

# Methodology for the collaboration in supply chains with a focus on continuous improvement

## Metodología para la colaboración en las cadenas de suministro con énfasis en la mejora continua

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### ABSTRACT

A collaborative relationship between companies in a supply chain makes it possible to improve both the performance and the results of the companies and of the supply chain. Several studies have analyzed supply chains, but few studies have proposed the application of tools for continuous improvement in a collaborative manner within the supply chain. The objective of this work is to present a methodology for the collaboration in a supply chain with a focus on continuous improvement. Three case studies were conducted with Brazilian multinational focal companies that manufacture technology-based products. It was seen that relationships, trust, the exchange of information, and the sharing of gains and risks sustains collaborative practices focused on continuous improvement. The proposed methodology considers the need for supplier development, for the monitoring of the supplies, and for the development of a partnership for problem solving through the application of tools for continuous improvement.

**Keywords:** Supply chain management, collaboration in supply chains, continuous improvement.

### RESUMEN

Una relación de colaboración entre una cadena de suministro permite a las empresas mejorar el rendimiento y los resultados de las empresas y de la cadena de suministro. Hay varios estudios que se ocupan de las cadenas de suministro, pero son pocos los estudios que apuntan a la aplicación de herramientas colaborativas para lograr una mejora continua en la cadena de suministro. El objetivo de este trabajo es presentar una metodología para la colaboración en la cadena de suministro, enfocado en una mejora continua. Se realizaron tres estudios de caso en empresas multinacionales brasileñas que fabrican productos de base tecnológica. Se observó que las relaciones, la confianza, el intercambio de información, y la participación conjunta en riesgos y beneficios sustentan las prácticas colaborativas enfocadas hacia una mejora continua. La metodología propuesta considera la necesidad del desarrollo de proveedores, la supervisión de los suministros, y la colaboración en la solución de problemas a través de la aplicación de herramientas de mejora continua.

**Palabras clave:** Gestión de la cadena de suministro, colaboración en la cadena de suministro, mejora continua.

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### Introduction

Supply chain management is considered an operations strategy that is capable of improving organizational competitiveness in the twenty-first century (Gunasekaran *et al.*, 2008). Many organizations are attempting to achieve competitive advantage through the integration of its suppliers in key processes of the supply chain. This requires strategic and operational collaboration between the buying company and the supplier companies and often involves some degree of collaborative planning (Petersen *et al.*, 2005).

Strategic supply chain collaboration provides benefits to each partner organization, among which the following could be mentioned: collaboration focused on the long term with an emphasis on two-way communication; use, by the purchasing company, of cross-functional teams acting toward improvements in the supplying companies;

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establishment of high levels of trust between the buying and the supplying companies; and improvement in the competitive advantage of the purchasing and supplying companies (Cadden *et al.*, 2010). Collaboration in the supply chain can be achieved through different approaches, one of which is focused on Supply Chain Quality Management (SCQM) (Foster *et al.*, 2011). In the context of SCQM, quality management practices are significantly correlated with the players' interactions that influence tangible business results and customer satisfaction levels. Therefore, quality improvement is an important issue in supply chain quality management (Foster and Ogden, 2008). A natural question is whether and what type of interaction between the manufacturer and its supplier(s) can improve the quality of the products in a given market segment in a competitive environment (Xie and Wang, 2011).

Collaborative practices associated with quality improvement in supply chains were studied in several operations and supply chains, such as the coffee chain and the textile chain in China (Foster *et al.*, 2008; Jiang *et al.*, 2012; Biotto *et al.*, 2012). The role of the different parts of a supply chain in quality improvement, the involvement of the focal company in the application of these practices, and their impact in the profit of the supplying and buying companies was reported by Zhu *et al.* (2007). To improve the supply chain performance, Lin *et al.* (2013) proposed the use of quality business models, such as the European Foundation for Quality Management (EFQM) Excellence model, ISO 9000, and the Malcolm Baldrige National Quality Award (MBNQA).

It has been recognized that competition is switching from a "company versus company perspective" to a "supply chain versus supply chain perspective" due to the decrease in the life cycle of products and global competition (Whipple and Frankel, 2006). Quality management practices are widely accepted and necessary for the integration of the companies in the chain (Theodorakioglou *et al.*, 2006). Collaboration between the buying and supplying firms requires structure and coordination; there is a remarkable need to study this collaboration in chains from other emerging countries based on TQM (Total Quality Management) principles (Theodorakioglou *et al.*, 2006).

