involvement	SUPPN01	0,80	0,77	0,03
	SUPPN02	0,80	0,78	0,02
	SUPPN03	0,63	0,59	0,04
Customer Involvement	CUSTN01	0,76	0,74	0,02
	CUSTN02	0,65	0,62	0,03
	CUSTN05	0,85	0,83	0,02
Manufacturing Involvement	MANUN01	0,68	0,63	0,05
	MANUN02	0,76	0,76	0,00
	MANUN04	0,54	0,47	0,07
Anticipation of New Technologies	TECHN02	0,79	0,73	0,06
	TECHN03	0,64	0,59	0,05
	TECHN04	0,83	0,79	0,04
Continuous Improvement	CONTN01	0,77	0,71	0,06
	CONTN03	0,78	0,69	0,09
	CONTN05	0,62	0,50	0,12
Marketing Performance	MARKN01	0,66	0,62	0,04
	MARKN02	0,76	0,71	0,05
	MARKN03	0,54	0,47	0,07
Operational Performance	OPERN01	0,65	0,57	0,08
	OPERN03	0,43	0,39	0,04
	OPERN04	0,55	0,48	0,07
Business Performance	BUSIN01	0,65	0,59	0,06
	BUSIN02	0,85	0,81	0,04
	BUSIN03	0,84	0,80	0,04

Source: elaborated by the author

According to the table 7, the differences between the factor loadings with and without the common factor were all below 0.20. Although there is no reference in the literature about the cutoff point for these differences, studies have considered that differences equal or below 0.20 are not significant, since the explanation power of the common factor on the indicator would be at most 4%. This is akin to say that those differences don't influence the indicators

to the point of compromising the validity of the conclusions about the relationship between the latent variables in the structural model (Lowry et al., 2013). Thus, no corrective action was required.

4.3 HYPOTHESES TESTING

At this topic we seek for testing the hypotheses described in the section 2.3 that guide this study. The results of the tests are shown from the table 8 to the table 11. We analyzed the hypotheses in the general model and with the moderating variables. Thus, the first table is regard to the overall model and the others three tables consider the environmental turbulence, the industry and the location as moderating variables.

Table 8 – Hypotheses testing without moderation

Hypotheses				Overall Model		
				Regression Weights	Standardized Regression Weights	*p-value*
H1a	Manufacturing_Involvement	<---	Cooperation	0,318	0,165	0,039
H1b	Supplier_Involvement	<---	Cooperation	0,217	0,097	0,191
H1c	Customer_Involvement	<---	Cooperation	0,082	0,026	0,717
H2a	Anticip of New Technologies	<---	Customer_Involvement	0,024	0,037	0,575
H2b	Operational_Performance	<---	Customer_Involvement	0,077	0,156	0,015
H3a	Anticip of New Technologies	<---	Supplier_Involvement	0,076	0,081	0,227
H3b	Continuous_Improvement	<---	Supplier_Involvement	0,077	0,115	0,08
H3c	Operational_Performance	<---	Supplier_Involvement	0,147	0,21	0,002
H4a	Continuous_Improvement	<---	Manufacturing_Involvement	-0,029	-0,037	0,584
H4b	Operational_Performance	<---	Manufacturing_Involvement	0,046	0,057	0,393
H5a	Continuous_Improvement	<---	Anticip of New Technologies	0,265	0,371	***
H5b	Operational_Performance	<---	Anticip of New Technologies	0,024	0,032	0,702
H5c	Marketing_Performance	<---	Anticip of New Technologies	0,085	0,096	0,147
H6a	Operational_Performance	<---	Continuous_Improvement	-0,02	-0,019	0,816
H6b	Marketing_Performance	<---	Continuous_Improvement	-0,086	-0,069	0,254
H7a	Business_Performance	<---	Operational_Performance	1,531	1	0,117
H7b	Marketing_Performance	<---	Operational_Performance	1,219	1,026	***
H8	Business_Performance	<---	Marketing_Performance	-0,2	-0,155	0,811

Source: elaborated by the author
Fit indexes: GFI=0,86; CFI= 0,85; RMSEA = 0,05

Table 9 – Hypotheses testing with multi-group moderation: Environmental Turbulence

Environmental Turbulence												
Hypotheses				Low (n= 117)			Medium (n=107)			High (n=115)			Path by Path Chi-square
				RW	SRW	p	RW	SRW	p	RW	SRW	p	
H1a	MANUF	<---	COOP	-0,182	-0,054	0,597	0,633	0,334	0,023	0,393	0,215	0,126	1489,894
H1b	SUPP	<---	COOP	-0,453	-0,201	0,084	0,492	0,211	0,111	0,054	0,023	0,852	1490,711
H1c	CUST	<---	COOP	-0,443	-0,076	0,432	0,333	0,118	0,361	-0,297	-0,1	0,413	1489,357
H2a	ANT	<---	CUST	-0,004	-0,008	0,942	0,003	0,005	0,966	0,064	0,078	0,479	1487,807
H2b	OPER	<---	CUST	0,102	0,18	0,065	0,109	0,229	0,045	-0,01	-0,052	0,745	1492,585
H3a	ANT	<---	SUPP	0,296	0,202	0,063	0,076	0,109	0,347	0,003	0,003	0,978	1489,307
H3b	CONT	<---	SUPP	0,142	0,118	0,248	0,02	0,029	0,786	0,02	0,036	0,735	1488,306
H3c	OPER	<---	SUPP	0,492	0,333	0,006	0,174	0,302	0,011	0,01	0,04	0,748	1499,076
H4a	CONT	<---	MANUF	-0,001	-0,001	0,996	0,088	0,102	0,368	-0,069	-0,093	0,415	1488,910
H4b	OPER	<---	MANUF	0,142	0,143	0,17	-0,024	-0,033	0,77	0,001	0,003	0,926	1488,505
H5a	CONT	<---	ANT	0,29	0,351	0,005	0,177	0,177	0,114	0,241	0,441	***	1487,981
H5b	OPER	<---	ANT	-0,142	-0,14	0,272	-0,014	-0,017	0,881	0,127	0,533	0,189	1490,530
H5c	MARK	<---	ANT	0,24	0,239	0,024	0,004	0,004	0,871	-1,104	-1,476	0,78	1493,984
H6a	OPER	<---	CONT	0,175	0,143	0,27	-0,052	-0,062	0,592	-0,199	-0,457	0,271	1489,837
H6b	MARK	<---	CONT	-0,239	-0,196	0,063	0,016	0,017	0,852	1,809	1,324	0,775	1490,722
H7a	BUSIN	<---	OPER	1,092	0,91	0,002	12,205	7,932	0,844	0,252	0,058	0,173	1490,531
H7b	MARK	<---	OPER	1,144	1,147	***	1,18	1,001	***	10,534	3,358	0,728	1491,296
H8	BUSIN	<---	MARK	-0,011	-0,009	0,975	-9,361	-7,178	0,859	0,974	0,708	***	1490,967

Source: elaborated by the author

Overall Model: Unconstrained Chi-square=1487,476; df=918; Constrained Chi-square=1586,702;df=990; Δ Chi-square=99,226;Δdf=72; p-value=0,018

Path by path's Chi-square: 1492,08 at 0,1 level; 1493,47 at 0,05 level; 1496,69 at 0,001 level

CUST = Customer Involvement; COOP = Cooperation; SUPP=Supplier Involvement; ANT= Anticipation of New Technologies;

MANUF= Manufacturing Involvement; OPER = Operational Performance; MARK = Marketing Performance; BUSIN = Business Performance

RW = Regression Weights; SRW= Standardized Regression Weights

Table 10 - Hypotheses testing with multi-group moderation: Industry

Industry												
Hypotheses				Electronics (n=114)			Machinery (n=112)			Transport Equipment (n=113)			Path by Path Chi-square
				RW	SRW	p	RW	SRW	p	RW	SRW	p	
H1a	MANUF	<---	COOP	0,42	0,33	0,032	0,245	0,077	0,523	-0,096	-0,059	0,623	1538,315
H1b	SUPP	<---	COOP	0,186	0,106	0,385	-0,123	-0,044	0,709	0,312	0,15	0,274	1536,233
H1c	CUST	<---	COOP	-0,324	-0,138	0,26	0,353	0,073	0,526	0,097	0,036	0,782	1536,793
H2a	ANT	<---	CUST	0,023	0,035	0,76	0,081	0,144	0,178	-0,038	-0,046	0,688	1536,331
H2b	OPER	<---	CUST	0,041	0,089	0,46	0,191	0,432	***	0,025	0,038	0,704	1539,799
H3a	ANT	<---	SUPP	0,132	0,146	0,208	-0,102	-0,107	0,325	0,158	0,151	0,202	1538,267
H3b	CONT	<---	SUPP	-0,095	-0,114	0,323	0,163	0,243	0,02	0,153	0,263	0,034	1539,846
H3c	OPER	<---	SUPP	0,103	0,164	0,196	0,028	0,037	0,738	0,314	0,383	0,004	1539,750
H4a	CONT	<---	MANUF	0,268	0,234	0,079	-0,095	-0,159	0,12	-0,126	-0,168	0,106	1539,359
H4b	OPER	<---	MANUF	-0,036	-0,042	0,762	0,11	0,165	0,138	0,053	0,05	0,587	1536,103
H5a	CONT	<---	ANT	0,214	0,231	0,044	0,379	0,538	***	0,134	0,241	0,05	1540,157
H5b	OPER	<---	ANT	0,039	0,057	0,681	0,102	0,13	0,4	-0,09	-0,115	0,395	1536,769
H5c	MARK	<---	ANT	0,139	0,168	0,142	-0,068	-0,075	0,467	0,154	0,183	0,114	1537,804
H6a	OPER	<---	CONT	0,02	0,026	0,854	0,037	0,033	0,837	0,051	0,036	0,8	1535,323
H6b	MARK	<---	CONT	-0,065	-0,074	0,504	-0,077	-0,06	0,549	-0,11	-0,073	0,528	1535,346
H7a	BUSIN	<---	OPER	0,476	0,269	0,312	-0,461	-0,296	0,515	0,62	0,491	0,098	1537,203
H7b	MARK	<---	OPER	0,969	0,816	***	1,064	0,925	***	1,212	1,127	***	1535,704
H8	BUSIN	<---	MARK	0,891	0,597	0,031	1,668	1,232	0,012	0,305	0,26	0,396	1539,016

