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THE PROCESS OF BUYER-SUPPLIER COLLABORATION TO INNOVATION: A STUDY OF BRAZIL-CHINA ELECTRONICS INDUSTRY

O PROCESSO DE COLABORAÇÃO COMPRADOR- FORNECEDOR PARA A INOVAÇÃO: UM ESTUDO DA INDÚSTRIA ELETRÔNICA BRASIL-CHINA

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ABSTRACT

Purpose: This study aimed to study the process of collaboration for innovation in a Brazilian electronics company with its Chinese suppliers, specifically in the bonds generated for the development of new products.

Methodology: Firstly, it brings the theoretical ground about this field of study, related to the collaborative ties for the development of new products with international suppliers, focusing on the learning processes and innovation capacity. For the data collection, twelve interviews were made with internal actors and Chinese suppliers, as well as documental research. The data analysis was descriptive and interpretative through categorical content analysis.

Findings: This study results show that the company does not have a solid supplier database nor stimulate internal collaborative practices of portfolio definition, which makes products sourcing slow and inefficient. In regards to the collaboration with suppliers, the interactions are reactive and focused on problem-solving. Besides, regarding the new product developments with suppliers, there is no formal policy that values learning processes and knowledge sharing practices internally.

Originality/Value: These glimpses the possibility of improving the collaboration processes with suppliers regarding new products' development impacting on the time-to-market and innovation capacity.

Keywords: Collaboration; Innovation; Learning; New product development.



RESUMO

Objetivo: Este estudo teve como objetivo analisar o processo de colaboração para inovação de uma empresa de produtos eletrônicos brasileira com fornecedores chineses, nos vínculos gerados a partir do desenvolvimento de novos produtos.

Desenho: Primeiramente buscou-se os fundamentos teóricos sobre a temática, relacionados aos vínculos cooperativos de desenvolvimentos de novos produtos com fornecedores internacionais, com enfoque aos processos de aprendizagem e capacidade de inovação. Para a coleta de dados foram realizadas doze entrevistas com atores internos e fornecedores chineses, e pesquisa documental. A análise dos dados foi descritiva e interpretativa, por meio de análise de conteúdo categorial.

Resultados: O estudo de caso em questão mostrou que a Empresa I não possui uma base de dados sólida de fornecedores e não executa práticas internas colaborativas de definição de portfólio, o que torna os *sourcings* morosos e por vezes ineficazes. Em relação à colaboração com os fornecedores, as interações são bastante reativas e focadas na resolução de problemas. Também não existe uma política formal de valorização de práticas de aprendizagem e de disseminação interna do conhecimento adquirido em projetos.

Originalidade/valor: Vislumbra-se a possibilidade de aprimorar os processos de colaboração com fornecedores no que tange ao desenvolvimento de novos produtos, impactando no *time-to-market* e capacidade de inovação.

Palavras-chave: Colaboração; Inovação; Aprendizagem; Desenvolvimento de novos produtos

1 INTRODUCTION

Regarding the systemic approach of innovation, companies do not innovate in isolation. “[...] the performance of innovation in the economy is systemic because not only depends on innovation capacities of individual firms but also on how they interact with each other, the financial sector, research organizations, and the government” (Johnson & Lundvall, 2005, p.99). In general, firms engage in collaborative arrangements for innovation because they do not have the necessary resources internally, including knowledge, and they also want to reduce the risks associated with modernization (Tether, 2002).

In a scenario of systemic innovation and virtualization, processes sometimes go beyond national boundaries and take on a global nature. Thus, internationalization is a phenomenon highly correlated with a company's innovation capacity. The endeavor of breaking international markets and/or internationalizing the production can catalyze innovations from the absorption of knowledge and technology transfers. Also, the innovations could compose a more solid basis for the company's international launches, especially in the search for new markets and sources of production and knowledge.

Regarding the internationalization efforts, organizations must seek strategic partnerships capable of increasing their innovation potential. In the industrial sector, vertical partnerships with suppliers are very significant because they allow the exchange of technical knowledge, portfolio renovation, and cost reduction (Tidd, Bessant & Pavitt, 2008). Therefore, suppliers constitute themselves as potential partners for innovation.

The electronics market, in particular, is very competitive and can benefit positively from partnerships with suppliers for innovation. Thus, the study deals with the case of one Brazilian electronics industry and its relations of collaboration with the Chinese suppliers. The studied firm is a large electronics industry, active in this market for over 40 years, here called Company I.

The company's structure is divided into five Business Units that develop and commercialize products and solutions in the segments of security, telecommunications, networks, and employs

around 3,000 workers. The branch in China acts mainly in the search and maintenance of partners for the co-development of new solutions. The Company I also imports raw materials and outsources the production of certain products.

To deal with imported finished products, the Company I has a core in its headquarters that handles the OEM (Original Equipment Manufacturer) business, a supply chain model in which the finished product is produced by the supplier. Thus, production is outsourced. One of the key drivers of developing the product, together with Asian suppliers, especially the Chinese ones, is the greater agility to make it available in the market. The cost factor is also very decisive for the internationalization of the company's supply chain since, in some cases, it is less expensive to import than manufacture domestically, even considering the high import taxes.

In the type of cooperation for innovation adopted by the Company I, the supplier relations assume the form of outsourcing/supply relationships, coupled with some characteristics of strategic alliances (Tidd, Bessant & Pavitt, 2008). Therefore, they are not ad hoc arrangements of supplies, but current links permeated by constant developments of new projects. Maintaining a long-term relationship with international partners is beneficial to both parties because it lowers transaction costs (Williamson, 1981), and enhances the exchange of knowledge and experience.