The purpose of this study is to answer the following research question: How should the collaboration between the buying and supplying companies be structured to achieve continuous improvement in the relationship and performance of the companies involved? This manuscript presents a methodology for the collaboration between the focal company (buying company) and the direct material suppliers of the supply chain to continuously improve the relationship and the performance. The proposal is based on a theoretical frame of reference as well as on the analysis of case studies of three focal companies whose principles are the relationship and collaboration with their suppliers through the application of continuous improvement tools. The focal companies studied are located in Brazil. They are

multinational companies that have direct material suppliers from several countries. The collaborative practices of these focal companies with their direct material suppliers were surveyed.

## Collaboration in supply chains

Supply Chain Management (SCM) can be conceptualized as an integration of key processes, from the end customer to the original sources, which provide products, services, and information that add value to the customers and other stakeholders (Lambert and Pohlen, 2001). SCM involves integration, coordination, and collaboration along the supply chain. A production flow, as well as an information flow, travels through the supply chain, starting from the suppliers and traveling through the focal company toward the distributors and customers (Cooper *et al.*, 1997).

Companies that learn how to manage the risks of a global supply chain have more chances of surviving and meeting the challenges of global competition. The main collaborative actions include the establishment of common goals, the sharing of information, and the sharing of gains and risks. Besides these, there is a need to establish integrated performance evaluation systems between the focal company and the supplying companies (Paulraj *et al.*, 2007). The need to develop relationships of trust stands out because it is opposed to a focus that is exclusively based on economic and transactional contracts (Simatupang and Sridharan, 2005).

The continuous improvement tools that are typically presented in studies associated with the supply chain and operations, such as that conducted by Foster *et al.* (2011), include the following: Six Sigma, FMEA (Failure Mode Effect and Analysis), PDCA (Plan-Do-Check-Analysis), lean tools (Kaizen), control charts and SPC (Statistical Process Control), 5S, DOE (Design of Experiment), QFD (Quality Function Deployment), and QC (Quality Control) Story.

Table 1 summarizes the main constructs related to the present research. We present the definitions associated with the constructs "collaboration and relationship", "performance", and "continuous improvement", as well as their references.

However, even though companies are aware of the benefits achieved by working together, they face daily barriers and difficulties. Examples of barriers that hinder the relationship and performance in companies include (Moberg *et al.*, 2003): lack of trust between the focal company and its trading partners within the supply chain, failure to understand the importance of the supply chain integration between the focal company and its suppliers and customers, fear associated with a loss of control related to a loss of autonomy as a result of the relationship between the companies, misalignment in the objectives and goals between the companies within the supply chain due to

different competitive or financial circumstances, deficient information systems, focus on short-term relationships, and

complexity of matters related to the supply chain as a result of the numerous companies within the chain.

**Table 1.** Collaboration in supply chains - constructs

Construct	Definitions	References
Collaboration and relationship in the supply chain	Supply Chain Collaboration (SCC): when two or more independent companies form long-term relationships and work closely in the planning and executing of operations in the SC toward common goals, thus achieving more benefits than when acting independently. Collaborative efforts include product development coordination and just-in-time practices, data exchange on demand forecasts and delivery deadlines, and the sharing of costs and other strategic information. Trust is an essential mechanism in collaborative relationships. Advances in information technology are making it possible for companies to share planning information in an easier way. Effective collaborative planning depends on the quality of information shared between the companies.	Simatupang and Sridharan (2005); Adler (2001); Petersen <i>et al.</i> (2005); Jung <i>et al.</i> (2012).
Performance	In the context of the relationships within the strategic supply chain, performance is becoming increasingly more important due to the long-term and the cooperative natures of the relationships. Performance evaluation systems must be concerned with systemic aspects of the performance assessment. There is a need for indicators that are integrated with each other and linked to the organization strategy to which they relate.	Paulraj <i>et al.</i> (2007).
Continuous improvement tools	Continuous improvement includes the use of methods or specific tools with established procedures for their implementation. This aims to improve performance indicators, such as productivity, quality, costs, and delivery. The commonly used tools in supply chain collaboration include: PDCA, QC STORY, FMEA, 5S, Kaizen events, and Six Sigma.	Welborn (2010).