Source: elaborated by the author

Overall Model: Unconstrained Chi-square=1535,304; df=918; Constrained Chi-square=1620,988;df=990; Δ Chi-square=85,684;Δdf=72; p-value=0,129

Path by path's Chi-square: 1539,91 at 0,1 level; 1541,30 at 0,05 level; 1544,51 at 0,001 level

CUST = Customer Involvement; COOP = Cooperation; SUPP=Supplier Involvement; ANT= Anticipation of New Technologies;

MANUF= Manufacturing Involvement; OPER = Operational Performance; MARK = Marketing Performance; BUSIN = Business Performance

RW = Regression Weights; SRW= Standardized Regression Weights

Table 11 - Hypotheses testing with multi-group moderation: Location

Location												
Hypotheses				America (n=51)			Europe (n=171)			Asia (n=117)			Path by Path Chi-square
				RW	SRW	p	RW	SRW	p	RW	SRW	p	
H1a	MANUF	<---	COOP	0,789	0,519	0,043	0,306	0,176	0,09	0,155	0,065	0,629	1564,522
H1b	SUPP	<---	COOP	-0,152	-0,167	0,421	0,429	0,201	0,046	0,089	0,033	0,793	1566,105
H1c	CUST	<---	COOP	-0,974	-0,404	0,068	0,512	0,167	0,066	-0,155	-0,049	0,711	1569,728
H2a	ANT	<---	CUST	-0,275	-0,289	0,076	0,03	0,056	0,509	0,069	0,092	0,435	1566,095
H2b	OPER	<---	CUST	0	-0,001	0,997	0,039	0,109	0,184	0,204	0,262	0,017	1565,725
H3a	ANT	<---	SUPP	0,831	0,329	0,14	0,105	0,135	0,147	0,018	0,02	0,856	1565,825
H3b	CONT	<---	SUPP	-0,068	-0,064	0,706	0,059	0,129	0,171	0,142	0,133	0,179	1563,429
H3c	OPER	<---	SUPP	0,65	0,475	0,117	0,127	0,244	0,013	0,172	0,19	0,067	1565,968
H4a	CONT	<---	MANUF	0,24	0,377	0,068	-0,02	-0,036	0,698	-0,322	-0,266	0,017	1569,940
H4b	OPER	<---	MANUF	0,185	0,226	0,252	-0,046	-0,073	0,418	0,417	0,405	0,003	1572,014
H5a	CONT	<---	ANT	0,17	0,403	0,027	0,241	0,409	***	0,599	0,493	***	1569,897
H5b	OPER	<---	ANT	-0,201	-0,37	0,126	0,116	0,173	0,226	-0,295	-0,285	0,037	1567,766
H5c	MARK	<---	ANT	0,111	0,233	0,326	-0,054	-0,075	0,532	0,24	0,194	0,063	1565,035
H6a	OPER	<---	CONT	0,624	0,487	0,062	-0,292	-0,257	0,084	0,268	0,316	0,027	1571,903
H6b	MARK	<---	CONT	-0,185	-0,164	0,406	0,091	0,073	0,536	-0,238	-0,234	0,026	1565,187
H7a	BUSIN	<---	OPER	-2,246	-1,556	0,388	-2,732	-1,753	0,572	1,173	0,763	***	1569,563
H7b	MARK	<---	OPER	0,95	1,079	0,021	1,104	1,014	***	1,436	1,2	***	1563,818
H8	BUSIN	<---	MARK	3,669	2,237	0,249	3,705	2,589	0,41	0,071	0,055	0,777	1569,844

Source: elaborated by the author

Overall Model: Unconstrained Chi-square=1562,408; df=918; Constrained Chi-square=1690,108;df=990; Δ Chi-square=127,699;Δdf=72; p-value=0,000

Path by path's Chi-square: 1567,01 at 0,1 level; 1569,40 at 0,05 level; 1571,62 at 0,001 level

CUST = Customer Involvement; COOP = Cooperation; SUPP=Supplier Involvement; ANT= Anticipation of New Technologies;

MANUF= Manufacturing Involvement; OPER = Operational Performance; MARK = Marketing Performance; BUSIN = Business Performance

RW = Regression Weights; SRW= Standardized Regression Weights

4.3.1 The influence of the guidance to cooperate on manufacturing, supplier and customer involvement into NPD.

In this study, cooperation has been defined as the guidance of the firm to involve both internal (manufacturing) and external linkages (suppliers and customers) into new product development in order to get upper performance. At this process, partners tend to integrate their routines, transact resources and seek for reaching out collective and self-interest goals (Borys & Jemison, 1989; Pinto et al., 1993; Swink & Song, 2007). In addition, once the needed resources to perform the activities are not inside the company boundary, firms are aroused by the sense of partners' dependence that leads them to cooperation (Das et al., 2006).

Thus, within this construct the hypotheses that will be tested are:

Hypothesis 1a: Firm's guidance to cooperate influences positively on the manufacturing involvement into new product development.

Hypothesis 1b: Firm's guidance to cooperate influences positively on the supplier involvement into new product development.

Hypothesis 1c: Firm's guidance to cooperate influences positively on the customer involvement into new product development.

According to the descriptive analysis provided in the section 4.1, the manufacturers have demonstrated a clear trend to get into cooperation. However, our sample shows that the guidance to cooperate does not imply necessarily on effective cooperation. In general, manufacturers seem to be more willing to involve the manufacturing into new product development than involve external partners at this same process. These findings are supported by the structural equation modeling depicted in the table 8. Thus, for these relationships, the firm's guidance to cooperate didn't present significant influence on the supplier and customer involvement into new product development, while it was significant (0,165 at 0.05 level) when involving the manufacturing for the same purpose. For the overall model, the hypothesis *1a* is not rejected, while the *1b* and *1c* were rejected.

Considering the environmental turbulence as moderating variable, manufacturers have shown that in both low and high levels of environmental turbulence the guidance to cooperate

has no influence on the involvement of internal and external partners into NPD (table 9). However, the results pointed out that in environments with medium level of turbulence, the guidance to cooperate influenced on 0.33 (at 0.05 level) the involvement of manufacturing into new product development. Those results do not mean that firms are not involving external partners into NPD, but rather the guidance to cooperate is not perceived as antecedent of external partnership in those scenarios.

In medium levels of environmental turbulence, technologies and customers preferences do not change so fast, which allow the involvement of manufacturing into NPD as way to decrease the moderate levels of uncertainty. Manufacturing involvement into NPD also offers new perceptions, skills and overwhelms the limits of work division (Fernandez et al., 2010).

Moreover, we analyzed if the relationship between the firm's guidance to cooperate and manufacturing, supplier and customers involvement into NPD are significantly different in the three industries under study (table 10). In general, the analysis of the relationships demonstrated that there is no significant difference between industries (p-value = 0,129). The guidance to cooperate influenced significantly on the manufacturing involvement into NPD only in Electronics industry. No significant influences were found on supplier and customer involvement in electronics, machinery and transport equipment industries.

Finally, we checked if plants located in different continents may present dissimilar relationships between the scales described above. To do so, we test if the structure of the relationships is different among the groups of countries (American, European and Asian). The results have shown that the location does moderate the relationship between cooperation and manufacturing, supplier and customer involvement into NPD (p-value= 0.000). In American countries (Brazil and USA) the guidance to cooperate influences positively on the manufacturing involvement (0.519 at 0.05 level), while it influences negatively on the customer and supplier involvement.

European countries, in turn, presented significant positive influence of the guidance to cooperate on internal and external partners. The standardized regression weights were 0.176 (at 0.1 level), 0.201 (at 0.05 level) and 0.167 (at 0.1 level) for manufacturing, supplier and customer involvement, respectively. Counteracting, no influence was perceived on internal and external involvement in Asian countries.

