Chapter 9
Collaborative New Product Development and the Supplier/Client Relationship: Cases from the Furniture Industry

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Abstract The main goal of this chapter is to identify the procedures and management methods used by firms of the furniture industry on collaborative new product development (CNPD) involving supplier–customer relationships. Using a qualitative methodology involving the analysis of eight firms, it is possible to conclude that: (1) the majority of the firms studied use throughout their R&D activities the principles of open innovation; (2) the wood and metallic furniture industries present divergent characteristics concerning the coordination and management of resources associated with CNPD; (3) all firms encourage the involvement of the suppliers in the CNPD process; (4) the management procedures used during the CNPD process are directly related to the size of the firms and the sub-sector they operate; (5) the CNPD process is underpinned by the business relationships between all the parties involved, as well as by the type of products, type of industry, and size of the firms; (6) there are differences in the CNPD processes between firms from the wood furniture industry and firms from the metallic furniture industry.

Keywords CNPD · New product development · Supplier–client relationship

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9.1 Introduction

Business dynamics based on innovation promotes strategies sustained on new technologies, new manufacturing processes, and new product development (NPD), breaking up with firms' previous core competences (Moreira 2005). In this context, important aspects must be considered when articulating the firm's business strategy with the NPD process, such as identifying market needs, the degree of product innovation, and the marketing strategy implemented by the firm (Shoham et al. 2005; Jeong et al. 2006; Carrizo-Moreira and Leonidivna-Karachun 2014). Similarly, the NPD process requires effective management of the critical success factors that influence its performance, such as: the NPD process, organization of the NPD process, the organizational structure, the organization's culture, the involvement and strategic action of top management, and its strategic orientation (Moreira 2005; Ledwith et al. 2006; Zhao and Lavin 2012).

The involvement of suppliers and clients in the NPD process gave collaborative strategies a new relational attitude, inasmuch as this reduces products time to market (Johnsen 2009; Park et al. 2010; Greco et al. 2015), enhances new product quality (Koufteros et al. 2007; Eisto et al. 2010), and lowers the NPD costs (Eisto et al. 2010; Park et al. 2010). Although studies of NPD involving clients and suppliers are not new, most of those studies analyze technology-based products in which the main actors are very large firms from technology-endowed countries. As such, taking into account the importance of the supply chain and the lack of studies involving small- and medium-sized firms from less technology-based industries, this chapter seeks to explore how and with whom collaborative new product development (CNPD) is carried out according to the firms' size, type of product under development, and the type of the supplier–customer relationship. Moreover, as the relational perspective in supplier–client NPD depends on the cooperation, commitment, trust, type of the relationship of both parties, and the organizational environment in which the relationship occurs (Powers and Reagan 2007; Nieto and Santamaria 2007), the chapter also seeks to achieve the following objectives:

- Identify and characterize the innovation models present in the activity sectors studied;
- Determine the resources involved in the NPD process, their coordination, and final assessment of performance;
- Determine the typology of existing relationship, as well as the type of communication between functions in the NPD process;
- Identify the strategic orientation of the NPD process;
- Identify the main problems arising from the NPD process;
- Identify the typology of supplier–client involvement in NPD, as well as the advantages and disadvantages of that relationship;
- Understand the suppliers and clients' roles when involved in the NPD process.

With this purpose, eight firms belonging to the furniture sector were interviewed to analyze, through an exploratory study, the articulation of their NPD processes, as

well as the existence of collaborative behavior involving suppliers and clients in these processes, and determine the differences between firms according their size and the procedures using in the NPD process.

9.2 Literature Review on New Product Development

Garcia and Calantone (2002), Diedericks and Hoonhout (2007) and Winter and Lasch (2016) classify innovation according to two typologies: incremental and radical. The former repositions obsolete products or technologies, transforming their concept, attributes, or characteristics, proposing the commercialization of improved versions (Garcia and Calantone 2002; Laursen and Salter 2006). The definition of an innovation focused business strategy, based on customer needs, materializes radical innovation that is directed toward creating new products, technologies or markets, breaking away from existing ones (Garcia and Calantone 2002; Koberg et al. 2003; Inaunen and Schenker-Wicki 2012).

Montoya-Weiss and Calantone (1994), Damanpour and Wischnevsky (2006) and Gassmann (2006) identify three aspects related to the management of NPD processes: strategic factors, organizational context, and the typology of adopted process development.