## Research design

This article aims to present a collaboration methodology in supply chains with a focus on continuous improvement and performance. The proposed methodology complements the one exposed by Theodorakioglou *et al.* (2006), who suggested that studies of this type should be conducted in other countries using qualitative approaches to understand in depth the process of coordinating the implementation of continuous improvement practices in companies that supply a focal company. This research has an applied, qualitative, and exploratory nature, and its structure follows the one exposed by Voss *et al.* (2002). Three case studies were carried out in focal companies (A, B, and C) located in the south of Brazil.

The study consisted of the following steps: (i) preparation, in which the research problem was elucidated and the theoretical reference built; (ii) planning, in which the analysis units were selected, the methods and techniques for data collection were defined, an interview guide was

developed and validated, and the data registering protocol was elaborated; (iii) execution, in which the pilot test was conducted on focal company A, adjustments were made to the interview guide, interviews were conducted with companies B and C, and the interviews were transcribed; (iv) analysis, in which the data were compiled and analyzed; (v) proposition of a collaborative methodology; (vi) discussion of the management implications of the proposed methodology; and (vi) conclusions.

Three companies were selected for the planning stage, all of which are focal and global references in their areas. The three focal multinational companies (A, B, and C) produce technology-based products, and their principles are the relationship and collaboration with their suppliers through the application of continuous improvement tools (according to the values reported by the companies). The three companies that were studied are characterized in Table 2. Figure 1, 2, and 3 illustrate the supply chain of the studied companies.

**Table 2.** Characteristics of the studied companies

Characteristic	Company A	Company B	Company C
Location	Multinational company; has manufacturing plants in Brazil, USA, China, Austria, Switzerland, and Germany.	Multinational company; has manufacturing plants in Brazil, France, USA, Germany, China, and other countries.	Multinational company; has manufacturing plants in Brazil, China, Argentina, USA, Mexico, France, and Italy.
Products	Technology-based products for silviculture, agriculture, farming, gardening.	Technology-based products for agribusiness.	Technology-based products for climate systems.
Major productive processes	Casting, painting, plastic injection, assembly line.	Assembly line, machining processes, heat treatment, grinding, painting.	Stamping, painting, finned manufacture, assembly line.
Employees	2,000 employees	1,690 employees	600 employees
Certifications	ISO 9001, ISO 14001, and OHSAS 18000	ISO 9001, ISO 14001, and OHSAS 18000	ISO 9001, ISO 14001, and OHSAS 18000
Supplier origin	International (~ 47% of volume): Asia, Europe, North America, companies belonging to the group. National (~ 53% of volume): Brazil.	International (~ 36% of volume): Asia, USA, Europe, and companies belonging to the group. National (~ 64% of volume): Brazil.	International (~ 39% of volume): Asia, USA, Europe, companies belonging to the group. National (~ 61% of volume): Brazil.
Commercialization	Export: exports to units belonging to the group that resell via dealers. National market: via dealers.	Supplies throughout South America via dealers and units belonging to the group, located in Argentina, USA, Europe, and Mexico.	Supplies the domestic market through dealers, distributors, retail. Supplies the Argentinean unit of the group.

Three main sources of evidence were used: documents, observations, and interviews. The interview was semi-structured through open questions. The interview guide was previously elaborated from a theoretical study on the subject, using the constructs indicated on Table 1 as the basis. Three representatives from each of the three focal

companies were selected for the interview. The selected interviewees are managers or specialists in the following areas or departments: purchasing, production planning, and quality. In addition to the interviews, a documentary analysis and direct observations were conducted.

