ORIGINAL ARTICLE

Influence of collaboration in the supply chain on operational performance in the textile and metal-mechanical industry in Vale do Itajaí (SC)

Influencia da colaboração em cadeias de suprimentos sobre o desempenho operacional em industrias do texteis e metalomacanicas no Vale do Itajais (SC)

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Abstract: Collaboration in the supply chain is involved in studies that suggest the relationship between companies in search of mutual benefits and maintenance of a strategic partner to improve the operational performance of organizations. The collaborative practices defined in the literature refer to a collaborative culture, joint planning, joint problem solving, and sharing of resources and information. From this perspective, this article aims to evaluate the influence of collaboration in the supply chain on the operational performance of the medium and large industries of the Textile and Metal-mechanic segment of the Vale do Itajaí (SC). Through questionnaires applied in the supply area in a universe of 109 industries, it was possible to collect data from 66 companies. It was found that joint planning and collaborative culture are collaborative practices that influence operational performance. Regarding the performance factors, flexibility was shown as an absent attribute in the industries: after the analysis of the moderating effect by segment, it was concluded that flexibility was not present only in the Metal-mechanic sector. It was also tried to diagnose the influence of the collaboration practices by industrial segment: in the Textile sector the influence of the joint resolution of problems was revealed and, in the Metal-mechanic sector the joint planning as a variable of impact on the operational performance was highlighted.

Keywords: Supply chain; Collaboration; Operational performance; Industries, Textile Industrie, Metal-mechanic Industrie.

Resumo: O presente estudo tem como objetivo avaliar a influência da colaboração na cadeia de suprimentos sobre o desempenho operacional das indústrias de médio e grande porte do segmento Têxtil e Metalmecânico do Vale do Itajaí (SC). São consideradas práticas colaborativas a cultura colaborativa, planejamento conjunto, resolução conjunta de problemas e compartilhamento de recursos e informações. O estudo foi delineado sob a abordagem quantitativa, quanto aos objetivos descritiva e *survey*. A amostra da pesquisa correspondeu a 66

organizações, considerando uma população de 109 organizações. Os dados foram coletados por meio de questionário autoadministrado, respondidos pela área de suprimentos de cada organização. Como resultados, constatou-se que o planejamento conjunto e a cultura colaborativa são práticas de colaboração que influenciam no desempenho operacional. Quanto aos fatores de desempenho, a flexibilidade mostrou-se como atributo ausente na indústria metalomecânica. O diagnóstico da influência das práticas de colaboração por segmento industrial apresentou algumas particularidades, na indústria têxtil revelou-se a influência da resolução conjunta de problemas e na indústria metalomecânica destacou-se o planejamento conjunto como variável de impacto no desempenho operacional.

Palavras-chave: Cadeia de suprimentos; Colaboração; Desempenho operacional; Indústria têxtil; Indústria metalomecânica.

1 Introduction

The industrial segment in Santa Catarina accounts for 27.1% of all the wealth generated in the state, acting strongly in stimulating the economy and generating jobs (Federação das Indústrias do Estado de Santa Catarina, 2019). The Itajaí Valley, one of the six mesoregions of the state, is responsible for a large part of this economy, with a share of 31% in the Gross Domestic Product (GDP) and the highest concentration of companies in the state (28%), according to FIESC data (Federação das Indústrias do Estado de Santa Catarina, 2019). The Textile and Metal-mechanic sectors are part of the main industrial activities operating in the state of Santa Catarina, which will be studied at work.

The context of the supply chain is closely linked to industrial activity. In this way, one can be involved in approaches to increase the competitive advantage of organizations, from collaborative initiatives between chains and not only between isolated companies (Gomes & Kliemann, 2015). Burnette & Dittmann (2018) state that there is a need for innovation in the supply chain in order to meet the challenges related to some factors such as better cost, new product initiatives, and customer service. This highlights the importance of prioritizing collaboration across organizational, internal, and external boundaries.