Based on this context, the article analyzes the collaboration process for innovation of a Brazilian electronics company with the Chinese suppliers, in the bonds generated from new products' development.

2 LITERATURE REVIEW

A supply chain is seen not only as a source of new products and services but also as a useful network for leveraging new ideas that can significantly improve the operational efficiency and performance of a company's projects and new products (Lawson, Petersen & Cousins, 2009). Thus, collaboration strategies for innovation can go beyond contracts and compliance agreements towards value co-creation (Nudurupati, Bhattacharya, Lascelles & Caton, 2015).

New product development capabilities are one of the facets of innovation (Luzzini, Amann, Caniato, Essig & Ronchi, 2015). To develop new products, the suppliers play a key role in helping companies to achieve their market success (Lawson, Krause & Potter, 2015; Oke, Prajogo & Jayaram, 2013). New products' development is central to the long-term success of an organization (Brown & Eisenhardt, 1995; Clark & Fujimoto, 1991). Also, the ability to seek information and knowledge about new technologies to transform them into new developments is a topic of growing interest.

Due to the increasing trend of business internationalization, a growing number of studies have been investigating the factors affecting a subsidiary's capacity abroad. Tseng and Chen (2014), for example, conclude that head office investments, subsidiary entrepreneurship level, host countries' environments, and links with local suppliers of the supply chains are factors that positively influence the subsidiary's technological capacity. Thus, the specific investments of assets (economic aspect) and relational capital (social attitude) allied with international experience and orientation towards innovation will determine the subsidiary's technological capacity.

In terms of sourcing processes for new product developments, suppliers with more technological expertise are useful for establishing more realistic technological goals and decision-making regarding product design vs. process trade-offs such as size, weight, and speed (Cousins, Lawson, Petersen & Handfield, 2011). The technological performance of a supplier has a positive impact on the advantages of a new product; however, suppliers with a lower technical capacity can catch up if they can meet the requirements of problem-solving (Lawson, Tyler & Potter, 2015).

The integration with suppliers is positively or negatively related to time-to-market (Perols, Zimmermann & Kortmann, 2013) depending on the type: by product or process. While in the former

the supplier develops engineering activities on its own to meet the customer's need, in the latter, the engineering teams work together to reach the final design.

Concerning the Original Equipment Manufacturer business model, surveys distinguish between a first-tier OEM supply relationship and lower-level supply chain relationships (Clark & Fujimoto, 1991). Compared to lower-level supply networks, the relationships between an OEM buyer and a first-tier supplier are characterized by a high degree of interdependence. Knowledge about the OEM product will help with customization as well as on-site installations are important for testing and refining innovations (Joshi, 2017).

Several studies on external integration focused on the inter-firm relationship between the supplier and the OEM or focal company. Based on a survey of machinery, electronics, and transportation equipment industries, Heide and John (1990) reported that the level of joint action (operationalized as joint component testing effort and/or prototyping, long-range planning, and forecasting) is affected by the bilateral expectation of partnership continuity, the buyer's ex-ante effort to verify the supplier's capacity, and the specific investments of the participating companies (Luo, Mallick & Schroeder, 2010).

In the phenomenon of interaction with suppliers, it is possible to emphasize the relational view (Dyer & Singh, 1998) that deals with interorganizational dynamics, whether dual or networked. Moreover, two other theories are associated: resource-based view (Barney, 1991) and knowledge-based view (Eisenhardt & Santos, 2002; Kogut & Zander, 1992; Grant, 1996). Both views allow us to conclude that knowledge-sharing routines with external partners in innovation processes can generate competitive advantages (Nonaka & Takeuchi, 1995; Conner & Prahalad, 1996).

A relational context promotes joint innovation generation and problem-solving. Besides, a high degree of formalization of the relationship, if legitimate, can also lead to innovation, while sporadic and tense surface interactions make it difficult to generate joint innovation (Clauss, 2012).

Effective exploitation of vendor expertise includes two key considerations (Azadegan & Dooley, 2010). The first one concerns the supplier's innovation capacity, which results in the distinction of criteria for identifying innovative suppliers and relationship requirements. The second one regards the processes of assimilation and exploitation of external knowledge. Thus, efforts have been put into revealing mechanisms and organizational forms for knowledge integration, effective buyer-supplier relationships, and approaches to interorganizational learning and collaboration (Bengtsson, Lakemond & Dabhikar, 2013).

It is also significant to mention some issues regarding the decision to cooperate with suppliers for innovation pushing such as lack of resources and skills, mistrust and fear of intellectual property concerns. The Transaction Cost Economics Theory (Williamson, 1981) considers these matters to some extent as it deals with transaction and opportunity costs about an external partnership.

In technology industries, considerable technological uncertainty is also a factor that sometimes weighs against the decision to cooperate. However, many studies show that ambiguity serves to strengthen the cooperative links to innovation and, consequently, increase performance (de Leeuw et al., 2015; Bengtsson, Lekmond & Dabhikar, 2013; Jean, Sinkovics & Kim, 2017; Luzzini, Amann, Caniato, Essig & Ronchi, 2015). In particular, the mediating effect of the absorptive capacity on innovation increases with technological uncertainty (Saenz, Revilla & Knoppen, 2014).

Collaborations between buyers and suppliers in new product development processes are characterized by attributes such as long-term relationships, a high level of trust, commitment, high coordination, and cooperation (Inemek & Matthyssens, 2013). In the context of buyer-supplier relationships, external knowledge is captured from key suppliers through the establishment of deep relationships (Dyer & Singh, 1998).