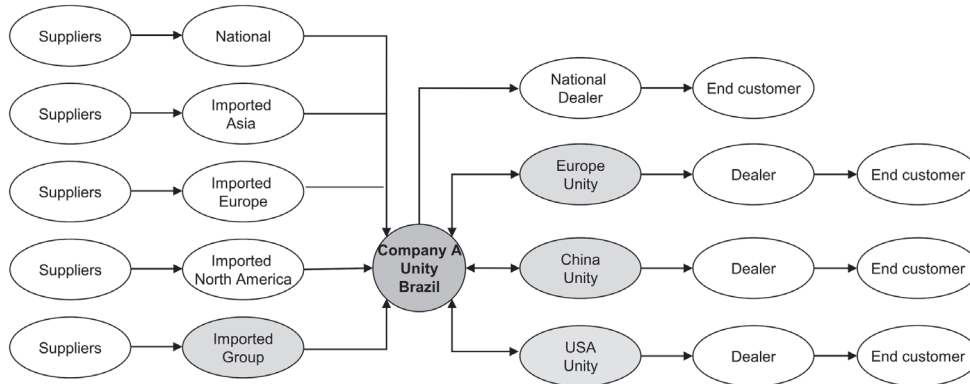


Figure 1. Supply chain for focal company A.

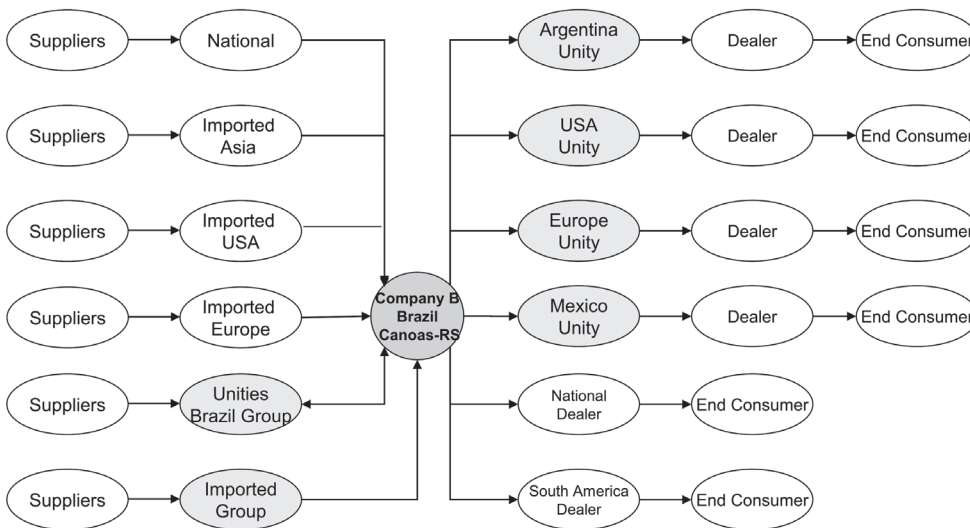


Figure 2. Supply chain for focal company B.

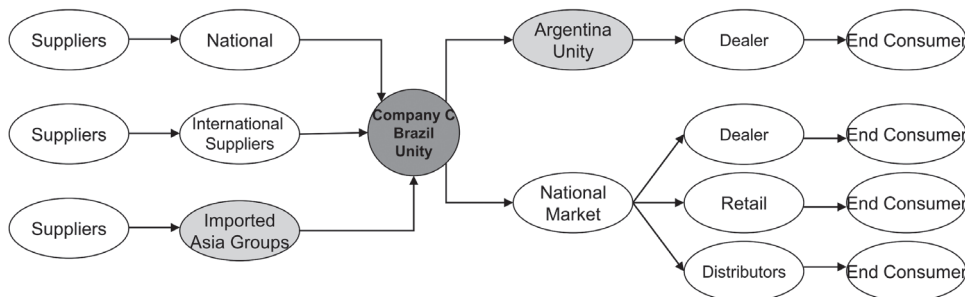


Figure 3. Supply chain for focal company C.

## Findings and proposition of collaborative methodology

The three companies agree that, for a good supply chain management, it is important for the company to integrate and collaborate with its suppliers. Integration, alignment, and collaboration between companies have brought positive results to both the focal company and its suppliers. The coordination of the focal company in these studies was mentioned as being crucial because it increased the trust and relationships between the companies, and thereby generated a win-win situation. The companies need to detail the focus of their conjoint actions with the suppliers based on clear goals related to the improvement of the processes. Besides, the type of involvement expected from the suppliers must be clarified.

Regarding the construct "collaboration and relationship in the supply chain", the three companies mentioned having focused on long-term relationships. There is a stimulus for bidirectional communication, trust, flexibility, agility, and responsiveness. The companies mentioned that the ability of the supplier to accept a collaboration with the focal company is associated with the cultural values of the supplier. The initiative of the supplier to search for help in a problem-solving situation or for continuous improvements is essential. The establishment of clear objectives and targets for the collaborative actions with suppliers avoids conflicts and facilitates the relationship.