European countries have faced an economic crisis during the last three years, but its signs began in earlier 2008 after the American economic crisis. During the economic crisis customers get their purchasing power minimized and in turn, consume less. This scenario drives the manufacturer to seek for alternatives that might optimize the internal process, minimize the production costs and offer products that are close to the customers' expectations under more affordable prices. Due to this contingent, manufacturers tend to cooperate with partners to get the needed resources to outperform in operational and marketing issues.

In short, the results show that the influence of the guidance to cooperate on the manufacturing involvement is perceived in environments with medium levels of turbulence, in the industry of electronics and in American and European countries. The influence on supplier involvement, in turn, was realized in medium level of environmental turbulence and in European countries. Finally, the positive influence on customer involvement was perceived only in European countries.

According to the literature review, there are two basic reasons that incite the organizations to cooperate externally, which are related to the resources scarcity and the possibility to explore new opportunities (Van de Ven, 1976b). Nevertheless, scholars have pointed out that without a guidance to cooperate, supported by policies and managerial mechanisms to stimulate the employees to get involved both internally and externally, the firms are not capable to cooperate efficiently with their partners (Laughlin, 1978; Souder, 1988).

Our results suggest that firms, in general, are oriented to cooperate with partners in order to get mutual benefits from this relationship, as preconized by the social capital theory (Bourdieu, 1980; Coleman, 1988). However, the influence of the guidance to cooperate on the involvement with partners seems to rely on others factors that moderate those relationships as the environmental turbulence and the macroeconomic environment.

4.3.2 The influence of customer involvement on the anticipation of new technologies and operational performance

Customer involvement was defined as a formalized working relationship between a customer and a manufacturer, involving the performance of coordinated activities to develop a

new product (Campbell & Cooper, 1999). As the consumers require process, quality, shorter delivery cycles and demand innovation, the customer involvement into NPD drives the manufacturer to acquire new technologies in order to get efficiency on these processes (Calvert, 2003; Gatignon & Xuereb, 1997). Thus, the hypothesis to be tested is:

Hypothesis 2a: Customer involvement into new products development influences positively on the anticipation of new technologies.

Hypothesis 2b: Customer involvement into new products development influences positively on the operational performance.

The results have shown that manufacturers have involved moderately customers into the NPD's process. In line with the tables 8, 9, 10 and 11, the relationship between customer involvement and anticipation of new technologies were not significant in the general model and when the environmental turbulence and the industry acted as mediating variables (p-values higher than 0.05).

The influence of customer involvement on anticipation of new technologies were significant always in American countries, but in negative way (standardized regression weight = -0.28). Hence, the hypothesis 2 was rejected in the overall model and when the moderating variables were included in the model.

The literature has illustrated that customers who are involved into NPD requires characteristics in the product that are related to the operational performance of the NPD. To get best results on it, the anticipation of new technologies have worked as a tool to optimize the internal routines and process the information got from customers. Thus, the higher the involvement of customer into NPD, the higher would be the anticipation of new technologies (Calvert, 2003; Dean Jr & Snell, 1996; Gatinon & Xuereb, 1997; Gemünden et al., 1992). However our results do not confirm what has been postulated in the literature, once the involvement of customers into NPD did not show any significance on the anticipation of new technologies, even considering different levels of environmental turbulence, industries and location.

In terms of performance, customer involvement affected positively on the operational performance as postulated by previous studies. Such influence has been stronger in medium and low levels of environmental turbulence. In these scenarios, as the market knowledge and technology don't change rapidly, moderate levels of customer involvement enable the

company to gather information from market, process it and convert it in products that are operationally feasible and according to the customers expectation (DeSarbo, Anthony Di Benedetto, Michael, & Sinha, 2005).

On the other hand, although high environmental turbulence is supposed to be an enabler for customer involvement into NPD since the knowledge and technology held by the company might get obsolete rapidly, increased customer involvement is considered risky and may hurt the performance (Kaulio, 1998). Thus, customer involvement in this scenario delays the design and hampers the operational performance (production process and time to-market) by providing a great amount of information that's difficult to process and exploit it (Bajaj et al., 2004).

4.3.3 The influence of the supplier involvement on the anticipation of new technologies, continuous improvement and operational performance

Supplier involvement is taken as a new or existing relationship between the buyer and the supplier to strive benefits for both through collaborative activities (Ellram, 1995). Those benefits are better evidenced on operational performance as it is a spillover of the supplier experience and its capacity to offer information about new technologies to improve the NPD performance (Cousins & Lawson, 2007; Primo & Amundson, 2002; Ragatz et al., 1997; Wasti & Liker, 1997). Thus, the higher the supplier involvement into NPD, the higher the manufacturer ability to improve its internal process (continuous improvement) and get new technologies to enhance its results (Liker et al., 1996). Under these arguments, we test the following hypotheses:

Hypothesis 3a: Supplier involvement into new products development influences positively on the manufacturer's anticipation of new technologies.

Hypothesis 3b: Supplier integration into new products development influences positively on the manufacturer's continuous improvement.

Hypothesis 3c: Supplier integration into new products development influences positively on the operational performance.

Based on the descriptive analysis depicted in the table 3, the surveyed firms demonstrated moderate levels of supplier involvement into NPD. In the general model, such involvement has influenced positively on the manufacturer continuous improvement in 0,07 (at 0.1 level), on the operational performance in 0,147 (at 0.05 level) and has not influenced on the anticipation of new technologies.

Moreover, tests considering the moderation power of the environmental turbulence showed that supplier involvement has no influence on anticipation of new technologies and continuous improvement in any of the three levels of environmental turbulence. Those results differ from findings in previous studies once supplier involvement and anticipation of new technologies are understood as strategies closely linked, wherein the presence of one strategy drives the manufacturer to get the other one (Narasimhan et al., 2010).

In terms of performance, supplier involvement has influenced on the operational performance in low and medium level of environmental turbulence. The rejection of the positive influence of supplier involvement on operational performance moderated by high environmental turbulence lays on the fact that such environment requires high supplier involvement into NPD (Eisenhardt & Martin, 2000). High supplier involvement into NPD means that the product design is supplier driven, which was named by Handfield and colleagues (1999) as black box integration.

As studied by Koufteros, Cheng and Lai (2007), black box integration hamper the operational performance by having the NPD process taken basically by the supplier. This increased supplier responsibility in NPD process is seen as the dark-side of the social capital, wherein too much integration injuries the performance (Villena et al., 2011). To get better results, suppliers must be involved moderately into NPD, performing activities that are shared with the manufacturer, just as the grey-box integration required by medium level of environmental turbulence (Koufteros, Cheng & Lai; 2007).

Testing the same hypotheses under the moderation of the location, supplier involvement had no influence on anticipation of new technologies and continuous improvement in all group of countries. Those results lead to the understanding that suppliers have no influence on the firm`s absorptive capacity when factors related to regional social structure, culture or macroeconomic systems are taken in account. When it comes to operational performance, it was affected positively in European and Asian countries.

The positive influence of the supplier involvement on operational performance in Asian countries was not an unexpected result since those countries are considered pioneers in getting benefits from this external partner in terms of quality, product development cycle time and production cost's reduction (Clark & Fujimoto, 1991). Taking the Japanese manufactures as reference, European and American countries adopted the same practices to get similar results. Based on our results, European countries have learned from Asian ones how to take advantage from such social capital while the American countries don't (Bidault et al., 1998; Eisenhardt & Tabrizi, 1995; Zirger & Hartley, 1996).

Finally, supplier involvement had positive influence on operational performance in transport equipment and machinery industries. Those results also are in line with previous studies which highlight, since mid-eights, the operational benefits generated through supplier involvement in Japanese automobile manufacturers (Clark & Fujimoto, 1991).

4.3.4 The influence of the manufacturing involvement on the continuous improvement and operational performance.

As in suppliers and customers involvement, manufacturing involvement refers to its participation on new product development (Pisano & Wheelright, 1995; Shapiro, 1977). Manufacturing involvement into NPD leads to the adaptation of the internal resources to the market requirements; and due to this context, firms must constantly update and enhance its process in order to keep competitive at market (Tse, 1991; Zangwill & Kantor, 1998). This understanding drives us to test the following hypothesis:

Hypothesis 4a: Manufacturing involvement into new products development influences positively on the manufacturer's continuous improvement.

Hypothesis 4b: Manufacturing involvement into new products development influences positively on operational performance.

In spite of finding supportive argumentations on the literature review, the relationships between manufacturing involvement and continuous improvement and also with operational performance was not confirmed in the overall analysis model. No influence was also perceived when considering the different levels of environmental turbulence. This is akin to

say that the decision to improve the internal routines is not dependent on the changes at the market when it comes to customer's requirements. Moreover, we would say that turbulent market does not moderate the relationship between manufacturing involvement and the firm's capacity of assimilating new information and technologies and learning. Thus, no effect was also verified on operational performance.

The influence of manufacturing involvement on continuous improvement was supported in the electronics industry (0.242 at 0.1 level) and in American countries (0.414 at 0.05 level), while the influence on operational performance was notices only in Asian countries. These relationships presented very dissimilar results across locations so that it might be understood as a moderating relationship (X^2 = 1622,23 at 0.05 level and X^2 = 1572,014 at 0.01 level).