Buyer-supplier integration mechanisms focusing on product development emphasize the sharing of detailed technical modifications. Then, knowledge is expressed through technical specifi-

cations and divided between various parties involved through communication channels with relative ease. In this process, the buyer constructs incremental improvements in the products, in an ongoing and usually formal case of communication (Tsinopoulos & Mena, 2015). Therefore, both e-mail and face-to-face conversations positively impact knowledge exchange (Thomas, 2013). Merminod and Rowe (2012, p.315) complement this idea by stating that “knowledge transfer effectiveness improves through greater standardization and transparency supported by IT features.”

The trust degree between buyer and supplier plays a key role in knowledge transfer and innovation success. Trust is the “relational lubricant” that facilitates knowledge transfer, shared learning, and collaboration in supplies (Ojha, Schckley & Acharya, 2016). The “capture” of knowledge represents its integration through decoupling, and a basic level of trust is required. Also, joint learning represents a process of integration of coupled knowledge. It occurs over a longer time, before and after the R&D manufacturing interface, and bases on relational trust (Rosell, Lakemond & Wasti, 2013).

Internal coordination has a significant effect on the achievement of positive results of alliances with suppliers and influences the level of supplier involvement in collaborative development projects (Luo, Mallick & Schroeder, 2010). The internal integration of knowledge regarding supplier-management proficiency and cross-functional decision-making enhances innovation performance, particularly when technological uncertainty is high (Bengtsson, Lakemong & Dabhikar, 2013). A well-coordinated subsidiary with its parent company demonstrates confidence to the supplier (Back & Kohtamaki, 2015; Jean, Sinkovics & Hiebaum, 2014).

Besides, the level of internal coordination with subsidiaries highly influences two other factors: cultural effect and identity. On cultural differences, a subsidiary may act to soften them by incorporating local culture elements and knowledge levels approximation (Jean, Sinkovics & Kim, 2017). On identity, a well-coordinated subsidiary with its parent company gives confidence to the supplier, which is an element that facilitates successful cooperation in R&D and product innovation (Back & Kohtamaki, 2015; Jean, Sinkovics & Kim, 2017).

3 METHODOLOGY

It is applied research with a qualitative approach and characterized as a case study, which is significant to general public knowledge. Although it is located in a defined context, it can be extrapolated to other scenarios and contexts. Therefore, it contributes significantly to the collective of subjects inserted in the context and environment studied

The instruments used for data collection were interview application and documentary analysis. The interviews happened with the company employees located in Brazil, China, and Chinese suppliers. They based on a semi-structured script with open questions, according to the interviewed actor.

There were seven interviews with employees involved in the company’s product development process. The selected actors were present in some stages of the process of collaboration with suppliers. However, some of them participated more intensely in the initial phase of sourcing and supplier choice. Others were more active during the development process of the product itself. Of the total number of respondents, three were from the supply chain area, two from engineering, one from marketing, and one from project management.

There were five interviews with suppliers. Thus, the subjects’ selection considered some criteria. 1) The supplier’s location: all of them located in the region of Shenzhen, in the south of China. Then, the researcher performed the interviews in person. 2) The cooperation time: all the chosen

suppliers have a history of more than five years of collaboration with the company and business unit.
3) One supplier for each Business Unit of the company.

Data analysis is descriptive and interpretive through categorical content analysis (Bardin, 2009). In the first phase, the pre-analysis, an analysis protocol was based on analysis categories. The second phase of material exploration took place with the execution of data collection instruments. Finally, data obtained were processed by a categorical analysis, in which there was a description of the main elements found in the investigated reality.

During the process, it was possible to realize that some categories could be unified into just one as they contained very similar elements (codes and meanings) that converged to a common point. Thus, for the organizational analysis protocol, three dimensions of analysis were established by the researcher: New Product Development, Collaboration with Suppliers, and Learning Processes. The interview questions were linked to these dimensions. To facilitate data analysis, the internal actors interviewed were classified from I1 to I7 (employees), and F1 to F5 (suppliers).

4 FINDINGS AND DISCUSSION

4.1 New Product Development

This dimension of analysis encompasses the definition of portfolio needs, sourcing and partner selection processes, business models, and methods used to manage projects internally, and with the supplier.

Regarding the sourcing process in Company I, there was some degree of maturity, and the flow happened according to the established procedure. For interviewees I1, I2, and I5, the current sourcing process is acceptable. For interviewees I3, I4, and I7 the current process is very reactive and dependent on marketing demand. Then, Company I only looked for what already exists in the market instead of following a two-way path, with the supplies team also fueling the business segment with more information on trends and new technologies. Therefore, there is a lack of a more strategic and bold product research process (Luzzini, Amann, Caniato, Essig & Ronchi, 2015) due to the already appropriated knowledge on purchases, and the existing technological uncertainty.

Purchasing and procurement teams' visits to trade fairs and shows, which would help in this opposite flow in the subsidiary to the headquarters direction, were mentioned positively by some interviewees (I2, I3 and I5). However, according to I5, fairs are not enough because they are usually composed of the largest suppliers, while a smaller partner may be more appropriate to the business scope. Thus, Lawson, Tyler and Potter (2015) point out that a supplier's technological performance has a positive impact on the new product's advantages. However, suppliers with less technical capacity may catch up if they can respond to problem-solving requirements.

In opposition, most of the large and high-tech companies have product development initiatives on their own. One of the reasons for this movement is the cooperation with large Chinese universities as well as greater interaction with Chinese and international clients (Chung & Tan, 2017). Therefore, for the same product line, it seems to be strategic for Company I to balance the purchasing portfolio with companies of different sizes to maintain its competitiveness and absorb product innovations.

One significant point of attention is that Company I has no clear roadmap of its portfolio's needs because development decisions take a long time, and sometimes sourcing does not become a developed product due to constant prioritization changes. Then, it is difficult for suppliers to "anticipate" themselves to develop and deliver what the company is planning to launch in the Brazilian market. Besides, all the suppliers interviewed mentioned there is a high level of demand regarding the factory process and products adequacy, which is sometimes above the international and market standards.