Collaborative practices are observed in the development of products, just-in-time use, data exchange on demand forecasting and delivery deadlines, exchange of strategic information, and sharing of the costs of collaborative actions. Focal companies use cross-functional teams with engineers, technicians and/or experts to support the implementation of improvement actions in their suppliers' processes. The major training performed by the focal company in its supplying companies is related to PDCA, QC STORY, FMEA, and Kaizen.

In the construct "performance", it was seen that the three focal companies establish indicators to evaluate their suppliers: (i) quantity of defective parts per million, (ii) compliance with quality requirements specified for product conformity, (iii) number of interruptions in assembly or receipt lines, (iv) percentage of orders delivered in due time, and (v) corrective actions taken and their effectiveness. The indicators and targets are defined by the focal companies, and the suppliers do not participate in this definition. The suppliers are informed of the indicators and targets and receive training and guidance on these (supplier's manual). The three companies stress that performance indicators are the same regardless of the size or importance of the supplier. The targets are established by groups of suppliers depending on the process type or commodity. The indicators are monitored and reported monthly to the suppliers via an online portal and emails. When the supplier does not meet the goal of some indicator or presents any non-conformity, the supplier needs to perform an analysis through some

continuous improvement tool. Depending on the situation, the focal company performs technical visits to the supplying companies and verifies their need for help. A follow-up plan of action is conducted with the supplier for action and result monitoring. The three companies commented that the suppliers with the best performances compete annually as a candidate for "Supplier of the Year" which is awarded at the Supplier Day event.

In the construct "continuous improvement tools", the focal companies use the following in a collaborative manner with their suppliers: (i) Kaizen events in the suppliers, which are coordinated by the focal company; (ii) VSM (Value Stream Mapping) to map the current state of the processes to eliminate wastes (the focal company's technical staff participate in this tool); (iii) S&OP (Sales and Operation Planning), which involves the integrated planning of the focal company's demands with the manufacturing capacity of the supplier; (iv) supplier's manual; (v) supplier evaluation, which is a suppliers' performance evaluation tool; (vi) supplier online, which is a collaborative tool through which the supplier can observe daily the necessary information for its planning (necessary demands, quality, and delivery indicators); (vii) Supplier Day, which is an annual event for the sharing of information between the suppliers and the focal company; (viii) the application of other quality tools, such as FMEA, QC STORY, PDCA, and SPC; and (ix) audits of the supplier, which are conducted to observe the process, to raise technical problems and systemic problems, and to guide the search for solutions.

The companies mentioned the following benefits arising from the application of collaborative practices: larger stability and gains in processes, increased productivity, improved quality, improved delivery on time by the supplier, waste and cost reductions of processes, improvement of supplier qualification, greater agility and speed in the supply chain, and increased trust and relationship improvements between the companies.

As barriers, the companies mentioned the following: lack of trust, failure in understanding and insufficient knowledge of the importance of integration within the supply chain, fear associated with the loss of control, misalignment of goals and conflicting objectives, lack of communication or weak information systems, low amount of work in the relationship, focus on short-term relationships rather than long-term relationships, complexity of matters related to the supply chain, and incompatible organizational cultures between the various partners.

The proposed methodology for supporting collaboration between a focal company and its direct material suppliers has taken as a basis the studied business practices. Besides, these practices are aligned with the studied bibliographical references. Figure 4 details each step of the proposed methodology. The proposed tools are placed next to each step and follow a logical sequence, but there is no need to follow the described sequence. There may be cases which

might require the use of a more complex tool, and, as a result, the proposed simpler tool will not be used. Other tools can also be added to this flowchart, as long as the

proposed tool is used in a collaborative manner with the supplier toward the approximation, integration, and the constant search for a better relationship and performance.