In large firms, the strategic factors related to NPD are tuned to creating conditions to adapt available resources to large-scale production, allowing the management and control of major projects (Damanpour and Wischnevsky 2006; Ledwith et al. 2006; Gassmann 2006). On the other hand, Van de Vrande et al. (2009) and Lee et al. (2010) argue that smaller firms have greater flexibility to respond to market opportunities.

The literature also shows the existence of similar organizational contexts in small and large firms regarding supervision of NPD processes and the efficiency of communication.

Jeong et al. (2006), Dahlander and Gann (2010) and Zhao and Lavin (2012) conclude that the strategic orientation of the NPD process addresses the analysis of two principal variables: market orientation and technological orientation. Kohli and Jaworski (1990), Shoham et al. (2005), Oke et al. (2007), Brettel et al. (2012) and Reid and Brady (2012) suggest that strategic market orientation determines the success of the NPD process, simultaneously influencing firms' performance. According to Ogulin (2014), supplying products that satisfy the market's needs allows firms to gain competitiveness over competition and increase the degree of consumer satisfaction. In this context, Shoham et al. (2005) and Jeong et al. (2006) also suggest that launching technologically advanced products and being close to their target market give firms competitive advantages.

Strategic orientation toward technology arises from firms' capacity to provide the market with products, processes, and procedures that are innovative and technologically differentiated from existing ones (Montoya-Weiss and Calantone 1994; Danneels and Kleinschmidt 2001; Jeong et al. 2006; Parida et al. 2012). This means

it is difficult for competitors to incorporate such processes and methodologies, as these are clearly difficult to imitate (Jeong et al. 2006; Carrizo-Moreira and Leonidivna-Karachun 2014).

The simultaneous importance of both market and technology orientation for the NPD process is also important (Jeong et al. 2006; Van de Vrande et al. 2009; Carrizo-Moreira and Leonidivna-Karachun 2014). Market orientation contributes to a great extent to the acceptance of that process, directing it according to consumers' needs. Technology orientation potentiates the generation of new technology-based products, which may be unknown to the market, increasing the NPD process performance.

The global business competitiveness has led firms to adopt partnership-based strategies codeveloping and cocreating new products (Moreira 2009). Consequently, supplier–client collaboration has become intense (Ploetner and Ehret 2006; Parida et al. 2012; Greco et al. 2015). Various authors mention advantages of integrating suppliers in the NPD process. Clark and Fujimoto (1989, 1991), Fujimoto et al. (1996), Ploetner and Ehret (2006), and Johnsen (2009) suggest that the supplier–client integration accelerates physical, financial, and information flows, reducing the time necessary to develop new products and increasing their quality (Bidault et al. 1998; Koufteros et al. 2007; Eisto et al. 2010; Greco et al. 2015). Similarly, early supplier involvement may lead to reducing the costs of the NPD process (Wynstra et al. 2001; Petersen et al. 2003), due to the greater capacity to adapt to market needs, better interpretation of the information together with the other partners involved and consequently reducing the total cost of the process (Petersen et al. 2003; Ploetner and Ehret 2006; Park et al. 2010). However, Bruce et al. (1995) find that the NPD process can become costlier and inefficient when it integrates supplier collaboration. The literature also shows that supplier integration in NPD does not necessarily lead to a reduction in operational times (Hartley et al. 1997), and may make it less efficient, more cumbersome, and difficult to coordinate (Bruce et al. 1995; Littler et al. 1998; Hoegl and Wagner 2005) due the complexity of the processes (Haque 2003; Coras and Tantau 2014).

Moreira (2009) and Le Dain et al. (2011) corroborate the theory that the supplier–client integration in NPD increases the information conveyed throughout the supply chain, with regard to the creation of products, processes, and methodologies, and consequently reduces the complexity and duration of operations of the NPD process (Wynstra et al. 2001; Eisto et al. 2010; Greco et al. 2015). Clark and Fujimoto (1991) and Petersen et al. (2003) conclude that both suppliers and clients' involvement in NPD contributes to reducing mistakes during the initial phase of the NPD process, since these are rapidly detected and corrected by the elements involved in their coordination, due to the closer relationship between suppliers and producers.

Handfield et al. (1999), Wasti and Liker (1999), Wynstra et al. (2001) and Eisto et al. (2010) identify some relevant variables in the integration of suppliers and clients in the NPD process, such as: suppliers' influence on the NPD process, the control exercised by clients during product design, the transmission of information throughout the supply chain during the product design stage, and the technological uncertainty found in the industry.