Two suppliers (F2 and F3) mentioned the difficulty of Company I in researching new technologies due to process rigidity and work overload. Also, they both pointed out it would be difficult for the company to have direct contact with semiconductor manufacturers and thoroughly understand the roadmap of new solutions, especially for the lack of someone in Asia who focuses on this process. Therefore, Cousins, Lawson, Petersen and Handfield (2011) argue that some companies designate an engineer to exploit emerging technologies solely and exclusively. Such a profound and more structured search, which he calls “breakthrough scanning,” leads companies to suppliers with more technical proficiency, knowledge exchange about new technologies, process performance improvement, and the result of new development.

Regarding the OEM business model, in which Company I customizes a project belonging to the supplier, respondents I3, I4, and I6 believe it is a positive model because there is a new product in less time (time-to-market) with less investment in financial resources and people. Besides, most of the suppliers’ products have more competitiveness than if they were made internally in Brazil. The model brings, in the words of interviewee I4, *“strength and competitiveness,”* and the possibility of *“absorbing technology, knowledge, the opportunity to indirectly train some workers and live in a different environment.”*

For the interviewee I3, the volume is a problem because when there are no intense business demand customizations become very costly and difficult to achieve with the supplier. Interviewee I7, on the other hand, mentions that concerning customizations *“are often overly judicious, especially regarding quality and logistics, which can cause us a lot of time and cost in some situations.”* Then, he defends some customizations’ flexibility.

About the Company I portfolio definition, there is great difficulty in integrating the solutions between different business units due to three factors, in particular. 1) The OEM business model itself makes integration difficult since each product belongs to a different supplier. 2) The high level of internal segmentation hinders the interaction between different segments and search for collaborative development platforms, and 3) multiplicity of platforms and software codes that do not “talk” to each other. Johnsen (2009) suggests that managing supplier relationships requires the ability to internally coordinate cross-functional relationships (bonds promoting the interface and coordination between different positions and areas of the company).

In this model, the supplier management compartmentalizes between different business units. Then, there is no centralization despite the systemic vision of the company’s top management. For Bengtsson, Lakemond and Dabhikar (2013), innovative suppliers are more specialized, have their development capabilities and are embedded in multiple collaborative arrangements. Therefore, the criteria could be included by the supply team to choose a partner to build links that might bring more innovation.

The operation and supply chain of Company I is in China (the subsidiary’s location). I3 (one of the respondents) mentioned that the company’s efforts to search for new technologies in China restrict the company’s vision field. He mentions that for some products with higher added value, truly global sourcing could be done by looking at Europe and the United States, for example. A multi-dimensional approach to sourcing that includes complex and specific procurement tools such as Krajic, portfolio risk analysis, and Balanced Score Card could be useful in deepening sourcing processes beyond cost and factory analysis (Nudurupati, Bhattacharya, Lascelles and Caton, 2015).

It was possible to identify the need for greater internal synergy in definition and search for new products that can be promoted by the purchasing and procurement department at the kick-off time of sourcing. The construction of internal structures, intergroup spaces, and the supplier could be useful to this integration. The process might be led by Company I’s subsidiary in China. Such an issue is in line with Tseng and Chen (2014) that underline the need for specific investment in local suppliers, especially in financial and social aspects.



The interviews brought to light some internal weaknesses in the management of new product development, which in turn impacted the lack of shared control mechanisms with the partners. Development and production activities are more easily controlled because they do not require formal contracts that predetermine the collaboration scope. Also, rework rates are lower because weaknesses are identified earlier. "This early identification of potential mistakes also improves the buyer's ability to focus its time and resources on additional productive uses" (Perols, Zimmermann & Kortmann, 2013, p.156).

Regarding the alignment of expectations at project kick-off, the interview responses demonstrated the practice is fragile and heterogeneous (it depends on the project manager conduction), and there is a lot of potential for improvement with both new and current suppliers. According to interviewee I5, when product development with a partner is made official, one fault is not making a more detailed alignment. *"I think we fail in this [alignment]. When I tie [product] development with someone, they must know where they fit, so that they feel part of the process and have a vision of the whole."* He also mentions there is an initial contact asking for information, but there is no proper talk about *"what I expect from him, what he wants in this partnership, and what can we gain together."*

There are no many practices regarding technical alignments. According to interviewee I4, *"sometimes things are rushed, especially based on the initial cost. Then, derailments of specifications, packaging, labels, and other things are only cleared up in the next moment. It causes a feeling of insecurity for the supplier, so it is significant to clarify the project as much as possible beforehand."* Supplier F3 corroborated the internal perception of misalignment between the parties in its interview. *"We still need a deeper understanding [...]. At least, to understand each step, what is needed, and what it takes from the supplier side. A kick-off meeting would be helpful with the project manager and R&D."* The supplier F4 mentioned that, over time, the approximation between parties and alignment increased. *"After the first month of project, we got more familiar, got to know each other better after a lot of calls, and kept improving."*

The supplier needs to know better where it fits, his responsibilities, and effectively feel as part of the development process. One approach to exploiting the mechanisms of integration with suppliers may be to break the stages of developing a new product, for example, from idea generation to launch and then explore the parties' collaboration degree in each step that shapes a new product (Carbonell Apud Tsinopoulos & Mena, 2015).

Regarding the main "locks" and bottlenecks during product development, mechanical tests were cited by almost all the interviewees (I1, I2, I3, I4, I5, and I6), and therefore, they constitute a chronic problem in Company I. This requirement was based on the company's experience with the first segment of operations, and there were no reviews over the years, even after the incorporation of other types of products, with different mechanical shapes. Thus, it could be ideal to have different criteria for other product families, according to the mechanical characteristics of each one.