Therefore, the supply chain can be understood as the relationship between interdependent companies involved in the flow and transformation of goods, services, and other necessary information from the origin to the final customer (Simatupang & Sridharan, 2002).

In this way, collaborative practices have been considered of paramount importance to improve the performance of organizations (Min et al. 2005). Oliveira (2016) states that, collaborative practices in the supply chain are directly related to better performance in the quality of products and services offered, in the reduction of production and delivery times (lead time), and in facilitating operations. Collaboration practices in the supply chain are commonly designated by collaborative culture, joint planning, joint problem solving, and sharing of resources and information (Oliveira, 2016). Given the above, this article aims to evaluate the influence of collaboration in the supply chain on the operational performance of medium and large size industries in the Textile and Metalworking segment of Vale do Itajaí (SC).

As a justification for this research, the importance of collaboration in the supply chain and its benefits to operational performance is considered relevant, considering factors such as cost, quality, flexibility, reliability, innovation, and delivery time, which come from this practice.

2 Theoretical foundation

2.1 Collaborative practices in the supply chain

Ballou (2006) describes the supply chain as the set of activities for transforming raw material into a finished product, adding value to the consumer. Another definition is found in Burnette & Dittmann (2018, p.12) state that the supply chain is seen as "an end-to-end integrated system of processes and activities necessary to deliver products or services from the supplier to the consumer's shelf".

Some of the necessary supply chain steps and resources include procurement, manufacturing, engineering, process control, quality, safety, innovation, and environmental projects, warehousing, transportation, distribution, and all the logistics involved (Burnette & Dittmann, 2018). The authors also add that there is a need for innovation throughout the chain to meet the contemporary challenges of better costs, implementation of sustainable practices, new products, and innovations in the transport used.

According to Pires (2004), due to the complexity of the supply chain, there is a specific field of study to coordinate activities involving production, logistics, marketing, and purchasing, called Supply Chain Management. The authors Bowersox et al. (2014) describe supply chain management as relationships that reflect strategies to connect suppliers, business partners, and customers across organizational boundaries, based on dependency and collaboration, to improve the efficiency of operations. Based on the same idea, Ballou (2006) describes supply chain management as opportunities to improve costs and services through coordination and collaboration between those involved in this relationship channel.

For Rodrigues & Sellitto (2008), supply chain management should be formed by logistical practices that facilitate the flow of information, integrating companies and favoring a collaborative environment with suppliers. In this way, Pires and Sacomano (2010) define supply chain management as a new contemporary management model that should seek greater synergy between the chain processes, to serve consumers and stakeholders as effectively and efficiently as possible, through products and/or services obtained at the lowest possible cost and with the highest value perceived by the customer.

According to Burnette & Dittmann (2018), supply chain managers need to explore new strategic business models to satisfy increasingly demanding customers. They also add that to be successful, leaders need to direct efforts to two primary management gaps, namely: internal collaboration in supply chain activities and external development of partners such as suppliers and even competitors.

Therefore, supply chain management is essential within the entire production chain. For Magalhães et al. (2013), this management is important so that companies and organizations can add value to the customer and reduce operational costs. The authors also state that a strong cultural change is necessary in the current form of management, aiming at breaking paradigms and renewing the traditional way, in which companies are operating against each other and not together, even if they are suppliers and customers.

Relationships of cooperation and collaboration can be seen in countless examples in the organizational world. "Formal and informal cartels to set prices, make agreements on areas of competition and market share, co-sponsorship of pressure groups to influence the legislature are obvious examples" (Morgan, 2002, p. 82). Still for this author, examples of collaboration in financial services can be seen, in which banks and insurance companies offer joint services; and in companies, partnerships are created to share risks in research and development, as well as agreements are signed with suppliers aiming at vertical integration.