In their studies about collaborative relationships, Powers and Reagan (2007), Monczka et al. (2008) and Maarten and Van Weele (2015) find that common objectives, trust, satisfactory performance, adaptation, cooperation, and commitment are the most important factors for forming and maintaining a strategic relationship, whereas social bonds are less important.

According to Powers and Reagan (2007) and Mishra and Mishra (2012), establishing common objectives determined by the joint action of those involved in a NPD partnership influences both its formation and continuation. They also claim that sharing resources, technology, and methodologies contributes to increased interdependence between organizations. Therefore, taking into account the diversity of identified variables, the complexity of organizations, and the surrounding internal and external environment, each has a particular importance when studying different organizations.

The participation of suppliers in CNPD activities is influenced by the typology of products to be developed (Handfield et al. 1999; Melander et al. 2014). In this context, each supplier's contribution to NPD depends on their capacity to assume operationalization of the process (physical development) and its inherent risk. Clark and Fujimoto (1991) and Koufteros et al. (2007) classify the level of supplier involvement in CNPD according to the following division: (a) Supplier-proprietary parts; (b) Black-box parts; (c) Gray-box parts; and (d) Detail-controlled parts.

Studies of the automotive, electronics, and footwear industries suggest that greater involvement between suppliers and clients in the NPD process occurs when products are characterized as black-box parts, gray-box, and detail-controlled parts (Moreira 2010). Moreira (2010) and Dowlatshahi (1998) also reveal that the supplier–client relationship contributes to earlier involvement between interested parties in the process and with long-term effects. According to Koufteros et al. (2007), the level of involvement between suppliers and clients in developing gray-box parts promotes a greater degree of innovation than in the other typologies.

9.3 Methodology

This study was based on a sample collected from a short-list of 20 furniture-producing firms previously selected from the business universe in the district of Aveiro, Portugal. The list of firms was formed based on the authors' previous knowledge about them, supported by official lists of addresses and computer-based searches. Within the furniture sector, there was a balanced selection of firms producing wooden and metal furniture. This aims to determine the existence of convergent and divergent factors in the analysis of the two sub-sectors.

The research carried out incorporates the analysis of eight case studies, and is based on information of a qualitative nature. Information was gathered through face-to-face interviews held in the eight firms. The inclusion of some numerical data in the information gathered aims to frame some topics of analysis, for example, the size of the organizations interviewed.

The number of case studies was determined in accordance with the results obtained throughout the research from analysis of the variables considered (Yin 2003; Eisenhardt and Graebner 2007; Baxter and Jack 2008).

The study is based on the collection of primary data, through the interviews held, and on secondary data gathered from the firms' websites, which provided more thorough knowledge about each organization invited to participate in the research.

The interviews were guided by a semi-structured script. This option gave the interviewee freedom of answer, and simultaneously focused and oriented answers according to the topic of each question (Malhotra 2007). In this way, it was possible to explore the depth of the answers obtained and their inherent motivations, without distancing them from the purposes and aims of the study. All the interviews took place in the companies' industrial premises, which in some cases allowed visiting the production areas and showrooms. Consequently, and aiming for rigor in the data gathered, it was decided to make a short summary of the answers obtained after recording them.

9.4 Results of the Case Studies

The firms participating in the study belong to the furniture sector and carry out their industrial activity in Portugal. The information gathered from the interviews lets us sub-divide their production, considering the typology of products manufactured and the raw materials used in the production process. Therefore, the universe of firms studied is sub-divided in two groups: firms producing furniture in wood and firms producing furniture in metal, as shown in Table 9.1.

Data gathered and treated are shown in Tables 9.1, 9.2, 9.3 and 9.4, allowing the organizations' management strategies and procedures regarding NPD to be determined and characterized. The cases demonstrate similarities and differences regarding the structural and organizational size of the firms, as well as the business culture and leadership style in operation.