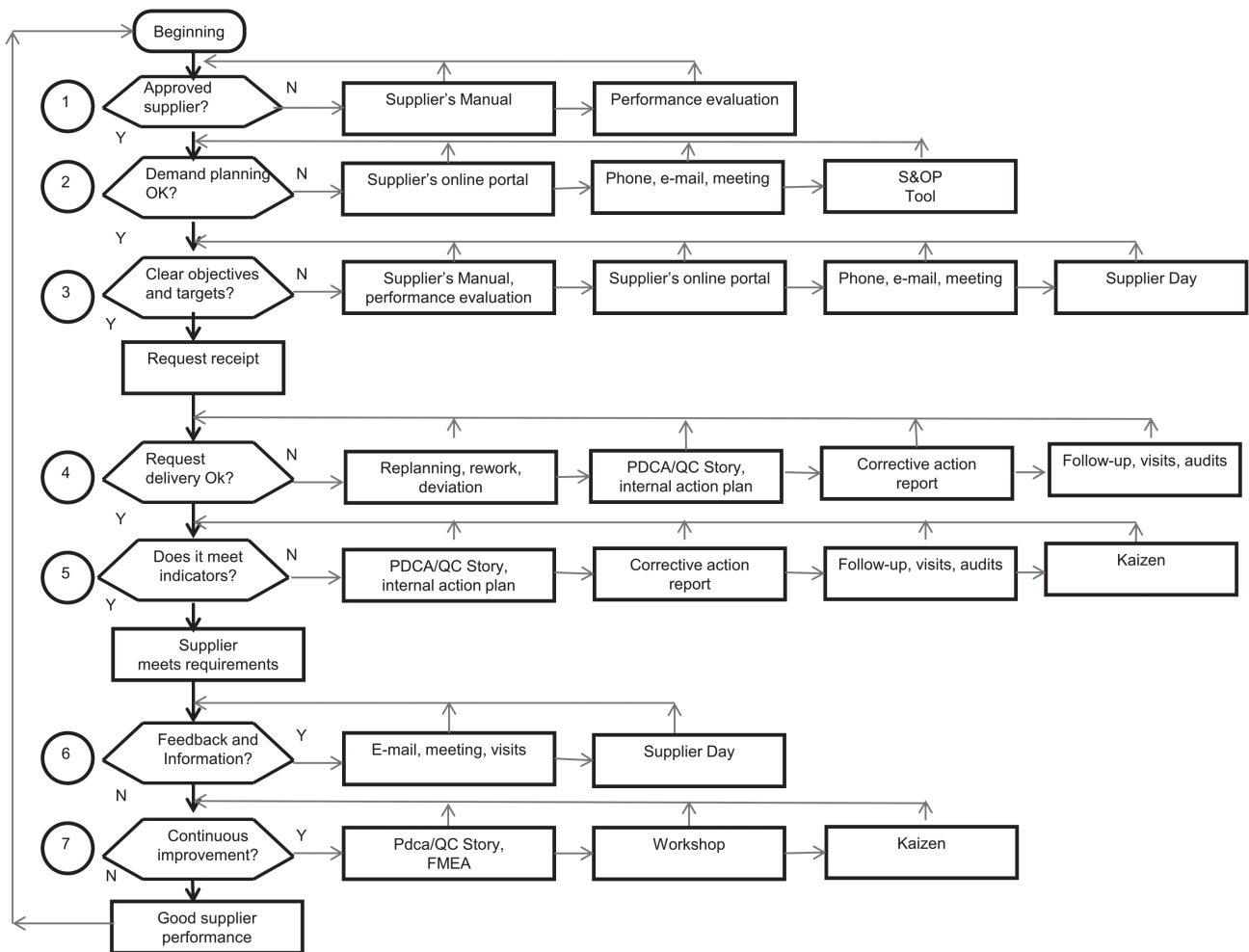


Figure 4. Methodology for supporting collaboration in the supply chain.

Steps 1, 2, and 3 are related to the supplier’s activities before the delivery of its product to the focal company. Step 1 starts with a basic question: is the supplier approved or not? It also identifies the tools needed to obtain the approval, as well as a clear understanding between the supplier and the focal company regarding what it means to be a supplier for the specific focal company. Because the coordination of this process is a role of the focal company, at this stage the focal company should establish the actions to be taken by the suppliers to the improvement of the processes and the type of involvement expected from the supplier, as suggested by Petersen *et al.* (2005).

Step 2 questions whether the supplier’s demand planning for the focal company is clear, to determine whether there is any doubt and whether the supplier has sufficient capacity to meet the demand. Information channels, such as the supplier’s portal, phone, e-mail, and meetings, must be established.