Regarding the project's control mechanisms with the supplier, it is worth mentioning they are not sufficient for a new product's development. Concerning the theory of Dyer and Singh (1998), it is possible to verify that control mechanisms, in a relational context, refer to routines of institutionalized interactions to maximize the interactions between companies. According to the interviewee I6, control with the supplier only happens when there is a critical situation of delay, cost, or quality.

Some reasons raised for the situation was the physical and cultural distance between Company I and the supplier (I1 and I5); a project management methodology excessively internal and non-inclusive so that the supplier does not feel like part of it (I2, I3, I4, I5, and I6). Also, superficial schedules and milestones (I4 and I5), lack of more synergistic and integrated management with standardized tools and greater support from the areas involved (I4, I6).

Respondents I3 and I4 said the Company's branch role, in China, is beneficial and very helpful in development as it is a space to support engineers who are sent to the Asian country. Besides, it is a laboratory for some tests, mainly mechanical and functional, before the final samples for certifications and field tests are sent to Brazil. On the other hand, internal interviewees I3 and I4, suppliers F2 and F3 stressed the need for the company to be more local through a fixed position in China to co-develop products (unlike sporadic trips of engineers from Brazil to China) that may facilitate and accelerate developments. Thus, Yan and Nair (2016) concluded that task execution structures were very useful to the buyer learning in US-China projects, especially the physical co-location processes.

The following chart presents a summary of the main results of the new product development category.

Chart 1 Summary Table: New Product Development

Sourcing	lack of a more strategic and bold product research process lack of clear roadmap of needs in portfolio lack of specific sourcing tools use
OEM business model	good for time-to-market
Portfolio definition	difficulty in integrating the solutions between different business units
Supplier management	compartmentalized between different business units difficulty of expectations alignment at a project kick-off insufficient control mechanisms physical and cultural distance

Source: Findings from research, 2018

4.2 Collaboration with Suppliers

While the previous dimension has brought light to the product development processes in Company I, this dimension deals with the level of relational depth with suppliers considering a more comprehensive Supply Relationship Management scenario. It addresses the interactive and communicative processes, the alignment of long-term expectations, the bonds of confidence generated for the development of new solutions, and the improvement of innovation capabilities of both parties.

From the collected data, it is possible to conclude that the interviewees' opinions in positions of marketing, project management, R&D, and procurement, the interactions' nature with suppliers could be classified as superficial and reactive (Claus, 2012). On the other hand, the supply chain posts located in the headquarters of Company I have stated the communication routine is very good, especially in online tools and chats.

According to interviewee I3, the conversation is only more "intense" when there are problems to be solved. *"We contact [the supplier] when we need information, we don't have a constant relationship."* For respondent I3, the proximity to more strategic suppliers is better, but in general, it is considered bad. For I1 declares *"We only have contact with a supplier that has a problem, not with everyone, and so we end up having more affinity with those that give us more issues."*

Concerning the interaction type, respondent I4 mentioned that technical communication is disregarded from commercial one at many moments, which may confuse the supplier and pass an image of misalignment. Thus, interviewee I3 mentions that *"[...] we talk very well at the technical level, and we have a very good command of the commercial one as well, but things often go wrong."*

According to interviewee I4, for new suppliers, the technical visit should be mandatory as it brings the dimension of physical infrastructure and possibilities of co-location activities, for example. Besides, it could create empathy and help in bonds of trust. *"It is extremely significant to pay a visit as a new supplier, we end up seeing his reality well and understanding to what extent we*

can use the structure for our controls. It creates a level of confidence that the business will happen. Then, it gives you an opening to better use other online communication tools.” On this point, Inemek and Matthyssens (2013) suggest that “inter-firm routines or mechanisms that promote suppliers’ learning, adaptation, and integration may offer important opportunities for suppliers to enhance their innovativeness.”

Regarding communication strategies, interviewee I6 cited online communication tools as a positive point and said it is used daily to contact the suppliers. Interviewee I7 also said communication is daily, but pointed out that as many R&D analysts and project managers do not speak English well, communication often ends up being centralized in the positions of the supply chain (purchasing and procurement). In general, both internal interviewees and suppliers consider that virtual communication happens, but more personal interaction is needed. Supplier F3 revealed there are many e-mails, which ends up being formal and impersonal. *“The way we write an email is very official and sometimes hides the real feeling. For sure, we need to do more calls because as time goes by we have misunderstandings, especially for the new staff that is not very used to our way.”* For interviewee I3 *“an e-mail is good for formalization, but causes communication delay, especially due to the time zone.”* According to Thomas (2013), the best way is to use both communication strategies in a new product development: virtual (e-mail) and personal (face-to-face).

Time zone difference was cited as a major impediment to more frequent communications for both internal respondents and suppliers. For interviewee I7, the timetable disturbs the interactions, demanding the supplier to be available for conferences during the Brazilian working day while it is late at night, in China. For I6, although the time zone is a problem, it can be overcome by the use of social media. Therefore, according to interviewee I3, the use of social media needs to be done with care because it could be invasive and suggests a flexibilization of schedules to the positions that have more direct contact with the supplier, so that they follow days’ working conditions. Supplier F1 mentions that communication takes place mainly with the headquarters in Brazil, and the time zone is an obstacle. *“We don’t have too much talking with the office in China, only inspectors, and quality reports. With Brazil, we already have a lot of communication, but there’s a big-time difference.”*

According to F3 vendor’s opinion, due to the e-mail formality and impersonality, and real-time communication difficulty, it could be significant to have a technical contact window in the office in China with enough empowerment for decision making to speed up problem-solving. *“To communicate back to your office in China is hard because of the time difference. If we had someone here, in the office, to make small decisions and talk directly in real-time, it might help to do things faster.”*

Regarding the tool used to evaluate suppliers’ performance (a specific internal methodology of Company I by which suppliers are evaluated every six months), supplier F1 mentioned it is positive because they know what they need to improve. Still, in the supplier’s view, Company I always considers both sides and has enough empathy: it is always in contact and seeking to build a path of mutual aid. Joshi (2017, p. 562) argues that the recognition of innovative suppliers is beneficial in terms of reputational advantages since it stimulates innovative actions in other suppliers of the supply chain.