Firm A is a small family firm, where strategic decisions are centered on top managers. Those concerning NPD are coordinated by the manager of the firm. Management of the resources allocated to the NPD process is based on the company's internal (traditional) procedures. Consequently, the difficulties inherent to

Table 9.1 Main characteristics of the firms studied

Industrial activity	Furniture in wood				Furniture in metal			
	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H
Sales volume (10^3€)	700	600	4500	1800	3250	20,000	5000	13,000
R&D expenses (% sales)	1.5	2.5	1.5	10	7.5	2.5	5	6
Number of employees	20	18	79	40	66	200	80	129

Table 9.2 New product development process

	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H
Responsibility for managing NPD process	Top management	Top management	Top management	Technical department	Planning department	R&D department	Top management	Top management
Top management involvement in NPD	Total	Total	Total	Monitoring	Monitoring	Initial phase/Ideation	Total	Total
Departments/Functions directly involved in the NPD process	–	Production; Administrative	Production	Accounting; Production; Marketing; Purchasing	Finance; Technical; Production; Marketing; Quality; Purchasing	Industrial; Marketing; Administrative; Human resources; Finance	Marketing; Technical	Purchasing; Technical; Marketing; Exports;
Management and resource allocation procedures	Internal procedures	Internal procedures	Internal procedures	Internal procedures	NPD plan	NPD plan	NPD plan	Internal procedures
Lack of a NPD plan creates difficulties	Yes	–	–	Yes	–	–	–	Yes
NPD inter-departmental communication process	Informal	Informal	Informal	Informal	Formal	Formal	Formal	Formal
Assessment of NPD process								
Process of evaluation of NPD	Internal process	Internal process	Internal process	Internal process	Internal process	Internal process	Internal process	Internal process
Number of phases	5 phases	4 phases	Final check up	6 phases	3 phases	3 phases	Final check up	4 phases
Strategic orientation of NPD	Market	Market	Market	Market	Market	Market	Market	Market

(continued)

Table 9.2 (continued)

	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H
Factor that spark NPD	Competition	Competition; Client	Competition; Client	Competition; Technology	Competition; Client	Competition; Client	Client	Competition; Client
Problems with the NPD process								
Internal conflicts among personnel	–	–	–	–	Yes	–	Yes	Yes
Insufficient technical training	–	–	–	–	Yes	–	–	Yes
Insufficient technological resources	Yes	Yes	–	–	–	Yes	–	–
Product complexity	Yes	Yes	Yes	Yes	–	Yes	Yes	Yes
Ineffective internal communication	–	–	–	–	Yes	–	Yes	Yes
Ineffective external communication	–	–	–	Yes	–	–	Yes	–
Inadequate resource allocation	Yes	Yes	Yes	–	Yes	–	–	–
Lack of Time to NPD process	Yes	–	–	–	–	–	–	Yes
Weak involvement of personnel	–	–	–	–	Yes	–	–	–
Unfulfilled NPD timing	–	–	Yes	Yes	–	–	Yes	–

Table 9.3 Characteristics of CNPD

	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H
Type of involvement with suppliers	Technical support	Technical support	Technical support	Technical support	Technical support	Technical support; Product quality tests	Technical support; Knowledge share	Technical support; Knowledge share
Advantages of CNPD								
Accelerates information exchange	–	–	Yes	Yes	–	–	Yes	Yes
Accelerates NPD process	Yes	Yes	–	Yes	Yes	Yes	–	–
Enhances product quality	–	Yes	Yes	Yes	Yes	–	–	Yes
Reduces process costs	Yes	–	–	–	Yes	Yes	Yes	–
Reduces numbers of procedures	–	–	Yes	–	–	Yes	Yes	–
Disadvantages of CNPD								
Increases NPD process cost	–	–	–	Yes	–	–	–	–
Increases NPD time to market	–	–	Yes	–	–	Yes	Yes	Yes
More difficult coordination	–	–	Yes	Yes	–	–	Yes	–
Leak of information	Yes	–	–	–	Yes	–	–	–
Product specifications definition	Client	Client	Client	Client	Client	Client	Client	Client; Supplier
Influence of the supplier in the NPD process	Technical specifications	–	Technical specifications	–	Technical specifications	Technical specifications	–	Technical specifications

(continued)

Table 9.3 (continued)

	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H
Phase in which the supplier is involved in CNPD								
Ideation	Yes	Yes	–	–	Yes	Yes	Yes	Yes
Development/Design/Engineering	–	–	Yes	Yes	–	–	–	–
Physical development/Prototyping	–	–	–	–	–	–	–	–
Responsibility for managing the NPD process	Client	Client	Client	Client	Client	Client	Client	Client
Responsibility for assessing NPD	Client	Client	Client	Client	Client	Client	Client	Client
Status of suppliers involved	"Preferred"	"Preferred"	"Preferred"	"Preferred"	"Preferred"	"Preferred"	"Preferred"	"Preferred"