Authors Cao & Zhang (2011, p. 166) define supply chain collaboration as "[...] a partnership process where two or more autonomous companies work together to plan and execute supply chain operations with common goals and to achieve mutual benefits". In turn, collaboration in the supply chain is designated by Burnette & Dittmann (2018) as an opportunity to increase the overall value of the entire chain, proposing specific business objectives between two or more parties. These authors also add that collaboration is created in some organizational interfaces, such as purchasing, logistics, manufacturing and other stakeholders such as suppliers. Companies that integrate a supply network share strategic objectives, information and plan together, thus reducing risks and increasing trust between the parties (Bowersox et al., 2014).

For Jain et al. (2017), collaboration combined with trust and information sharing between partners will increase visibility, reducing uncertainties and vulnerability in the chain. The authors further add that organizations that hold global markets are part of a complex supply chain that requires highly coordinated flows of goods, services, information, and capital across and across borders.

Oliveira (2016, p. 90) states that "supply chain performance is positively related to collaboration" due to the perception of improvements in some factors such as the quality of products and services and lead time reduction. However, even if the literature identifies mutual benefits for the partners, many practices are not carried out due to the difference of interest between the parties and lack of alignment; for that, a collaborative supply chain with integrated policies must be installed as an initiative to mitigate the possible harmful effects of the lack of integration between partners (Simatupang; Sridharan, 2002).

Thus, according to Kumar et al. (2017, p. 46) "[...] the main objective of the collaboration is twofold: one is to make internal functions effective and efficient and the other is to expand market share or make market-oriented strategies."

Some components of collaborative practices are proposed by several authors in order to demonstrate their effects on the performance of the supply chain. Figure 1 - Collaborative Practices X Operational Performance represents the main collaboration practices in the supply chain based on the literature:
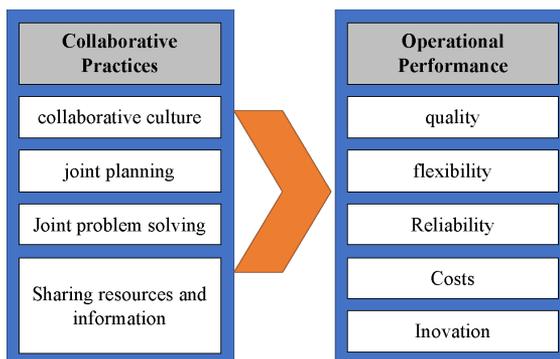
Figure 1. Collaborative Practices X Operational Performance. Source: Adapted from Oliveira (2016).

In order for there to be collaboration in the supply chain, it is necessary to create and improve a collaborative culture in organizations. Initially, an in-depth analysis of current practices, policies, and internal cultures is required, as well as assessing the ability to act on the internal changes necessary to initiate successful collaborative relationships (Bowersox et al., 2014).

According to Burnette & Dittmann (2018), the collaborative culture is built on visible activities of incentives such as strategies, remuneration, employee benefits, hiring, promotions, among others. However, according to these authors, creating a culture of collaboration is not simple and requires long-term thinking, never aiming to achieve immediate goals. Oliveira (2016) adds that some corporate cultures face challenges in implementation due to the influence of globalization, making the search for internal and inter-organizational collaboration more complex.

For Morgan (2002), organizations act as mini-societies that establish their own standards of culture, being able to consider united work teams that work together or establish the idea of sovereignty in the branch. Still for this author, these established patterns and beliefs exert a decisive influence on the power of an organization to deal with the challenges of changing paradigms.

According to Kumar et al. (2017), joint planning is a good example of cooperation between partners. For these authors, a gradual evolution is necessary for the collaborative relationship, with the need for constant interaction and exchange of ideas, as well as the mutual development of factors such as trust, commitment, loyalty, and learning.

To keep collaboration working in the supply chain, joint planning, as well as strategic alignments, must be monitored frequently, analyzing and updating the objectives of the parties involved (Bowersox et al., 2014). Soosay et al. (2008) defend joint planning as an effective way to make better planning between customers and suppliers, allowing for a reduction in inventory levels and a better match between supply and demand. Thus, "[...] joint planning is necessary to co-align operations as well as the capabilities of each collaborative partner [...]" (Min et al., 2005, p. 246).