Concerning the formation of strong collaboration links and mutual goodwill, respondents I1, I3, I4, I5, and I7 sustained there is no link of trust between Company I and its suppliers since it is a commercial, financial, and bargaining relation. However, they directly or indirectly mentioned in their speeches that with larger and more strategic suppliers there will be more potential for trust relationships. Therefore, there seems to be a mutual exchange between parties characterized by shared learning that builds up relational bonds of assurance, according to the typology of Rosell, Lakemond and Wasti (2013).

Interviewee I1 mentions that small size suppliers only think about the financial part and urge for the placement of purchase orders. *“Certain industries just want to take orders, but with higher added value products, we face another level.”* However, for smaller companies, the trust factor seems to be fundamental to leverage new developments. Chung and Tan (2017) point out that for Chinese SMEs, the role of trust known as “Guangxi” (a term denoting the construction of good relations with other individuals or organizations) is fundamental to stimulate innovation strategies.

According to respondent I5, the buying-selling relationship should be considered as commercial. There is a common financial interest to achieve, and if it does not happen, there will be a direct trust impact between the parties. Besides, since there is no synergy or confidence, most of the verbal agreements are not honored by the parties. Interviewee I3 also mentioned that trust decreases when agreements involving volume expectations by the company are not met. Trust facilitates the development of skills that enable shared learning and the creation of tacit knowledge in long-term partnerships. Also, it has a central role in link formation (Back & Kohtamaki, 2015).

The supplier’s top management culture and nationality is also a factor to consider. One of the interviewees, a Brazilian who has lived in Asia for many years, mentioned that trust construction with Chinese companies is much more difficult than those located in Hong Kong and Taiwan, for example. They are more professional and formal, while in many Chinese firms, there is a Confucian culture of always seeking the best for themselves in detriment of the other party. Interviewee I7 raised the Chinese cultural issue as an obstacle to the creation of trust bonds. It is difficult to trust Chinese companies. *“Problems come up when we have to open some information because, based on my experience, I don’t think they are reliable. It is a cultural issue.”*

Moreover, respondents I3 and I4 said that Chinese suppliers often change components and/or specifications without warning. In the words of interviewee I3 *“trust is a complex word. You know, sometimes suppliers change the materials, use second hand ones without informing, so there will be no trust, especially with the small companies in China. It is really hard to trust them.”* Wang, Yeung and Zhang (2011) concluded, in their study, that both trust and contract factors are useful in controlling opportunistic behavior, and can benefit transparency and openness in buyers/suppliers’ processes, providing a stable scenario for collaboration and innovation.

According to Jean, Sinkovics and Kim (2017), a subsidiary may act to soften cultural differences between parties, incorporating elements of local culture, and knowledge levels approximation. Besides, a well-coordinated subsidiary with its parent company demonstrates confidence to the supplier (Back & Kohtamaki, 2015; Jean, Sinkovics & Hiebaum, 2014). Therefore, it is apparent from data collection that Company I’s branch, in China, could act with more strength in this regard.

However, interviewee I6 brought a slightly more pondered view by pointing out there is trust only with strategic suppliers. With less important suppliers, the relationship is non-existent or very fragile. Then, relational trust happens when the buyer and supplier share and use knowledge together, and also competence-based trust through which the buyer captures the supplier’s knowledge and uses it internally (Rosell, Lakemond & Wasti, 2013).

As opposed to internal interviewees, the relationship of distrust regarding Company I was not present in the suppliers’ statements. When asked if they trusted Company I’s managerial style, all 5 of them answered yes. F2 mentioned the company has a very stable management style, similar to F3 speech that underscores the company’s long history. *“I know there are over 40 years of history, so for sure there’s something special to keep. For general management, the way they treat the workers and build the culture is significant and quite good.”* F1 was succinct in its response, noting there is a lot to learn from Company I. F4 talked about quality management, which is the best you’ve ever seen. However, it suggested flexible quality rules and internal procedures according to each prod-

uct line. Similarly, F3 has advised giving more autonomy to people over rigid procedures. Finally, F5 mentioned that purchases and shipments' flows are well defined and clear.

For supplier F3, regarding common objectives and future vision, it is necessary to review the expectations and directions from time to time as they are not always clear. *"There should be interaction from time-to-time, talking about the next step, always. Now I think we have problems because we don't know the future."* Furthermore, for F4, the door is always open to collaboration, and they expect more projects. *At this moment we expect the company can help to give us more projects. We hope to have a long cooperation."* Here, it is significant to recall Heide and John (1990), who reported the level of joint action operationalized as the effort of both parties to develop a new solution is directly affected by the bilateral expectation of future interaction.

Finally, it should be mentioned the time of partnership impacts on confidence-building (Back & Kohtamaki, 2015), but few interviewees have referred to this point. Only respondent I3 mentioned that with new suppliers, there is a great distance, and consequently, the link is almost non-existent and takes time to build it. It is not possible to infer from the interviews that there is a stronger relationship of trust with older suppliers than new ones. Conversely, there were some cases of trust bonds broken or at least impaired when promised volumes were not met or when the supplier changed the product characteristics without prior notice.