Table 9.4 Criteria for selecting suppliers and product typology in CNPD

	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H
Criteria for selecting suppliers in CNPD process								
Previous knowledge of supplier	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trust	Yes	–	Yes	Yes	Yes	Yes	Yes	Yes
Supplier's market reputation	–	–	–	–	–	Yes	–	–
Supplier's influence in NPD process	Yes	–	–	–	–	Yes	–	–
Supplier's technological capability	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Supplier's R&D capability	–	Yes	Yes	Yes	Yes	Yes	–	–
Supplier's share of information	Yes	–	Yes	Yes	Yes	Yes	Yes	Yes
Supplier's collaborative experience	Yes	Yes	Yes	Yes	Yes	Yes	Yes	–
Length of relationship with supplier	Yes	Yes	Yes	Yes	–	Yes	–	–
Length of NPD process	Yes	–	Yes	–	Yes	–	–	–
Level of formalization of NPD process	–	Yes	–	–	–	–	–	Yes
Product complexity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Supplier's geographical proximity	–	Yes	–	–	–	–	–	–
Supplier's lead time	–	–	–	–	–	–	–	Yes
Supplier's added value	–	–	–	–	–	–	–	Yes
Typology of products in the NPD process								
Supplier-proprietary parts	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Black-box parts	–	Yes	–	–	Yes	–	–	–
Gray-box parts	–	–	Yes	Yes	Yes	–	–	–
Detail-controlled parts	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

carrying them out arise from the absence of a NPD plan incorporating a checklist of the resources necessary for its development and programming the lead times for each task, as well as the nondelegation of functions/tasks. The firm does not have its own resources to promote disruptive new products targeted at different markets. Therefore, its commercial intervention is directed at the traditional retail market of building materials, supplying radical products destined for specific market segments, as well as modified products destined to the general market. The firm promotes supplier involvement in the NPD process, aiming to overcome its technological insufficiencies concerning the R&D of new products. The criteria for selecting the suppliers involved in the NPD process are limited to trusting relationships formed over the years. Analysis of the competences related to management and monitoring the performance of the NPD process, as well as the typology of products acquired from suppliers and the responsibility for attributing their technical specifications, reinforces the underlying theory of the leadership style operating in the organization, centered on the manager's decisions.

Firm B is a small family firm. Management and coordination of the NPD process is in the hands of the manager; this being carried out with the help of technical specialists in the firm. Communication between those involved in the NPD process is informal, due to the organizational culture and family nature of the firm. The management procedures and monitoring of performance in relation to NPD do not include formal plans, which give rise to some problems in coordinating the process regarding the resources that are allocated. NPD is oriented according to market requests, as the firm does not possess resources that would allow any R&D activity on its own initiative. Early involvement of suppliers and clients in the NPD process aims to overcome the firm's insufficiencies concerning the resources necessary for researching new products, and also to satisfy the technical requirements imposed by an industrial client as regards the specifications of certain new products. The selection of suppliers to integrate the NPD process is based on long-standing relationships formed with them, on their innovation capacity and geographical proximity so as to respond quickly to the firm's requests, implying that the door is not open to new suppliers collaborating in NPD.

Firm C is a medium-sized organization. Management and coordination of the NPD process are led by the manager of the firm, with the support of the head of production. Problems with NPD arise from the lack of planning activities for new products and the leadership style operating in the firm, which does not encourage delegation of tasks. The organization promotes informal communication procedures and relations among staff working on the NPD process. Radically new products are developed according to architects' specifications and are produced in small batches destined to specific market niches, whereas new products based on market demands are adapted through incremental changes are targeted to the general market. As such, firm C is not being inclined toward creativity and design or radical development of new products, due to the lack of an R&D department. CNPD aims to accelerate the exchange of information between those involved in the NPD activities, contributing to increasing the reliability of the information produced in the organization's fabric, which involves its commercial and marketing department and

the suppliers' capabilities. Radical development of new products infers that the typology of products acquired from suppliers is based on specifications stipulated by the firm, according to those expressed by final clients. In this context, the selection of suppliers that take part in the CNPD process is based on the complexity and type of product to be developed, the degree of product innovation and the relationship formed with firm C, in terms of the supplier–client relationship and the capacity to share information.