Previous studies have pointed out that companies which desire to keep their competitiveness must consider the manufacturing involvement into NPD due its capacity to adapt its process to the market requirements (Tse, 1991; Zangwill & Kantor, 1998). Calantone and colleagues (2002), stress that this process may be more evidenced in industries that demand fast product development and fast market penetration. Hence, we assume that our results are according to the literature since the electronic industries has been considered one the most innovative industries, with high clockspeed, wherein the more manufacturing are involved into NPD, the more improvements are performed in the internal process.

4.3.5 The influence of the anticipation of new technologies on the continuous improvement and on the operational and marketing performance

Anticipation of new technologies refers to the firm's awareness to acquire technologies that will convert insights from market into products and services, in order to attend the customers' needs (Egelhoff, 1988 as cited by Kotha & Swamidass; 2000). Due to the fast changes in the customer's preferences, manufacturers must update their skills consantly through acquisition of new technologies and improvements on the process and routines. Thus, the anticipation of new technologies stimulates the manufacturer to reevaluate regularly its internal resources to avoid the obsolescence (Ishii et al., 2009).

Moreover, the anticipation of new technologies and the improvement of process drive the manufacturer to outperform in quality, flexibility, cost reduction and in customer satisfaction (Mohanty, 1993; Swink & Nair, 2007; Tracey et al., 1999; Tseng, 2004). Hence, we claim that:

Hypothesis 5a: Anticipation of new technologies influences positively on the manufacturer's continuous improvement.

Hypothesis 5b: Anticipation of new technologies influences positively on the NPD's operational performance.

Hypothesis 5c: Anticipation of new technologies influences positively on the NPD's marketing performance.

The descriptive analysis shows that firms have a slight trend to anticipate new technologies to be according to the market expectations. This trend has significantly influenced on the continuous improvements in 0,265 (at 0.01 level) and shown no significant influence on operational and marketing performance.

In the environmental turbulence scenario, the impact of ANT on the continuous improvement was positive and significant at low and high levels of it. No impact was perceived on operational performance at the three levels of turbulence and positive and significant impact was evidenced on marketing performance at low level (0.22 at 0.05 level).

When it comes to location, ANT has positive and significant influence on continuous improvement in America (0.389 at 0.05 level), Europe (0.41 at 0.01 level) and Asia (0.507 at 0.01 level). No influence was realized on operational performance for all three locations and some influence was evidenced on marketing performance in Asian countries (0.204 at 0.05 level). At this scenario, the hypothesis *5a* was not reject for all three groups of countries, the *5b* was reject for all them and the *5c* was not rejected in Asian countries.

Finally, the impact of ANT on continuous improvement was positive and significant in the Electronics (0.229 at 0.05 level), Machinery (0.537 at 0.01 level) and Transport Equipment industries (0.232 at 0.1 level). Contrarily, no influence was realized on operational and marketing performance in those industries. Hence, the hypothesis *5a* was not rejected for all industries, while the *5b* and *5c* was rejected for all them.

Comparing our results with the literature we assume that our results are supported by them, but with some caution about the conditions that enable them. The relationship between ANT and continuous improvement was significant in all scenarios, except in medium levels of environmental turbulence. The strongest relationship between those variables was realized in the machinery industry. Thus, we would say that companies have fostered a learning environment through the acquisition of new technologies to update their skills and keep them competitive. In addition, those results reinforce the concepts of absorptive capacity once the anticipation of new technologies are taken as new information that are acquired and assimilated by the firms and converted into products and services (Cohen & Levinthal, 1990; Zahra & George, 2002).

In terms of performance, our results do not show any influence of ANT on operational performance in all the ten scenarios presented, which are not in tune with was got from previous studies that gave rise to the hypothesis (Swink & Nair, 2007; Tracey et al., 1999; Tseng, 2004). In line, in terms of marketing performance, our results are supported by the findings of Tracey and colleagues (1999), however, in our sample, such influence only happens in low levels of environmental turbulence and in Asian countries

Our presumption, as illustrated in the topic 2.3, is that suppliers and customers have direct effect on operational performance and also indirect influences on operational and marketing performance by anticipation of new technologies. However, ANT has not played a good mediating role between the external partners and the firm's performance as described in the section 4.3.2 and 4.3.3. A possible explanation lays on the fact that the influence of the ANT on the results are more related to organizational features than to external conditions as the environmental turbulence, socioeconomic factors(location) and industry.

In line, previous studies have claimed that ANT has significant influence on the firm's performance when this relationship is moderated by issues related to the organizational structure, as educational program for production manager (Ishii et al., 2009), top managers support (Lewis et al., 2013), people training (Hofmann & Orr, 2005; Machuca, Diaz, & Gil, 2004), multidisciplinary planning team (Efstathiades et al., 2000) and less mechanist structure (Gupta, Chen, & Chiang, 1997).

4.3.6 The influence of the continuous improvement on operational and marketing performance

Continuous improvement is a production practice based on TQM philosophy that is concerned about the small enhancements on internal routines to obtain better results (Bessant et al., 1994; Mogab & Cole, 2000). Its deployment although doesn't demand high investments may bring consistent benefits in terms of operational and marketing performance (Al-Khawaldeh & Sloan, 2007, Chapman et al., 1997; Coughlan et al., 2001; de Ron, 1998; Gieskes et al., 1997; Jaber, Bonney, & Guiffrida, 2010). Hence we posit that:

Hypothesis 6a: Continuous Improvement influences positively on the operational performance of the new product development.

Hypothesis 6b: Continuous Improvement influences positively on the marketing performance of the new product development.

The influence of continuous improvement on operational performance was realized in American and Asian countries, with loadings of 0.553 (at 0.05 level) and 0.232 (at 0.1 level). The same influence was not evidenced in different levels of environmental turbulence and industries.

According to the Table 3, manufacturers have demonstrated high levels of practices toward to continuous improvement. However, it has not impacted on the marketing performance in new product development in the general model and when moderated by environmental turbulence, industry and location. Hence, the hypothesis *6b* was rejected for contexts under study.

In terms of operational performance, continuous improvement has affected it only in American and Asian countries. As continuous improvement has its origin in Japan, with the aid of American experts in the process of country reconstruction after Second World War and the economic crisis that came with it, we understand that these countries are specialized in take advantage from this manufacturing practice. Thus, the macroeconomics factors in that age leaded the companies to develop skills to handle with its internal resources in order to outperform and get competitiveness (Adler & Clark, 1991; Mogab & Cole, 2000)

Our results suggest very narrow conditions wherein CI influences the operational performance. Studies pointed out that owing to CI's politics, rules and philosophy, the results in operational and marketing performance would be expected since it works in the enhancement in routines and process that drive to improved quality, lower cost production and customer satisfaction (Al-Khawaldeh & Sloan, 2007, Chapman et al., 1997; Coughlan et al., 2001; de Ron, 1998; Gieskes et al., 1997; Jaber, Bonney, & Guiffrida, 2010).

According to the model proposition depicted in the section 2.3, continuous improvement was meant to be a good mediator between supplier and manufacturing involvement and operational and marketing performance due to its capacity of learning from external environment and enhancing the internal process to adapt to the contingencies. Thus, as in anticipation of new technologies (section 4.3.5), continuous improvement has not played a good mediating role between partners of the supply chain and firm's performance when moderated by external conditions.

A study performed by Al-Khawaldeh and Sloan (2007) in Jordan manufacturers also faced the same issues when measuring the influence of the continuous improvement on the firm's performance. Hence, just like in anticipation of new technologies, we believe that external features do not moderate the influence of the continuous improvement on the firm's performance, but rather by organizational characteristics toward to employees education, commitment and communication (Irani & Sharp, 1997; Mogab & Cole, 2000; Terziovski & Sohal, 2000).

4.3.7 The influence of operational performance on business and marketing performance

Operational performance refers to a set of indicators related to quality, delivery, flexibility and cost. Products with successful operational performance offer low costs, high quality, product launch's short-time and are targeted to the customer needs. Those features are converted into business performance since them promotes increased return on investments (ROI) and increased sales. Those features are also appealing for the customer acceptance, increasing satisfaction and loyalty (Brown & Eisenhardt, 1995). Thus we posit that:

Hypothesis 7a: NPD's operational performance influences positively on the NPD's business performance.

Hypothesis 7b: NPD's operational performance influences positively on the NPD's marketing performance.

In general, the surveyed companies reported that they have operational performance (OP) around the average of the industry that they belong to. In terms of influence, the general model illustrated that operational performance has no influence on business performance, but presented high impact on the marketing performance (above 1) and significance at 0.01 level.

Considering the environmental turbulence, influences on business performance was realized at low level of turbulences (0,91 at 0.01 level). Marketing performance was impacted in low and a medium level of turbulencs with regression weights above 1 and significance at 0.01 level. These results are consistent with our previous analysis wherein the moderate involvement with supplier and customers in low and medium level of turbulence allows the manufacturer to acquire information from external partners, assimilated it and exploit it. Such level of involvement does not hamper the operational performance and, in consequence, launches the product at the right time, conquering the customer acceptance and satisfaction.