As an example, according to Burnette & Dittmann (2018), strategic alignment can influence the design and creation of new products, quality improvements, and leverage of processes and systems. Kohli & Jensen (2010) also highlight joint planning as a form of collaboration through decision synchronization, capacity planning, and logistics and business strategy.

According to Min et al. (2005), collaborative partners must solve problems together in the supply chain, constantly evaluating new process difficulties, proposing mutually developed ideas and improvements, resulting in cost reduction and more effective processes. In addition, according to the authors, it is recommended the formation of cross-functional teams that organize periodic meetings to resolve issues ranging from quality control to distribution operations. For Min et al. (2005), the benefits, in addition to cost reduction and better processes, can be highlighted as the resolution of logistical problems, delivery times, stock maintenance, lead time, development of new products, among others.

Based on the same idea, Kohli & Jensen (2010) state that the indicator of a successful partnership is based on coordination, participation, and joint problem-solving among members.

Kumar et al. (2017) claim that conflicts and disagreements are common in relationships and, to solve these problems, it is necessary to monitor through performance indices. However, the authors add the presence of conflicts can result in resistance to sharing ideas and resources, undermining the overall objective of collaboration.

In this way, Simatupang & Sridharan (2002) highlight the need to reward partners for performance and effort, encouraging continuous progress in joint problem solving and serving as motivation and recognition. Kumar et al. (2017) assume that joint problem solving, combined with performance measurement, is positively related to joint planning to increase market share as well as a collaborative culture.

Mathuramaytha (2011, p. 3) defines the practice of information sharing as the "[...] act of capturing and disseminating timely and relevant information for decision-makers to plan and control supply chain operations".

Through integrated technology, the authors Bowersox et al. (2014), Simatupang & Sridharan (2002) describe information management as a method for improving purchasing, production, order fulfillment, and resource planning, through data sharing among the members of the supply chain. Based on the same idea, Burnette & Dittmann (2018) state that partners need tools, systems, and data for communication between the parties so that all sectors involved can have access to documents such as contracts, supplier quality indices, and productive capacity, among others.

According to Min et al. (2005), collaborative partners should interact through communication and information exchange, involving more frequent meetings at the management level with the main intention of identifying areas for improvement. However, Kohli & Jensen (2010) state that there can only be full sharing of information and communication channels if trust, another component of collaboration, is perceived between partners.

There is also a certain resistance in the opening of information between the partners. According to Simatupang & Sridharan (2002), the problem of lack of information arises when members are not willing to share their private information transparently, due to the supposed economic values of this information. Still for these authors, because of this limited sharing of information, decisions are made based on estimates or assumptions, preventing the visualization of the real needs of the entire chain.

2.2 Operational performance

According to Cao & Zhang (2011), collaboration in the supply chain directly influences the operational performance of companies, showing itself as a method of obtaining superior advantage over competitors. For Bronzo (2004) collaborative relationships are supported by a common objective of creating environments conducive to innovation and more efficient production, thus favoring organized production chains with a competitive edge.

In this way, Simatupang & Sridharan (2002) indicate that collaboration in the supply chain is measured through the impact on the overall performance of the chain, pointing out the levels of improvement in some factors such as, for example, total costs, inventory, and customer satisfaction and use of assets.

Among the literature, there are some factors considered relevant to operational performance, treated as quality, reliability, flexibility, costs, and innovation. Quality is determined by the consumers' perception of some attributes of a product. Such attributes are given as performance, conformity, durability, aesthetics, maintenance, and perceived quality (Garvin, 1987).

Reliability is understood as the customer's perception of compliance with delivery deadlines of a product or service, complying with what was agreed (Garvin, 1987). Flexibility, on the other hand, is understood as the ability to meet demand fluctuations with agility and promptness, both in terms of quantity and product customization (Ward et al., 1998).