Firm D is a small organization. The R&D activities carried out by the firm are based mostly on the radical development of new products and processes, for which it turns to sub-contracting of specialist services. Management and coordination of the NPD process are the responsibility of the firm's technical department. Operationalization of the process involves the participation of all the organization's departments, with relationships and communication among functions being of an informal nature. Management and allocation of resources and monitoring NPD performance are based on internal (traditional) processes. New products are all directed at different market segments, with the NPD process being promoted through interaction with market agents and by the firm's technological capacity. Problems with the NPD process derive from the complexity of new products to be developed, the lack of a new product plan including technical requirements and deadlines necessary for completion of tasks in the process, and the informality of communication procedures with suppliers, which causes dubious interpretation of information. Radical development of new products is based on information obtained from final clients when providing the technical specifications required. The involvement of suppliers and clients in NPD encourages the exchange of more reliable information between the parties, contributing to the overall efficiency of the process, particularly the quality of the final products. However, the collaborative NPD process promoted by the firm is costly and difficult to coordinate due to the number of people involved. Selection of suppliers to collaborate in the NPD process is based on knowledge, and trust in the existing supplier–client relationship, on the supplier's experience in collaborating in NPD and on the typology of the new products.

Firm E is a medium-sized organization. Coordination of the NPD process is the responsibility of the firm's planning department. The firm has a NPD plan for the management and allocation of resources of NPD activities, which incorporates the resources attributed and the stages for monitoring its development, giving formality to the management of the various stages. The relationship between the departments involved in the NPD process allows both informal and formal communication procedures, formality resulting from the requirements of the NPD plan, the management procedures adopted by the firm and quality management standards. NPD is directed to specific market segments, with radical new products being manufactured according to clients' specifications, while also considering the competitors' action. Problems arising from NPD are related to deficient management and allocation of human resources, and their underlying relationships, as well as communication procedures among functions and departments in the organization. CNPD involves early supplier involvement regarding technical advice on materials to incorporate.

Early involvement of final clients is important due to their competence in attributing the technical specifications of new products. The CNPD process management, based on the relationship created between the parties, dictates the typology of products to be acquired from suppliers, the responsibility for assessing both the quality management and the functioning of new products by clients, together contributing to the speed of the NPD process. The criteria for selecting preferred suppliers to collaborate in NPD are based on suppliers' innovative capacity.

Firm F is a medium-sized organization. Coordination of the NPD process is the responsibility of the factory director, with management and allocation of resources being carried out by the R&D department. Management and allocation of resources for NPD are based on the NPD plan elaborated in accordance with the firm management procedures, which contains formal definition of the method of monitoring the various stages. Communication and relationships among the departments involved in NPD are appropriate to the culture and leadership style operating in the firm, adopting relationship typologies according to the content and formality of the matters in question. The NPD process, oriented to the general market, favors mass production. The problems found in the NPD process originate from some suppliers' failure to deliver and by the inappropriate internal management of some resources allocated to the NPD plan. Early involvement of suppliers and clients in the NPD process allows efficient selection of the materials to incorporate in new products, reduces the logistic process in selecting those materials, and underpins the success of products to be launched on the market according to clients' expectations. Due to the centralization of competences concerning management of the CNPD process, the firms attribute all technical specifications of the products to be acquired to suppliers and define and perform the final assessment of products developed. The suppliers that integrate the CNPD process are selected according to previously formed institutional relationships, the supplier's innovative capacity, their market image, and the product typology to be developed.

Firm G is a medium-sized organization. The firm's top manager takes on responsibility for managing the NPD process, with the help of the marketing and technical departments. Resources allocated to the NPD process are managed through a product plan conceived by the firm. Relationships and communications among departments involved in the NPD process follow formal procedures. However, some informality in communication and centralized coordination of the NPD process in the firm's top management are the main difficulties and problems arising from the process, concerning management and allocation of human resources and failing to meet deadlines for completing tasks. New products launched are directed at the general market, aiming for increased market share, this being sustained through mass production. CNPD undertaken by the organization promotes early supplier involvement concerning technical advice about materials, minimizing the number of procedures necessary to operationalize the NPD process and its associated costs. Selection of suppliers involved in the firm's NPD process considers the typology of products to be developed, the previously formed supplier–client relationship and other factors that promote innovative capacity and

share of knowledge. Centralization of management decisions, as a result of the firm's business culture, determines that coordination of CNPD process, assessment of products' final performance and attribution of the technical specifications of products to be acquired from suppliers are the firm's responsibility.