When the moderating variable was the industry, business performance was impacted only in the machinery industry (0.792 at 0.1 leve), while the marketing performance in the electronics, machinery and transport equipment (0.821 at 0.01 level; 1.08 at 0.01 level and 1.119 at 0.01 level, respectively). In terms of location, the operational performance impacted the business performance only in Asian countries (1.192 at 0.01 level), while the marketing performance was significant impacted in the three group of countries.

In line with the argumentation in the introduction of this topic, operational performance is supposed to influence both business and marketing performance. Our results support that rationale, however, very few studies have dedicated to analyze the relationship between those variables (Brown & Eisenhardt, 1995), and hence, we miss some comparisons. In spite of that, our results demonstrate some conditions wherein the operational performance influences the business and marketing performance, what may act as a stimulator for potential further researches about the topic.

4.3.8 The influence of marketing performance on business performance

Marketing performance is constituted by indicators that are related to customer satisfaction, commercial success and time to market. The rationale behind the influence on marketing performance on business performance lay up on the customer acceptance of products that are appealing to them that is converted into increased sales, market share and return on investments (Brown & Eisenhardt, 1995). Under these considerations we hypothesized that:

Hypothesis 8: NPD's marketing performance influences positively on the NPD's business performance.

Our results suggest that marketing performance has no influence on business performance when considering the general model and the location as moderating variable. Such influence was only noticed in electronic industry (0.595 at 0.05 level) and in high level of environmental turbulence (0.592 at 0.05 level).

Although a little literature has dedicated to explain the relationship between performance measurements, we presume that as the operational performance affected positive and significantly the marketing performance (section 4.3.7) in almost all scenarios, the product launch at right time in this dynamic industry was converted into customer acceptance and satisfaction , that in turn, resulted in increased sales, market-share and return on investments.

As mentioned previously, there is a lack of studies that measures the relationship between the indicators of NPD's performance. This is because most of the studies treat the NPD's performance as a single construct or single variable (Brown & Eisenhardt, 1995). Hence, like in the section 4.3.7 we have no studies to compare the results. Anyway, our study demonstrates the scenarios wherein such influence is more likely to happen.

4.3.9 Summary of hypotheses testing

At this topic we summarize the hypothesis testing in order to make easier the understanding about the results. The results are summarized in the Table 12. According to it, when the hypotheses were moderated by environmental turbulence, the three scenarios (low, medium and high) presented some peculiarities. While environments with low and high

levels turbulences presented more influences on measures of new product development, the medium one is more related to issues of cooperation.

When it comes to industry, electronics industry presented influences on cooperation, continuous improvement and new product performance, while the machinery and transport equipment industry only in continuous improvement and NPD performance. Finally, considering the location as moderating variable, American and Asian countries presented more influences on issues toward to NPD performance, while the European countries on involvement of supply chain agents on NPD.

Table 12 – Summary of hypotheses testing

Hypotheses				General Model	Enviromental Turbulence			Industry			Location		
					Low	Medium	High	Electronics	Machinery	Transport Equipment	America	Europe	Asia
H1a	MANUF	<---	COOP	NR	R	NR	R	NR	R	R	NR	NR	R
H1b	SUPP	<---	COOP	R	R	R	R	R	R	R	R	NR	R
H1c	CUST	<---	COOP	R	R	R	R	R	R	R	R	NR	R
H2a	ANT	<---	CUST	R	R	R	R	R	R	R	R	R	R
H2b	OPER	<---	CUST	NR	NR	NR	R	R	NR	R	R	R	NR
H3a	ANT	<---	SUPP	R	R	R	R	R	R	R	R	R	R
H3b	CONT	<---	SUPP	NR	R	R	R	R	NR	NR	R	R	R
H3c	OPER	<---	SUPP	NR	NR	NR	R	R	R	NR	R	NR	NR
H4a	CONT	<---	MANUF	R	R	R	R	NR	R	R	NR	R	R
H4b	OPER	<---	MANUF	R	R	R	R	R	R	R	R	R	NR
H5a	CONT	<---	ANT	NR	NR	R	NR	NR	NR	NR	NR	NR	NR
H5b	OPER	<---	ANT	R	R	R	R	R	R	R	R	R	R
H5c	MARK	<---	ANT	R	NR	R	R	R	R	R	R	R	NR
H6a	OPER	<---	CONT	R	R	R	R	R	R	R	NR	R	NR
H6b	MARK	<---	CONT	R	R	R	R	R	R	R	R	R	R
H7a	BUSIN	<---	OPER	R	NR	R	R	R	R	NR	R	R	NR
H7b	MARK	<---	OPER	NR	NR	NR	R	NR	NR	NR	NR	NR	NR
H8	BUSIN	<---	MARK	R	R	R	NR	NR	NR	R	R	R	R

Source: elaborated by the author
NR = Hypothesis not rejected
R = Hypothesis rejected

4.4 DIRECT AND INDIREC EFFECTS OF SUPPLY CHAIN AGENTS ON NEW PRODUCT DEVELOPMENT PERFORMANCE.

At this topic we seek to analyze the effects of the supply chain on new product development performance, also considering the environmental turbulence, industry and location as moderating variable. This analysis attends the call of Bajaj (2004), Campbell and Cooper (1999) and Haartman (2013) after evidences of dissimilar results in studies about the direct influence of the supply chain agents on NPD performance. Bajaj (2004) and Haartman (2013) also suggest that further studies should consider the indirect effects once most of studies are dedicated to the direct ones. Thus, the results of our analysis are depicted from the table 13 to the table 22.

Table 13 – Effects of Supply Chain Agents on NPD's performance - General

	Direct Effect						Indirect Effect						Total Effect					
	Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement	
	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value
OP	0,183	0,112	0,274	0,009	0,053	0,677	0,002	0,93	0,001	0,705	0	0,986	0,185	0,09	0,275	0,01	0,053	0,662
MP	0,038	0,555	-0,183	0,025	0,026	0,739	0,191	0,115	0,296	0,009	0,06	0,631	0,229	0,01	0,113	0,131	0,087	0,2
BP	0,004	0,909	-0,09	0,286	-0,043	0,603	0,168	0,106	0,213	0,038	0,052	0,573	0,172	0,016	0,123	0,127	0,009	0,98

Source: elaborated by the author

RW = standardized regression weight; OP = Operational performance; MP = Marketing performance; BP = Business performance

Table 14 - Effects of Supply Chain Agents on NPD's performance – Low Environmental Turbulence

	Direct Effect						Indirect Effect						Total Effect					
	Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement	
	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value
OP	0,352	0,005	0,159	0,134	0,048	0,809	0,014	0,878	0,001	0,771	0	0,916	0,365	0,003	0,16	0,152	0,049	0,815
MP	-0,019	0,697	0,069	0,246	0,087	0,556	0,399	0,006	0,175	0,217	0,054	0,819	0,38	0,021	0,243	0,028	0,14	0,359
BP	-0,157	0,123	-0,076	0,782	0,201	0,105	0,343	0,036	0,155	0,45	0,042	0,739	0,187	0,181	0,079	0,385	0,242	0,199

Source: elaborated by the author

RW = standardized regression weight; OP = Operational performance; MP = Marketing performance; BP = Business performance

Table 15 – Effects of Supply Chain Agents on NPD's performance - Medium Environmental Turbulence

	Direct Effect						Indirect Effect						Total Effect					
	Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement	
	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value
OP	0,207	0,277	0,36	0,017	-0,072	0,422	0	0,823	0,001	0,731	-0,006	0,366	0,207	0,253	0,36	0,015	-0,078	0,517
MP	0,146	0,218	-0,277	0,167	0,147	0,439	0,193	0,248	0,352	0,019	-0,075	0,466	0,339	0,015	0,075	0,603	0,072	0,876
BP	0,06	0,722	0,096	0,622	-0,187	0,459	0,197	0,173	0,145	0,496	-0,005	0,977	0,257	0,052	0,241	0,106	-0,192	0,252

Source: elaborated by the author

RW = standardized regression weight; OP = Operational performance; MP = Marketing performance; BP = Business performance

Table 16 - Effects of Supply Chain Agents on NPD's performance – High Environmental Turbulence

	Direct Effect						Indirect Effect						Total Effect					
	Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement	
	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value
OP	-0,203	0,149	0,493	0,018	0,119	0,638	-0,007	0,559	0,005	0,635	0,02	0,258	-0,21	0,109	0,498	0,015	0,139	0,525
MP	0,487	0,106	-1,077	0,008	-0,188	0,518	-0,439	0,114	1,059	0,012	0,274	0,485	0,048	0,89	-0,018	0,922	0,085	0,507
BP	0,093	0,435	-0,001	0,999	-0,113	0,649	0,005	0,956	0,067	0,621	0,068	0,567	0,098	0,581	0,066	0,524	-0,045	0,953

Source: elaborated by the author

RW = standardized regression weight; OP = Operational performance; MP = Marketing performance; BP = Business performance