The purpose of these is to strengthen the bidirectional communication, trust, and flexibility and to align these, as determined by Cadden *et al.* (2010), and Petersen *et al.* (2005).

Step 3 involves the confirmation of the objectives and goals, the checking of whether there are doubts or difficulties associated with the understanding and whether the supplier has other difficulties, in agreement with the findings reported by Simatupang and Sridharan (2005). The focal company then begins to receive items, components, or products from the supplier. These actions serve as reinforcement to the items mentioned by the companies with regards to the construct “collaboration and relationship in the supply chain”.

Steps 4 and 5 are related to situations that occur from the time of arrival to the final processing in the focal company. The construct “performance” is contemplated in these steps. Step 4 asks whether the delivery arrived on time

and whether there are any quality problems. If there are problems, the first step is to find solutions and quick actions to avoid stopping the focal company. The focal company should monitor its suppliers. The definitions of the payment of the costs associated with these actions, the risks involved, and the role of each of the companies must be established, in agreement with Cadden *et al.* (2010).

Step 5 addresses the meeting of indicators and targets by the supplier. The supplier can meet the delivery and the quality for a given item, but indicators can exhibit a poor performance considering all the requests (Paulraj *et al.*, 2007).

Step 6 addresses the supplier's feedback issues and strategic information for the planning and development of both the supplier and the focal company. It also refers to the construct "performance", in agreement with Petersen *et al.* (2005).

Step 7, which is associated with the construct "continuous improvement tools", addresses continuous improvement issues in the process and the product with the aim of further improving issues such as quality, delivery on time, cost, productivity, organization, and flexibility, as exposed by Welborn (2010). Step 7 should be encouraged by the focal company through continuous performance evaluations, visits, awards on Supplier Day, and the possibility of growth or new challenges to the supplier.

Table 3. Presents the main tools suggested for each step of the proposed methodology.

## Discussion and insights for practitioners

Through the proposed methodology for supporting the implementation of collaborative practices with a focus on continuous improvement tools between the focal company and the supplier, the supplier must, in addition to meeting the specifications of the focal company, pursue the continuous improvement of its processes and become a supplier with outstanding performance that is able to take on new challenges and continue to grow and develop. The focal company, in turn, also ends up winning because the improvement in the results and performance of its suppliers, in terms of quality, delivery on time, and cost, also helps improve the performance of the focal company, in addition to improving its relationship with the supplier and, in particular, meeting the needs of the end customer. Thus, this provides a win-win situation for all.

For the application of and a greater likelihood of a satisfactory outcome from the proposed methodology, the integration of continuous improvement tools with people who are motivated and qualified in the key relationship characteristics cited by Cadden *et al.* (2010) is required. The three focal companies commented and cited examples in which the collaborative use of continuous improvement tools between the focal company and its suppliers leverage the relationship and the performance of both companies.

In all constructs, the companies suggested practices in which personal contact between the focal company and its suppliers may occur. It is important to consider that the studied companies have suppliers from various countries. The collaborative actions, such as Supplier Day, audits, and technical visits, are more frequent with suppliers that are located geographically closer to the focal firms. With respect to suppliers that are distant or in other continents, these actions are only effective if other units of the group (focal company) assume this task. This tends to occur primarily if the supplier supplies various plants of the multinational company. According to the interviewees, the physical location and the integrated actions between companies of the same group may be factors that limit the collaboration between the focal company and its suppliers. There is a tendency to select direct material suppliers (not commodities) that might require collaborative actions which are located closer to the focal company. In the case of commodities, due to the larger availability of suppliers on the market, the geographical location is not as critical a factor, as noted by the interviewees. It is suggested that this point shall be examined in further research.

The establishment of objectives and targets to evaluate the suppliers' performance was identified as essential for the guidance of collaborative actions with suppliers that require such actions. However, it was observed that each company establishes the same set of indicators for all of its suppliers. The degree of its importance to the company and the dependence degree of the focal company with respect to a given supplier were not considered. This is an aspect that can be further studied and included later in the proposed methodology.