Firm H is a medium-sized organization. The NPD process is managed by the firm's top management, and operationalized by the technical, purchasing, commercial, and export departments. As there is no specific plan for NPD, management of resources and tasks allocated to the NPD process follow the firm's internal procedures. Assessment of the NPD process is based on quality management norms, with the various stages of the process being mapped for this purpose. The type of relations and communication among the departments involved in the NPD process are both formal and informal, the former due to quality management procedures, and the latter due to the lack of an NPD plan and the relationship culture operating in the firm. Early supplier involvement in the NPD process seeks to determine the most suitable material and work methodologies for the new products to be launched. The slowness found in the process is due to the lack of planning of common tasks to be performed by those involved. It is the firm's responsibility to manage the CNPD process, and assess products' final performance. Centralization of these competences in the organization means that the typology of products to be developed by suppliers respects the technical specifications determined by the firm, except in cases where the firm acquires certain generic components from them. Suppliers collaborating in the NPD process are selected considering the type of products to be developed, the existing supplier–manufacturer relationship, the capacity to innovate and share knowledge, and their contribution to adding commercial value to the final product.

9.5 General Results

The sample data were gathered in Tables 9.5 and 9.6, considering the variables of analysis and the sub-sector the firms belong to, allowing the study's main conclusions to be drawn.

Analysis of Table 9.5 reveals that of the eight firms, only three develop internal R&D activities of their own, although all the firms follow market tendencies and are concerned with NPD activities.

Tables 9.2 and 9.6 show that in 62.5% of the firms surveyed, top management is responsible for managing the NPD process, and this is noted in three of the four firms in the wooden furniture sub-sector. Only one firm in the sub-sector of metal furniture has an R&D department responsible for managing the NPD process. This might be explained by the organization's size and business culture, as argued by Hoegl and Wagner (2005), Ledwith et al. (2006), Parida et al. (2012) and Coras and Tantau (2014).

Table 9.5 Characterization of innovation

	Wooden furniture sub-sector	Metal furniture sub-sector	Total number of firms
Innovation strategy			
Market-based innovation	4	4	8
Internal R&D-based innovation	1	2	3
Foci of R&D activities			
Radical new product development	4	3	7
Incremental new product development	4	4	8
Radical new process development	2	1	3
Incremental new process development	0	2	2
Involvement with external entities (typology)			
Permanent cooperation	2	2	4
Occasional cooperation	0	3	3
No cooperation	2	0	2
Involvement with external entities (objective)			
Radical new product development	2	3	5
Incremental new product development	1	1	2

Table 9.6 Summary of NPD at sub-sector level

	Wooden furniture sub-sector	Metal furniture sub-sector	Total number of firms
Responsibility for process management			
Top management	3	2	5
Technical department	1	0	1
Planning department	0	1	1
R&D department	0	1	1
Procedures for managing and allocating resources			
Internal procedures	4	1	5
NPD specific plans	0	3	3
Factors that determine NPD			
Competition	4	3	7
Clients requests	2	4	6
Technology	1	0	1

The procedures for managing and allocating resources used in NPD by firms in the wooden furniture sub-sector relate to traditional internal operating procedures. On the other hand, 75% of the firms belonging to the metal furniture sub-sector use specific plans and procedures, set in the quality certification norms. One of the main difficulties with the NPD pointed out by the firms participating in the study has to do with the absence of plans for the management of resources and deadlines for each task. The difficulty in the provision of raw materials shown by the firms in the wooden furniture sub-sector arises from the complexity of products developed, together with the firms' organizational structure and the market they belong to, as mentioned in the studies by Haque (2003), Coras and Tantau (2014).

Regarding communication between functions, data indicate that the firms in the metal furniture sub-sector have formal communication processes, due to their procedures of resource management and allocation, their size, and in certain cases, the existence of quality certification norms. It is noted that all the firms assess the NPD process based on internal procedures. Another aspect of the analysis shows that the majority (75%) of firms belonging to the wooden furniture sub-sector reveal difficulties in managing resources in the NPD process, due to the lack of a specific plan for this purpose.

Tables 9.2 and 9.6 also show that the main factors catalyzing NPD relate to the competition and consumer behavior, inferring that market orientation is important, which is according to several studies (Shoham et al. 2005; Jeong et al. 2006; Oke et al. 2007; Reid and Brady 2012). In the two sub-sectors analyzed, the manufacturing of new products is based on production in small batches. The firms' size and production capacity justify their strategic decision regarding the scale of new product manufacture (Damanpour and Wischnevsky 2006; Parida et al. 2012).

The main problems arising from the NPD process, as seen in the sample, are due to the complexity of new products and the inappropriate allocation of resources.