Table 17 - Effects of Supply Chain Agents on NPD's performance – Electronics industry

	Direct Effect						Indirect Effect						Total Effect					
	Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement	
	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value
OP	0,117	0,456	0,156	0,498	0,073	0,804	0,003	...	0,001	0,727	0,003	0,794	0,12	0,423	0,157	0,506	0,076	0,62
MP	0,084	0,656	-0,122	0,577	-0,166	0,438	0,132	0,302	0,132	0,484	0,051	0,743	0,216	0,136	0,011	0,963	-0,115	0,507
BP	-0,006	0,994	0,02	0,924	-0,078	0,561	0,16	0,394	0,055	0,712	-0,041	0,921	0,153	0,383	0,075	0,553	-0,119	0,536

Source: elaborated by the author

RW = standardized regression weight; OP = Operational performance; MP = Marketing performance; BP = Business performance

Table 18 - Effects of Supply Chain Agents on NPD's performance – Machinery industry

	Direct Effect						Indirect Effect						Total Effect					
	Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement	
	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value
OP	-0,089	0,464	0,582	0,003	0,262	0,067	0,027	0,421	0,013	0,326	-0,024	0,291	-0,062	0,555	0,594	0,002	0,238	0,104
MP	0,194	0,256	-0,521	0,007	-0,188	0,258	-0,162	0,312	0,819	0,003	0,391	0,082	0,032	0,739	0,298	0,069	0,203	0,192
BP	0,141	0,19	-0,097	0,625	-0,156	0,111	-0,001	0,94	0,407	0,041	0,218	0,103	0,14	0,208	0,31	0,033	0,062	0,471

Source: elaborated by the author

RW = standardized regression weight; OP = Operational performance; MP = Marketing performance; BP = Business performance

Table 19 – Effects of Supply Chain Agents on NPD's performance – Transport Equipment industry

	Direct Effect						Indirect Effect						Total Effect					
	Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement	
	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value
OP	0,431	0,019	0,089	0,627	-0,068	0,713	-0,008	0,917	0,003	0,61	-0,001	0,984	0,423	0,023	0,092	0,559	-0,069	0,636
MP	-0,047	0,649	-0,063	0,688	0,183	0,23	0,5	0,032	0,101	0,627	-0,078	0,617	0,454	0,013	0,038	0,886	0,106	0,436
BP	-0,204	0,051	-0,073	0,495	-0,028	0,752	0,383	0,014	0,054	0,692	0,025	0,87	0,179	0,166	-0,019	0,7	-0,003	0,936

Source: elaborated by the author

RW = standardized regression weight; OP = Operational performance; MP = Marketing performance; BP = Business performance

Table 20 – Effects of Supply Chain Agents on NPD's performance – American countries

	Direct Effect						Indirect Effect						Total Effect					
	Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement	
	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value
OP	0,6	0,005	-0,098	0,728	0,052	0,781	-0,115	0,06	0,074	0,11	0,243	0,059	0,485	0,011	-0,024	0,951	0,295	0,339
MP	-0,414	0,047	0,096	0,552	0,152	0,694	0,84	0,009	-0,141	0,458	0,211	0,346	0,426	0,02	-0,045	0,751	0,362	0,09
BP	0,325	0,153	0,112	0,85	0,095	0,84	0,171	0,362	-0,038	0,865	0,234	0,373	0,497	0,001	0,074	0,898	0,329	0,201

Source: elaborated by the author

RW = standardized regression weight; OP = Operational performance; MP = Marketing performance; BP = Business performance

Table 21 – Effects of Supply Chain Agents on NPD's performance – European Countries

	Direct Effect						Indirect Effect						Total Effect					
	Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement	
	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value
OP	0,213	0,171	0,241	0,103	0,012	0,982	-0,039	0,407	0,002	0,639	0,007	0,681	0,174	0,268	0,242	0,11	0,019	0,902
MP	0,042	0,826	-0,215	0,29	-0,048	0,761	0,211	0,24	0,262	0,12	0,017	0,915	0,253	0,009	0,047	0,621	-0,031	0,73
BP	-0,081	0,534	0,221	0,189	-0,103	0,58	0,258	0,048	-0,077	0,609	-0,056	0,542	0,177	0,173	0,144	0,115	-0,159	0,216

Source: elaborated by the author

RW = standardized regression weight; OP = Operational performance; MP = Marketing performance; BP = Business performance

Table 22 - Effects of Supply Chain Agents on NPD's performance – Asian Countries

	Direct Effect						Indirect Effect						Total Effect					
	Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement		Supplier Involvement		Customer Involvement		Manufacturing Involvement	
	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value	RW	p-value
OP	0,199	0,198	0,436	0,006	0,31	0,148	0,042	0,146	-0,014	0,25	-0,085	0,033	0,241	0,084	0,422	0,008	0,225	0,259
MP	-0,018	0,981	-0,296	0,083	0,091	0,685	0,279	0,136	0,561	0,009	0,368	0,18	0,261	0,184	0,265	0,079	0,458	0,05
BP	-0,095	0,537	-0,22	0,086	0,106	0,316	0,219	0,064	0,342	0,02	0,252	0,197	0,124	0,469	0,122	0,357	0,358	0,093

Source: elaborated by the author

RW = standardized regression weight; OP = Operational performance; MP = Marketing performance; BP = Business performance

4.4.1 Direct and indirect effects of supplier involvement on NPD's performance.

The analysis of the direct influence of the suppliers on the new product development's performance showed that, in the general model, the supplier has no significant direct and indirect effect on any kind of NPD's performance. However, combining its direct and indirect effect (total effect), supplier impacts in 0,275 on operational performance.

Adding the environmental turbulence to the model, suppliers influenced NPD's performance only in low levels of turbulence. In this scenario, suppliers has affected directly the operational performance in 0,35 (at 0.05 level) and indirectly the marketing and business performance in 0,399 and 0,343, respectively. In low environmental turbulence, as the market knowledge and technology do not change fast, supplier integration works in activities of improvements of the manufacturer internal process, in order to keep the profits through production cost reduction, quality and delivery(Jansen, Van Den Bosch, & Volberda, 2006; Lichtenthaler, 2013). Thus in low environmental turbulence, suppliers play a critical role on operational performance if compared with customer and manufacturer involvement.

In terms of industry, supplier involvement impacted in 0,430 (at 0.05 level) on operational performance in transport equipment industry. This result seems to be in line with studies performed by several scholars wherein the supplier involvement was meant to improve the operational performance in transport correlated industries, as automobiles industry in Asian countries (Bidault et al., 1998). Studies performed on transport correlated-industries already reported gains in operational performance from this involvement since mid-eighties, being a reference to American and European countries to get upper performance (Clark & Fujimoto, 1991; Crosby, 1988; Garvin, 1988). Although Asian countries are pioneers in involving supplier into NPD, our sample shown that such involvement impacted significantly the operational performance in American countries (Brazil and USA).

Indirectly, supplier involvement did not show any influence on the measures of NPD's performance in the general model, however its influence was realized on marketing (0,39) and business (0,34) performance in low levels of environmental turbulence. The same influence was also realized in transport equipment industry, but with higher impact (0,50 and 0,38, respectively).

The highest influence of supplier on NPD's performance was realized in American countries with 0,84 of impact on marketing performance. In European countries the influence was on the business performance, with loading of almost 0,26 on it. Thus, supplier influenced the marketing and business performance in general model, in low level of environmental turbulence and in American and European countries.

Those results, in short, demonstrate that the supplier involvement influences directly the operational performance while it influences indirectly on marketing and business performance at same scenarios.

No impact of supplier involvement on NPD's performance was realized in Asian countries. This result sounds interesting since supplier has been involved since the eighties into NPD in Japan as the antecedent of best results in operational performance (Bidault et al., 1998; Garvin, 1998). As reported by Clark and Fujimoto (1991), while the involvement of suppliers into NPD was around 30% in Japan, the same involvement was only 7% in American manufacturers. Based on our results, although we are not considering only Japan in Asia and not only USA in America, they suggest the American manufacturers have learned from Asian countries how to integrate suppliers into NPD and get benefits from them.

Other studies also considered moderating factors when analyzing the influence of supplier into NPD, as the level of responsibility of the supplier in the NPD project (Koufteros, Cheng and Lai, 2007; Primo and Amundson, 2002) and the moment wherein the supplier is integrated into NPD project (Hartley et al., 1997). Our study contribute with the studies of those scholars by providing others factors that moderate the direct and indirect effect of suppliers on NPD's performance.

4.4.2 Direct and indirect effects of customer involvement on NPD's performance.

Customer involvement, in the general model, showed positive and significant influence on operational performance (0.274 at 0.05 level). The direct influence of customer involvement on operational performance was also evidenced at medium (0,36) and high levels (0,49) of environmental turbulence, in machinery industry (0,58) and in Asian countries (0,436). Customer involvement did not impact indirectly the operational performance in any of the scenarios under study.