Costs reflect the pricing strategy and market positioning, and it is through assertive cost management that the financial results for organizations can be verified (Ward et al., 1998). Finally, innovation can be perceived as the ability of an organization to develop new products and reach new markets, as well as to innovate internally in business processes and strategies (Wang & Ahmed, 2004).

Aloise (2018) characterizes a company as flexible when it presents alternative processes, versatile machines, and ease of change in the mix of parts. Barreto & Pozo (2011) complement the idea by stating that flexible companies are more competitive in the market because they can meet new demands with agility and effectiveness.

Therefore, as detailed in each collaborative practice, each element can directly affect performance indicators, also stated in several studies and surveys. As an example, Mathuramaytha (2011) demonstrated that collaboration in the supply chain has a positive effect on factors such as cost reduction and greater operational flexibility, concluding that there is a significant correlation between the collaboration rate and operational performance.

Regarding quality, Domenek & Moori (2016) pointed out as the main performance factor acquired as a result of collaboration processes should be implemented.

The reliability factor was diagnosed by Rodrigues & Sellitto (2008) through an improvement in the delivery schedule, reducing tasks that did not add value, and increasing the information of agreed deadlines.

In the innovation indicator, Bronzo (2004) stated in his research that, in collaborative processes with constant information transition, client companies can act in the offer of new technologies to their suppliers, destined to the innovation of processes and as well as the development of new technologies. products.

However, some difficulties end up harming the implementation and maintenance of collaborative practices in the supply chain. Simatupang & Sridharan (2002) point out the main one as the significant resistance to change by managers. Silva et al. (2006) argue that many companies remain with the current practices of the supply chain aiming only at better time and price, without worrying about strategic relationships. Another powerful barrier in organizations is the company's own culture, which is often restricted and closed to changes (Bowersox et al. 2014).

The relationship between collaborative practices in the supply chain and operational performance is evidenced by some authors in previous works. Burnette & Dittmann (2018) addressed the need for innovation and discipline in the supply chain, seeking greater synchrony between supplier and customer. To identify how the largest supply chains are expanding their knowledge and capabilities, interviews were conducted with 17 leading companies in 8 market sectors. As a result, 7 collaborative best practices that create value across the supply chain were demonstrated, providing leaders with in-depth information so they can create a collaborative culture.

Kumar et al. (2017), in turn, focused their studies on joint planning and joint problem-solving in developing a culture of collaboration in the supply chain. As data collection, the authors used questionnaires applied to medium and large companies in India, obtaining 77 valid responses. The results showed that the resolution and measurement of problems, besides joint planning between suppliers and customers, are fundamental for the development of a collaborative culture in the supply chain.

Domenek & Moori (2016) aimed to analyze the importance of collaborative practices characterized as the sharing of resources and information, common objectives, operational capabilities, and operational performance in companies in the capital goods sector in Brazil. The research was divided into interviews with 10 managers of multinational companies and questionnaires applied to 40 companies in the sector. As a result, the authors state that the level of collaboration in the study area is low and point to the need for improvements for companies to become more competitive in the market. They also suggest future studies to identify the reasons for the low effectiveness of the supply chain of companies in the capital goods sector.

Oliveira (2016) aimed to analyze the relationships between the antecedents that can lead to collaboration, the components of collaboration, and their effect on supply chain performance. Through quantitative research with companies in the metal mechanic sector in Rio Grande do Sul, the author got 111 valid answers for her research. The result found that there is a positive relationship between partnership orientation and collaboration and between collaboration and supply chain performance. It also highlights the importance of collaboration for the effective performance of the supply chain and suggests further studies on this topic.

Oliveira et al. (2015) aimed to identify elements of collaboration in supply chains that can reduce their vulnerabilities, through the analysis of scientific articles published in national and international journals. The result, purely literary, found that some elements are essential in the chain's collaboration, namely: horizontal collaboration, information sharing, closer relationships with suppliers, and collaborative planning.