From different interviewees' perceptions, it is possible to confirm that trust bonds are constructed slowly but easily broken as in all other social relations. The existence of trust with a supplier will depend on cultural, social, and economic variables as well as the managerial style of both parties throughout collaboration time.

Chart 2 presents a summary of the main collaboration results with the suppliers' category.

Chart 2 Summary Table: Collaboration with Suppliers

Interaction and communication	superficial and reactive interactions daily online communication time zone difference impedes more frequent communications
Trust bonds	more potential with larger and more strategic suppliers suppliers trust in the management style of Company I trust is affected when agreements involving volume expectations by the company are not accomplished or when the supplier changes product characteristics without prior notice

Source: Findings from the research, 2018

4.3 Learning Processes

The dimension encompasses knowledge sharing processes, absorptive capacity elements, and internal knowledge multiplication acquired from the suppliers by considering the new products' development processes and a scenario of collaboration with them.

Currently, there are no formal processes for this knowledge integration between Company I and its suppliers. Informally, the exchange happens, but respondents pointed out it is only with strategic suppliers, which regards to the fact that trust bonds are more present with these players. Of course, knowledge integration is facilitated when there are stronger ties of trust. Concerning technical knowledge, integration is greatly hampered by digital exchanges since online communication tools can cause much noise. Knowledge codification through digital instruments and platforms may promote knowledge transfer in new products' development (Merminod & Rowe, 2012).

Some internal respondents' perception (I3 and I6) is that the supplier benefits more from Company I's knowledge than the other way around. For I6, with suppliers of raw material, Company I could absorb enough knowledge, but with OEM suppliers, the flow is more unilateral. *For OEMs,*

"I see our company giving information to the supplier than the other way around. For raw material components, suppliers help more such as teaching how to use a certain metal in the connector instead of another metallic covering to achieve the same resistance at a lower cost. We learn, and then we take it [this knowledge] to OEM manufacturers." Therefore, some efforts must be made to establish processes of assimilation and knowledge exploitation of the selected suppliers with specific approaches to interorganizational learning and collaboration (Azadegan & Dooley, 2010).

When questioned about sharing market knowledge and trends, most respondents mentioned the exchange does not happen often. For interviewee I7, Company I takes advantage by sharing this kind of knowledge about the market when something is expected in return, such as a price discount, for example. Nevertheless, he recognizes the suppliers have more knowledge in this area. *"Suppliers have even more expertise to share because they export to various markets and are at the center of the hurricane"*. However, I7 declares that suppliers have more knowledge in this regard. On the supplier side, technical project information is shared in different degrees of depth. For some products and suppliers, strategic information is shared, such as the products' structural drawings, printed circuit board layouts, and documents with cost composition.

Interviewee F3 commented that although many engineers from Company I visit its structure to conduct new developments in loco, they do not always have a learning mentality. Besides, not everyone involved in projects has access to the information they need to do a great job. Therefore, it recommends the creation of a specific event or program to promote more knowledge exchanges between the parties. *"We should have a special program, meeting, or this kind of sharing experience. It is also significant to run the whole structure smoothly. Imagine a person who works for logistics and has never seen a camera, how they look like and package way, imagine how difficult is to do a good job."*

The execution of confidentiality agreements seems to be a significant step to drop the fear between the parties. However, it was possible to find that much information is exchanged without formal documents of confidentiality formality. It is perceived that information sharing is closely related to trust bonds. With suppliers considered as strategic, with whom trust bonds are more present and intense, information is more fluid, and there is access to the strategic knowledge of both parties in a relationship characterized by the union of efforts towards a common goal. In this type of relationship, there is also a greater interdependence between the parties.

Regarding knowledge acquisition from the interviewees' answers, it was possible to conclude that when there is a constant supply (ongoing orders being purchased and imported), it is easier to absorb knowledge since there is already greater proximity between the parties. Interviewee I3 highlighted that *"when current relationships are maintained, it is easier to apply the knowledge learned in the previous project."* Interviewee I2 mentioned that in technical relations, the exchange happened by giving and taking, and the company can acquire knowledge. Therefore, supplier F1 mentioned the exchange happens mainly in the technical sphere, and more than 70% of shared knowledge is between R&Ds.

For suppliers F2 and F3, it is necessary to prepare more people to capture knowledge from suppliers since information is there, transparent and explicit. So, if the Company I's engineer goes to the supplier to develop a new product with a learning mentality, he will definitely take all knowledge back to apply to new company projects. F4 vendor also corroborates this view but highlights that currently, it is not the case. *"If they [R&D] come to learn, they would bring it back very easily, but I don't think they come [here] to do it."* Bengtsson, Lakemond and Dabhikar (2013) suggest that internal knowledge integration capabilities are motors that can leverage innovation. Moreover, these capabilities are even more significant in the case of strategic suppliers with lower technical capacities (Lawson, Tyler & Potter, 2015).

Therefore, if Company I values this movement through rewards and recognition, the acquisition process will happen. Corroborating with this logic, the F5 vendor mentions it is a viable process. Knoppen, Johnston and Saenz (2015) emphasize the organization's need to focus on what they name the learning facet - structural, cultural, psychological, and political aspects of the relationships mentioned.