Positive influence of customer involvement on marketing performance was noticed in indirect relationships in the general model (0,296), medium (0,352) and high levels (1,059) of environmental turbulence and in machinery industry (0,81) and in Asian countries (0,561). Additionally, customer involvement affect the business performance, in the indirect way, in the general model (0,213) and in Asian countries (0,342).

Our results are in line with previous studies that demonstrated that customer involvement affect the operational performance once customer provide insights from the market that are converted into conformities that will aggregate value to the product (Gemünnden et al., 1992).

In spite of the acceptance of the direct influence of customer's involvement on operational performance (Feng et al., 2010; 2012; Kaulio, 1998) , Bajaj and colleagues (2004) pointed out that such influences happen indirectly. In medium and high environmental turbulence, manufacturers tend to increase the level of customers integration into NPD in order to overcome the obsolescence of market knowledge. High levels of integration lead the manufacturer to consider too much information that delays the product design, hurting its performance. On the other hand, the amount of information considered in the product design helps to minimize the flaws and the waste of resources in the production, impacting positively on the operational performance. Hence, according to Bajaj and colleagues (2004) customer involvement plays a ripple influence on operational performance instead of direct one. Counteracting, in our sample, the direct influence of customer involvement on the operational performance was stronger than the indirect one. For this reason, at same scenarios, customers presented a ripple influence on marketing and business performance.

Machinery industry, in turn, requires more customer involvement into NPD once the product is not pushed to the market as in electronic industry. Customers of electronics industry tend to expect novelties from the manufacturer instead of ask for them. Customers of machinery industry expect products that are in line with their expectations in terms of functionalities, quality and cost. Thus, we suggest that in machinery industry the involvement of customers into NPD plays a crucial role on the operational performance.

4.4.3 Direct and indirect effects of manufacturing involvement on NPD's performance.

The analysis of the direct and indirect influence of the manufacturing on NPD's performance showed that there is no relationship between manufacturing and operational, marketing or business performance in any of the ten scenarios presents through the moderating variables.

Our results counteracts with results found out in previous studies wherein the manufacturing involvement is supposed to analyze the requirements of the market and convert it into goods according to the resources available in the company. This analysis avoids the waste of resources that are deployed by others functional areas in the design of products that are not feasible to produce. Thus, we expected that manufacturing involvement would impact on the speed of NPD process, in the production cost (Pisano & Wheelright, 1995), productivity, quality, market penetration, customer satisfaction and sales (Calentone et al., 2002), that are represented here as operational, marketing and business performance.

4.5 CONSIDERATIONS ABOUT THE ANALYSIS MODEL

The results of the analysis model presented from the table 8 to the table 22, showed the influence of each agent of the supply chain agents, when analyzed jointly, on new product development's projects, considering a general scenario, three levels on environmental turbulence, three industries and three geographic regions. The goal was to show the nuances of supply chain integration under different conditions.

The model used to analyze such influences presented fit index slightly below of what is recommended by the literature. Kline (2005) and Hair Jr et al., (2009) suggest that the fit index, GFI, CFI and NNFI should be higher than 0.90 to be considered as a good model. On the other hand, Hair Jr et al. (2009) alerts the researchers about the "magic number" 0.90 as reference for well fit models.

Some models are built upon simulation data and may offer fit indexes higher than 0.90, however it does not mean that the model is well fit, since the real fit, based on real data, is unknown. Thus, the use of cutoff points for fit indexes must be used with caution in order to avoid the elimination of a significant potential research (Hair Jr et al., 2009).

In our model the fit indexes were: GFI = 0.86, CFI = 0.85 and RMSEA = 0.05. A possible explanation is about the running of the model considering multi-group moderation. The moderation splits the sample into groups that impact on the fit indexes since some of them are sensible to the sample size (Hair Jr et al., 2009; Kline, 2005). A good example is the moderating variable "location", wherein while the European and Asian countries had over one hundred companies each, the American countries had only 51, what might contribute to the decrease of the fit indexes.

As the model was run with three moderating variables, with three levels each one, the total of model run by the confirmatory factor analysis (CFA) was ten. Thus, the fit indexes are about the average of the fit indexes of all models run at same file. Under these considerations we assume that the model is valid and provide consistent results when analyzed under different perspectives.

4.6 CONSIDERATIONS ABOUT THE MEDIATING VARIABLES

This study considered the environmental turbulence, industry and location as mediating variables. The analysis of each one may be seen through the information contained in the footnotes of the tables 9, 10 and 11.

Environmental turbulence was taken as changes in the market caused by the customer's preferences (Hung & Chou, 2013; Jaworski & Kohli, 1993). It was categorized into three levels: low, medium and high. According to the table 9, environmental turbulence was considered a good moderator at 0.05 level, with divergent loadings in the hypothesis testing across the levels of turbulence.

In line with the table 9, the relationship between anticipation of new technologies and marketing performance, supplier involvement and operational performance, and customer involvement and operational performance were highly moderated by the environmental turbulence, with significance at 0.05 level

In terms of industry, the difference across industries were not dissimilar enough to characterize the variable as a good moderator (p-value = 0.126). However, in this model,

presented in the table 10, the relationship between anticipation of new technologies and continuous improvement was moderated by the industry at 0.1 level.

Finally, the location as mediating variable symbolized the social and economic conditions of the region that may enable or hamper the influence of the supply chain agents on new product development's performance. This variable was taken as good moderator at 0.000 level (99% of confidence) in the model depicted in the table 11. In this model several relationships were considered significant, as for instance: the influence of the cooperation on the customer involvement into NPD; the influence of the manufacturing involvement on continuous improvement; manufacturing involvement on operational performance, anticipation on new technologies on continuous improvement; continuous improvement on operational performance, anticipation of new technologies on operational performance, operational performance on business performance and marketing performance on business performance. All these influences were significant different across countries at 0.05 level (95% of confidence).

5 FINAL CONSIDERATIONS

This topic seeks to point out the research's conclusions, offer academic and managerial implications, demonstrate the limitations of the study and suggest further researches. The discussion of each of these issues is presented in the following five sections.

5.1 CONSIDERATIONS ABOUT THE RESEARCH

This dissertation sought to verify the supply chain agent's influence on the new product development's performance when those agents are analyzed jointly. To do so, we assumed that the involvement of such agents into NPD influence directly on the operational performance and indirectly on marketing and business performance.

Our approach is based on Flynn et al., (2010) and Bajaj and colleagues (2004) and Haartman (2013)'s studies which pointed out that although there are evidences of benefits generated by supply chain integration on the firm's performance, few information is available about the individual contribution of each supply chain agent on it when they are analyzed in the same context. Moreover, there are no consistent evidences about which part of NPD's performance (manufacturing, marketing or business performance) the involved agents have more influence.

Because of the dissimilar results about the straight influence of supply chain agents on new product performance, Haartman (2013) suggested that further studies should consider the indirect effects of those agents on new product performance. Thus, we attended the call of the authors mentioned previously and also analyzed if those influences change across different levels of environmental turbulence, industry and location.

Our analyses starta from the firm's guidance to cooperate as antecedents of the involvement of manufacturing, supplier and customer into new product development. In addition we considered that those agents influence on the anticipation of new technologies and on the firm's continuous improvement practices, which in turn, impact on the new product development's performance.

This analysis model is supported by Social Capital Theory and Absorptive Capacity Theory by considering that firms who have the guidance to cooperate are strategically interested in establish relationships with partners to obtain collective and self-interest goals. Thus, the involvement of manufacturing, supplier and customers are not a natural event, but rather the results of investments on partnerships that might bring benefits for all involved (Bourdieu, 1980; Coleman, 1988).

Furthermore, we assumed that supply chain agents contribute to the firm's absorptive capacity by providing new information that will be turned into institutionalized practices and for last converted into upper performance. The new practices here were measured as anticipation of new technologies as an information source, and the continuous improvement as the process of assimilation of that information. Finally, the new product development's performance represents the results of the exploitation of the two previous practices (Cohen & Levinthal, 1990; Zahra & George, 2002).

The results have shown that firms have the guidance to cooperate with internal and external partners. However, the guidance to cooperate, expressed by the internal politics, rules, the support of top managers to cooperation, efficient communication and the development of innovative ideas, has affected more the internal integration than the external one. The descriptive analysis also suggests that, in general, firms are more willing to involve manufacturing into NPD than the external partners.

Counteracting with studies in which supplier and customer involvement was meant to be antecedents of anticipation of new technologies (Cousins & Lawson, 2007; Primo & Amundson, 2002; Ragatz et al., 1997; Wasti & Liker, 1997), our studys show that there is no relationship between those variables in any of the scenarios presented. In others words, external agents didn't act as source of market information, or yet, those agents had no influence on the first stage of the firms' absorptive capacity.

The second stage of the firm's absorptive capacity, here treated as continuous improvement and learning, was mostly affect by the manufacturing involvement into NPD. The influence of the suppliers on it was realized only in machinery and transport equipment industry. Thus, our results strengths the studies of Tse (1991), Zangwill and Kantor (1998) and supports partially the studies of Koufteros and colleagues (2007) and Mahoney (1992).