The companies mentioned barriers that hamper and hinder integration, relationship, and performance between a focal company and its suppliers. The "lack of trust" barrier, which was highlighted in the current study, occurs when the focal company does not establish a long-term relationship with its supplier, when there is a lack of engagement and transparency by some of the parties, when there are instability problems within the supplier in the meeting the indicators established by the focal company, when there are communication problems or the exchange of inaccurate information, and when there is no sharing of risks, costs, and rewards. According to the studied references, to minimize these problems, collaborative actions are necessary (Simatupang and Sridharan, 2005). Another mentioned barrier refers to the lack of communication and misalignment of the objectives and goals. When establishing a methodology to support the collaboration, it is expected that the focal company and its suppliers understand it and its dynamics. This will allow the collaborations to be observed by the supplier in a cooperative and not imposing manner. The intent is to stimulate the relationship between companies to reduce the effect of the barriers and improve the performance of the focal companies and their suppliers.

**Table 3.** Steps of the proposed methodology and corresponding tools

Step	Proposed tools for collaborative practices
1	(i) Supplier's manual; (ii) supplier's performance evaluation
2	(i) Supplier's online portal; (ii) e-mail, phone, meetings, etc., are used when there is a need for negotiation due to the possibility of not meeting the demand; (iii) S&OP (Sales and Operation Planning), in cases in which the focal company alters the demand in favor of adapting to the supplier's capacity and bringing benefits to both companies.
3	(i) Supplier's manual and performance evaluation; (ii) Supplier's online portal (iii) e-mail, phone, meetings, etc.; (iv) Supplier Day.
4	(i) Re-planning of the focal company's production if there is no possibility of meeting the request by the supplier; (ii) PDCA cycle or QC STORY methodology within the setting of an action plan for internal use, which does not necessarily need to be sent to the focal company (if the problem is simple and not recurrent and there was no halt to the production or assembly line); (iii) Corrective action report, which is sent for validation by the focal company (in cases of greater non-conformities, in cases of recurrence, in cases of halts to the assembly line, and in situations in which the supplier does not meet an indicator, it encompasses the use of the Ishikawa diagram, cause and effect analysis, 5 Whys analysis, and action plans), the supplier receives support in case of doubt on the analysis and the filling out of this tool. The focal company evaluates the response quality of this report sent by the supplier for validation and performs a follow-up; (iv) Follow-up, visits, and audits to observe the process, to raise not only technical problems but also systemic problems and, through action plans, to identify solutions.
5	(i) PDCA or QC STORY with internal action plan; after that, the use of the Corrective action report and validation by the focal company, and then performing a follow-up of the report's action plan, visits and audits; (ii) one-week Kaizen event practiced effectively by the supplier with collaborative help from the focal company.
6	(i) Scheduling of visits, meetings, e-mails, etc.; (ii) annual Supplier Day, during which information is shared with suppliers, including a macro vision of the business, market and commodities information, quality-related issues, the results from the previous year, new products and projects, growth prospects and challenges, and giving awards to the suppliers with the best performance.
7	(i) PDCA or QC STORY and FMEA, in which the focal company offers training and support; (ii) workshops, which are used by the focal company in specific subjects for the development and alignment of the focal company with its suppliers; (iii) Kaizen events with value-flow mapping, 5S, etc., that are conducted by a multifunctional team formed by people with experience and know-how of the focal company and a supplier's internal team (this activity is effectively practiced by the supplier with collaborative help from the focal company).

## Conclusions

In this study, we analyzed the collaborative practices adopted by three focal companies with their direct material suppliers. From these practices, which are consistent with the studied theoretical findings, a methodology was proposed for supporting collaboration in the supply chain with a focus on continuous improvement and performance. The methodology was structured in seven steps, which cover the actions proposed by the defined constructs: (i) "collaboration and relationship in the supply chain" (ii) "performance" and (iii) "continuous improvement tools".

This research complements the theoretical model proposed by Theodorakioglou *et al.* (2006). The mentioned authors consider the relationship between TQM and SCM principles. We present a methodology with steps suggesting techniques or practices (such as FMEA, kaizen, corrective actions report, suppliers manual) in order to support the process of collaboration in a SC.

It is suggested that further research on the collaboration in supply chains should be conducted to verify the practices in chains that are focused on other types of products. Quantitative studies are suggested to understand how much each collaborative practice impacts the chain performance. It is suggested that the proposed methodology be enhanced through the addition of a supplier classification to be adopted depending on its importance and the strategy of the focal company. Thus, essential and critical suppliers may require different collaborative actions compared with those required for the suppliers of non-critical items.

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