Regarding the internal multiplication of knowledge acquired in new product developments, most of the internal interviewees (except for I2) agree there is a mentality of retention and non-dissemination, with the possibility of losing knowledge when there is a high turnover of people in the company. For interviewee I6, *"if a person leaves knowledge is lost, and it takes too long to pass on the information and make transitions. There is knowledge retention originated from an old mentality and people's profiles who do not seek information."*

According to I5, such behavior is stimulated by the organizational culture of Company I, which could enhance the moments and spaces of knowledge exchange. Likewise, in the opinion of suppliers F2 and F3, Company I needs to find ways to better share knowledge internally because when an employee leaves the organization, a lot of tacit knowledge is retained and it takes a long time for another person to become familiar with all the processes and methodologies. *"If a software engineer leaves the company, it is hard to absorb the knowledge. So, you need to think about ways to teach other guys or prevent them from getting out."*

Due to a high degree of internal segmentation, the internal exchange processes of project knowledge are very difficult. The research and development teams of each business unit are in different company's spots, and there is no interaction promotion. Even within the same business segment, the structuring of most development analysts split between internal products and OEM products, and there are no processes of knowledge exchange between them.

For respondent I7, sharing information about product development happens on a smaller scale compared to the knowledge of routine activities because there is a fear that other company's segments will steal the new product development's idea. He suggests an internal system of idea registration and patenting could soften this competition and race among the business units. *"Perhaps, a place to informally register [the idea] as if it were a patent to be developed, with someone validating the synergy with the segment's product line, would take away this fear of knowledge sharing."*

A change of behavior is necessary when thinking about the innovation capacity's improvement of Company I. Companies with strategic supply teams must first be apprentices before sustaining innovations. *"Strategically-oriented chains may first frame themselves to be learning organizations before they can sustain innovativeness. [...] ultimately, developing embedded learning routines in the supply chain culture may help to develop exploitative capabilities and supply chain innovations"* (Ojha, Schockley & Acharya, 2016, p. 221-222).

Chart 3 presents a summary of the main results of the learning processes category.

Chart 3 Summary Table: Learning Processes

Knowledge sharing	no formal processes for knowledge integration informal exchanges of knowledge take place with strategic suppliers trust bonds facilitate integration and knowledge sharing internal mentality of retention and non-dissemination of knowledge internal exchange processes of project knowledge are difficult (high degree of internal segmentation)
Knowledge acquisition	based on technical knowledge (more than 70% of shared knowledge is between R&Ds) need to prepare more people to capture knowledge from suppliers

Source: Findings from research, 2018

5 CONCLUSION

Collaboration with suppliers is extremely relevant to the innovations' implementation. In the links generated with this stakeholder to develop new technological solutions, the learning processes are significant to feedback the company's capacity for modernization.

The present case study shows that Company I does not have a solid supplier database and does not perform collaborative internal portfolio definition practices, which makes sourcing time consuming and sometimes ineffective. The requirements of new products are reactive and based on solutions already launched by competitors.

The Company I has a mature and documented process of new product development that follows a linear flow and passes through evaluations of a conservative product committee at each stage. It is a rigid flow, full of spines and too many technical requirements that sometimes hinder the time-to-market, and causing the projects to take more than seven months until its official launch.

The branch in China was identified as an important space between the headquarters and the suppliers, but it is clear that it could be better used with the purpose of being a more active agent in the integration with them (preferably in the front end) and in the promotion of shortening routines of physical and cultural distance between the actors of the supply chain and the actors of the headquarters. The Chinese branch would be crucial in this approach when considering the need to balance formal project rules with a certain level of informality with the Chinese to stimulate the project engagement.

Regarding collaboration with suppliers, the interactions are quite reactive and focused on problem-solving. Project control mechanisms are not uniform and vary between areas as well as with suppliers. Instant communication tools help in more informal information exchanges, but are not used by everyone and may become invasive. Personal exchanges are significant in building stronger bonds with suppliers, especially when it is the first contact and development, but only when the analysts located in Brazil travel to China.

Therefore, it is more difficult to establish a trust relationship with smaller suppliers because there is no security regarding conduct since many of them have an immediate demand for more purchase orders, narrower margins, and fewer resources than big companies. One way to mitigate a competitive advantage in the commercial relationship is to establish supplier assistance procedures and strong development routines.

With larger suppliers, the relationship is more easily constructed since the financial fragility does not exist as a hindrance. With these strategic suppliers, the company recognizes and values the technological capacity of the partner and recognizes its dependence on certain products, which leads to the search for a closer and more reliable relationship.

Finally, there is no formal policy for valuing learning practices and internal dissemination of knowledge acquired in projects. Knowledge is tacit and not very explicit, especially because of a culture of information retention and structures that do not facilitate internal exchanges. Knowledge exchange takes place in a reactive, informal, and technical problem-solving environment that leads to tacit learning. There is a great opportunity to improve this flow through formalization, institutionalization, and a greater appreciation of learning, which could encompass other expertise types than technical and functional.

One of the study's contributions is the possibility of a better understanding of Sino-Brazilian relations. China has been a significant player in political economy and international geopolitics. Currently, it is one of the main Brazilian partners in international trade both in imports and exports. Therefore, it is necessary to deepen studies that contemplate interorganizational relations between Brazilian and Chinese companies.

The study's subject and findings are not only useful for Company I, but also to other companies with international partnerships to the co-development of new products and solutions. It is possible to improve the collaboration processes with suppliers regarding the development of new technological solutions, impacting time-to-market, and innovation capacity. They are essential attributes to the companies in this field.

The study can be extrapolated to industries and technology developers operating in all market segments, and not necessarily in the electronics one, as long as they have ties with international business partners. In a globalized scenario where many multinational companies are present, innovation strategies need to be constantly reviewed and improved. Therefore, it provides a significant contribution to the fortification of Brazilian companies confronting the large transnational corporations that operate in the country. It also contributes to income generation and retention within the country. Ultimately, it helps to shed some light on paths leading to economic and social development.

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9. Critical revision of the manuscript	✓	✓
10. Manuscript writing	✓	✓
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