Continuous improvement also was affected by the anticipation of new technologies. The hypothesis which tested the influenced of the latter in the earlier was confirmed in nine of the ten scenarios presented. It means that, as in absorptive capacity theory, the acquisition stage (anticipation of new technologies) influences the assimilation stage (continuous improvement) (Cohen & Levinthal, 1990). In spite of that, the first and second stage of the absorptive capacity presented very restricted conditions to impact on the exploitation stage (marketing and operational performance).

In terms of performance, operational performance had significant influence on marketing and business performance in most of the scenarios studied, but the same influence was not perceived between marketing and business performance. The relationships between performance measures were better evidenced in low levels of environmental turbulence, electronics and machinery industries and in Asian and American countries.

Thus, in general, the hypotheses regard to cooperation were confirmed in medium level of environmental turbulence and in European countries, while the hypotheses toward to NPD performance were confirmed in electronics and machinery industries, low level of environmental turbulence and in Asian countries.

When it comes to the direct and indirect impact of the supply chain agents on the NPD's performance, surprisingly, manufacturing involvement had no influence on marketing, performance or business performance, as discussed previously in the section 4.4.3. In spite of that, suppliers and customers, when analyzed jointly, seem to influence on the NPD's performance differently, according to the scenarios.

Supplier involvement has influences on NPD's performance in low level of environmental turbulence, in transport equipment industry and in American and European countries. However, in these scenarios, suppliers affect directly only the operational performance and indirectly on the marketing and business performance. Suppliers have no direct effect on marketing and business performance and have no indirect effect on operational performance.

As in supplier involvement, customer involvement also presented some standards in influencing the NPD's performance, which were perceived in medium and high levels of environmental turbulence, the machinery industry and Asian countries. In these contexts, customer involvement impacts directly only the operational performance and indirectly on the

marketing and business performance. Customers had no direct influence on marketing and business performance and no indirect impact on operational performance.

Those results demonstrate that western companies learned from Asian countries how to integrate suppliers into NPD and improve their operational performance (Bidault, Despres, & Butler, 1998; Clark & Fujimoto, 1991; Garvin, 1998). The results also suggest the existence of a new trend in Asian countries through the involvement of customers into NPD to improve their operational performance.

In resume, we would say that customer and suppliers act directly on the operational performance and have a ripple influence on the marketing and business performance under certain conditions. These analyses allowed us to verify the nuances of supply chain behavior, when they are analyzed jointly, in different contexts.

5.2 ACADEMIC CONTRIBUTIONS

In terms academics, this research sought to elucidate conditions wherein supply chain agents act differently on the new product development, driving us to the understanding about the divergences among studies in terms of impacts on performances. Moreover, we offer a model to analyze the entire process of supply chain integration since the guidance to cooperate until the product development performance. As it encompasses suppliers, customers and the manufacturer, its analysis might afford insights about the supply chain competitiveness.

Through the analysis of the supply chain integration under different perspectives, we adapted an analysis method, usually performed in articles from information system's area, to evaluate the moderating power of the variables in every relationship proposed in the analytical model. The analysis is made through path-by-path's chi-square which establishes the moderation under three levels of confidence (90%, 95% and 99%).

5.3 MANAGERIAL CONTRIBUTIONS

Managers may also be benefited from this study through the information about in which situations suppliers and customers are supposed to outperform. In addition, managers may also involve agents in conditions that they don't have a strong direct effect in order to get benefits from their ripple influences on the marketing and business performance.

In appropriate conditions, firms might target investments on long term relationships with external agents that will benefit not only the company as the partners involved. Based in our analysis and according to the conditions, firms are supposed to get direct upper results in operational performance that will lead to marketing and business performance.

For the companies belonging to the one of the industries studied there is information about in what level of environmental turbulence they should invest on one or other external partner, since the suppliers influence on NPD differs from customers influence on NPD under the same conditions.

5.4 LIMITATIONS

One of the limitations of the study is related to the scales of the HPM project that in spite of being wide open in terms of topics in operations management, offers restriction regarding the indicator modification in the case of low index of content validity. Some scales were not validated yet and because the data was already collected and we did not perform the content validity, since the case of bad adequacy we would not be able to change the indicators.

Moreover, the data was collected in a window of seven years due to issues related to difficult to collect the data in some countries or the late entry of some countries in the project. Thus, the different periods of data collection across the countries might bias the results in terms of changes in the social and macroeconomic conditions that might influence the responses.

Although the questionnaires have followed the sense of reverse translation to check if the idea of the questions were preserved, the difference of backgrounds among countries may

influence in the interpretation of the questions by the respondents, hurting the quality of the responses. Furthermore, NPD performance was measured based on the managers perception about the firm's performance when compared with their competitors, which may offer some subjectivity to the measure of the marketing, operational and business performance.

In terms of analysis, we worked with multi-group moderation to evaluate the nuances of the supply chain integration on NPD's performance. To do so, the sample was split into groups and consequently decreased the fit indexes of the proposed analytical model. In addition, the American countries group had the smallest sample (51) while all the others groups of environmental turbulence, industry and location had sample over one hundred respondents.

When it comes to hypotheses testing, some divergences between our results and previous studies might be caused for the use of different scales to measure the same constructs. Thus, our study, as well the previous studies, doesn't overlap the results already known in the literature, but yet contribute to the knowledge construction under different perspectives.

5.5 SUGGESTIONS FOR FURTHER RESEARCHES

The results of this dissertation afforded some academic and managerial contributions that strength some previous studies while counteracts others. However we are sure that the extent of knowledge that come from the involvement with manufacturing, suppliers and customers may be amplified through further researches about the topic.

To do so, we suggest the further researches should consider the NPD's indicators based on data provided by reports of the controlling instead of getting it based on managers perception. Thus, the risks of subjectivity are minimized and the robustness of the results is maximized. Moreover, we also suggest the inclusion of other scales as representative of the firm's absorptive capacity, besides anticipation of new technologies and continuous improvement, once those scales did not show significant influence on NPD's performance, and for it, acting as poor mediating between supply chain agents and NPD's performance.

As manufacturing involvement had no influence on any type of performance, it's recommended the search for conditions wherein the influence of such agent may impact directly and indirectly the operational, marketing and business performance. The search for these conditions will help elucidating the environments wherein manufacturing involvement has a stronger impact on performance than external partners.

Finally, we also expect to test new variables that moderate the relationship between supply chain agents and performance with the intention of verifying the conditions wherein those agents act more efficiently on the operational, marketing and business performance.

6 REFERENCES

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APPENDIX

Table 23 – Fit indexes and Cronbach alfa of the constructs before the measurement purification

Latent Variable	Items	Standardized Loadings	GFI	NFI	CFI	Composite Reliability	AVE	Cronbach	α if deleted
Cooperation	COOPN01	0,66	0,95	0,87	0,89	0,65	0,27	0,680	0,574
	COOPN02	0,46							0,527
	COOPN03	0,63							0,587
	COOPN04	0,52							0,564
	COOPN05	0,56							0,558
	COOPN06	0,04							0,571
	COOPR07	0,66							0,741
Supplier Involvement	SUPPN01	0,83	0,98	0,97	0,98	0,77	0,43	0,746	0,631
	SUPPN02	0,77							0,652
	SUPPN03	0,63							0,689
	SUPPR04	0,27							0,807
	SUPPN05	0,63							0,699
Customer Involvement	CUSTN01	0,76	0,97	0,96	0,96	0,80	0,46	0,784	0,720
	CUSTN02	0,68							0,723
	CUSTN03	0,63							0,748
	CUSTR04	0,39							0,817
	CUSTN05	0,83							0,698
Manufact. Involvem.	MANUN01	0,62	0,99	0,96	0,97	0,70	0,38	0,685	0,621
	MANUN02	0,85							0,525
	MANUN03	0,43							0,682
	MANUN04	0,49							0,635
Environm Turbulence	TURBN01	0,13	0,99	0,90	0,93	1,06	1,08	0,278	0,210
	TURBR02	0,07							0,391
	TURBN03	0,08							0,268
	TURBN04	2,07							-0,032[a]
Anticip of New Tech	TECHN01	0,62	1,00	0,99	1,00	0,81	0,52	0,797	0,787
	TECHN02	0,81							0,711
	TECHN03	0,62							0,784
	TECHN04	0,81							0,703
Continuous Improvement	CONTN01	0,76	0,96	0,92	0,93	0,79	0,39	0,752	0,666
	CONTN02	0,39							0,757
	CONTN03	0,73							0,692
	CONTN04	0,52							0,722
	CONTN05	0,66							0,687
Busin Perform	BUSIN01	0,58	1,00	1,00	1,00	0,82	0,61	0,808	0,853
	BUSIN02	0,89							0,652
	BUSIN03	0,84							0,675
Mark Perform	MARKN01	0,70	1,00	1,00	1,00	0,70	0,44	0,66	0,483
	MARKN02	0,78							0,528
	MARKN03	0,48							0,706

Operational Perform	OPERN01	0,40	0,98	0,93	0,94	0,67	0,35	0,673	0,663
	OPERN02	0,71							0,565
	OPERN03	0,71							0,566
	OPERN04	0,49							0,618

Source: elaborated by the author