3 Methodological procedures

This study is classified in terms of objectives, as descriptive research; regarding procedures, such as survey, and regarding the approach, as research quantitative. Regarding the objectives, descriptive studies are those in which the researcher measures and/or collects important information about the phenomenon studied, without manipulations or inferences (Hair et al. 2005).

Based on this, this study is characterized as descriptive research because it aims to describe the relationships established between the dimensions of collaboration and operational performance (cost, quality, reliability, flexibility, and innovation). In other words, it seeks to describe whether collaboration influences operational performance in terms of cost, quality, reliability, and flexibility. In this sense, we sought to understand the relevance of a given phenomenon and describe the distribution of the phenomenon in the researched population; being outlined under the quantitative approach, seeking to analyze predetermined variables and, at the end, quantify the information in statistical data.

The research was carried out considering a population of 109 medium and large industries in the textile and metalworking industries located in the region of Vale do Itajaí, state of Santa Catarina; the region concentrates 53 organizations in the textile industry, of which 39 are considered medium-sized and 14 are large-sized, and the metalworking industry has 56 organizations, 46 of which are medium-sized and 10 are large-sized, listed in the Federation of Industries of the State of Santa Catarina - FIESC (Federação das Indústrias do Estado de Santa Catarina, 2019).

In this sense, we sought to understand the relevance of After the application of the questionnaire, 66 questionnaires were answered and considered valid, comprising the sample of this study, being 31 from the textile industry and 34 from the metalworking industry, characterizing the research as a cross-sectional study period. Data collection was from April to June 2019.

Data were collected through the application of a Survey-type questionnaire adapted from Oliveira (2016). In this adaptation, the research instrument had its group of reduced dimensions, adapting to the research.

The questionnaires were sent through the Google Forms tool, via email to the respondents. To increase the volume of responses, the respondents of each company were identified via LinkedIn; the group of respondents to this research is made up of professionals in supply chain management.

The first part of the questionnaire refers to Collaborative Practices and was subdivided into 4 (four) dimensions: Collaborative Culture, Joint Planning, Joint Problem Solving, and Sharing of resources and information (all with 4 items); the second part, refers to the OD, was subdivided into 5 (items) involving dimensions, quality, reliability, flexibility, costs, and innovativeness; finally, the third part, aimed at qualifying the sample's respondents.

An ordinal scale was used, through the attribution of scores to show how much a certain characteristic is present according to the respondent's perception, using a 5-point scale, with 1 corresponding to "totally disagree" and 5 to "totally agree", the data collection instrument, can be seen in Chart 1- Data collection instrument.

Chart 1. Data collection instrument.

Constructor	Assertive
Collaborative Practices - Collaborative Culture	The company is open in internal communication and interaction between its departments?
	The company internally shares technical skills and knowledge?
	The company learns from its partners, having a learning attitude?
	The company is firm about its collaborative principles with its partners?
Collaborative Practices - Joint Planning	The company makes forecasts related to operations, raw material requests, and other related activities (MRP Utilization) together with its partners?
	The company plans the purchase of raw materials and other inputs together with its partners?
	The company prioritizes its goals and objectives together with its partners?
	The company plans the policy for the development of new products/services together with its partners?
Collaborative Practices - Joint Problem Solving	The company resolves conflicts with its partners in a collaborative and friendly manner?
	The company manages and solves its difficulties (analysis and joint decision on the problem) together with its partners?
	The company has indicators that help to assess the collaboration of its partners?
	The company defines and takes corrective actions (joint implementation of practical actions) together with its partners?
Collaborative Practices - Sharing resources and information	The company shares demand forecasts with its partners?
	The company shares information about stock levels with its partners?
	The company shares information on costs arising from holding inventories with its partners?
	The company shares necessary technologies and machinery with its partners?
	The company shares end-user feedback on products/services with its partners?
Operating Performance	Has the company implemented process improvements that lower production costs?
	Can the company manufacture its products according to the specifications made in the product design?
	Does the company deliver the goods to its customers on time?
	Can the company quickly change production volume and product variety to meet customer demand?
	Does the company constantly invest to create innovative products and services?