Table 9.2 presents the data related to CNPD. In both sub-sectors of activity, there is early supplier involvement in the NPD process, with technical advice being the main reason for their involvement. The principal advantages indicated by the firms surveyed of supplier–client involvement in the NPD process corroborate previous studies (Clark and Fujimoto 1989, 1991; Fujimoto et al. 1996; Koufteros et al. 2007; Johnsen 2009; Park et al. 2010; Le Dain et al. 2011) referring to the increased speed of the process, cost reduction, and better quality of the products developed. On the contrary, three of the four firms in the metal furniture sub-sector indicated the slowness of the collaborative NPD process as a disadvantage, while more difficult coordination was mentioned as a disadvantage by the firms producing wooden furniture, which confirms several studies (Bruce et al. 1995; Littler et al. 1998; Hoegl and Wagner 2005; Nieto and Santamaria 2007; Coras and Tantau 2014). It is of note that the last disadvantage mentioned is the lack of an NPD plan to clearly articulate the large number of procedures and resources involved in the collaborative NPD process.

Both sub-sectors considered in this study show the control exercised by the client regarding the attribution of the technical specifications of new products, the management of the CNPD process, and the final assessment of these products.

Interpretation of Table 9.2, concerning the typology of products acquired from suppliers, leads to the conclusion that most of the firms studied acquire generic products (supplier-proprietary parts), as well as others produced according to the specifications stipulated by the manufacturer (detail-controlled-parts). In addition, certain products acquired by manufacturers are seen to respect specifications given by final clients, contributing to reducing the risk associated with innovation through a vertical supplier–manufacturer–client relationship. It is important to refer that two of the four firms in the wooden furniture sub-sector are responsible for managing both product quality and the proper functioning of products acquired from suppliers which will be incorporated in the final product (gray-box-parts). This is the result of the responsibility attributed to the manufacturer for assembly and managing the NPD operation with the end customer.

9.6 Conclusions, Limitations, and Research Proposals

The results reveal that most of the firms studied develop radically new products, based on input received by clients based on their design and on the adoption of new raw materials and components. This is a clear indication that regardless the firms' size, most of the furniture firms analyzed is market oriented.

Concerning the NPD process, both wooden and metal furniture sub-sectors present divergent characteristics as to coordination of the resources used in NPD, resource management and allocation, and in terms of relationships between functions/departments. The facts observed in the sample lead to the conclusion that companies' organizational structure, the business culture promoted by top management, the business vision, and the sector of activity where they operate determine the management procedures and methods used in the NPD process. It is also possible to conclude that firms making wooden furniture are part of a traditional sector, their structure being generally characterized by small industrial units, operating in traditional markets. On the other hand, firms making metal furniture operate in more demanding and differentiated markets, meaning their organizational structure must adapt to market demands in terms of necessary resources, the management procedures implemented and the commercial strategy explicitly defined. Regarding the strategic orientation, it is possible to conclude that firms studied follow market tendencies, as a way to reduce the risk associated with the innovation created.

Concerning CNPD, it is possible to conclude that all the firms analyzed encourage supplier involvement in the NPD process, this being fostered by the relationships formed between the parties, by suppliers and clients' influence on the NPD process, by the business culture of those involved, by the type of product, by the behavior of the sector activity they operate and not only by firms' size as argued by Littler et al. (1998), Handfield et al. (1999), Wasti and Liker (1999) and Lee et al. (2010). Regarding technical specifications, responsibility for managing the NPD process, responsibility for assessing the NPD process, as well as the typology

of products acquired from suppliers, it is possible to conclude that the firms studied do not promote equitable involvement among actors in the collaborative relationships, with the client behaving as a firms leading the development process and the supplier as the follower.

These facts show that firms intervention in CNPD, regarding adaptation and actor involvement, is influenced by the typology of supplier–client relationship, by the business environment of the economic sub-sector and by the size of the firm.

As the sample was not obtained randomly, it is not representative of the sectors of activity portrayed, which is a limitation of the study. The size of the companies studied is another limitation of the research, inasmuch as very large firms are not included in the sample.

Considering the two sub-sectors of activity analyzed, wooden, and metal furniture production, it would be pertinent to diversify the sample in future studies. Another proposal to consider for future research concerns the size of organizations in the sample. As such, it would be useful to analyze larger firms, comparing observations between small and large firms. It would also be interesting to analyze in future research the supplier–client relationship in both upstream and downstream activities. Moreover, it would be appropriate to make a quantitative study utilizing the variables analyzed in the study, contributing to a more solid analysis of the results and to their statistical validity.

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