Source: Adapted from Oliveira (2016).

For analysis, the data were exported into an Excel® spreadsheet and later converted to the SPSS® statistical software (Statistical Package for the Social Science, version 21). Data analysis took place in two stages; at first, the sample was characterized through descriptive statistics, and the mean and standard deviation of the sample was calculated.

The reliability of the constructs was calculated using Cronbach's Alpha, which is a test that measures the internal consistency of a data collection instrument in which the result is considered more reliable given the proximity of the value to 1 (one) (Cronbach, 1951). Also, according to Forza (2002), it is the most popular test and the most used reliability indicator in research in Operations Management. And finally, to answer the general aim, the data were evaluated by multiple linear regression, which as defined by Forza (2002) with a dependent variable related to one or more independent variables, it is possible to predict changes in the dependent variable in response to changes in the various independent variables. The multiple linear regression techniques that help in the explanation of a dependent variable, by the others, are called independent or predictors (Marôco, 2003).

4 Data presentation and analysis

According to the data report published by FIESC (Federação das Indústrias do Estado de Santa Catarina, 2019), the industry in Santa Catarina ranks as the 5th largest industrial park in the country, with 50,031 industrial establishments throughout the state. Also according to the published database, the industry in Santa Catarina had the 2nd largest share of GDP (Gross Domestic Product) in 2016, with a percentage of 27% in this indicator (Federação das Indústrias do Estado de Santa Catarina 2019).

The Itajaí Valley is composed of 54 cities in Santa Catarina. The municipalities of Blumenau, Balneário Camboriú, Brusque, Gaspar, Guabiruba, Indaial, Itajaí, Pomerode and Timbó stand out with the largest number of inhabitants and industries (Federação das Indústrias do Estado de Santa Catarina, 2019). The Itajaí Valley has as its main productive activities the agri-food, capital goods, maritime economy, civil construction, health, naval, metalworking and metallurgy industries, textiles and clothing, and information and communication technology (Federação das Indústrias do Estado de Santa Catarina, 2019).

The revenue of the Brazilian Textile and Apparel chain reached US$51.58 billion in 2017, against US$42.94 billion in 2016, according to data from the Brazilian Textile and Apparel Industry Association (Associação Brasileira da Indústria Têxtil e de Confecção, 2018), being the 2nd largest employer in the country regarding the national processing industry, second only to food and beverages (together). Globally, Brazil has the fifth largest textile industry in the world (Associação Brasileira da Indústria Têxtil e de Confecção, 2018). In Santa Catarina, the segment represents 18.5% of installed industries and 14.9% of the gross value of industrial production (Federação das Indústrias do Estado de Santa Catarina, 2019).

The Textile industry is characterized by the wide possibility of product and market segmentation, such as, for example, segmentation by sex, age group, income level, and type of use; aspects that, in turn, require constant market prospecting and updating trends to maintain competitiveness in the sector (Garcia et al., 2005). Regarding the production processes of the Textile industry, Carvalho (2010) describes the steps as discontinuous operations with their characteristics, and there may be different companies with technological levels and production scales.

The main processes of the textile industry are given by the preparation and spinning of textile fibers; weaving, except knitting; fabrication of knitted fabrics; finishes in yarns,

fabrics, and textile articles; and, manufacture of textile artifacts, except dressing rooms (Federação das Indústrias do Estado de Santa Catarina, 2018).

The first step in data analysis and presentation considers descriptive data of Mean and Standard Deviation, in addition to Cronbach's Alpha reliability test, as described in the methodological procedures. The results are evidenced in Table 1 – Descritive Analysis Reliability Test.

Table 1. Descriptive Analysis Reliability Test.

	1	2	3	4	5
A.C.	0.758	0.832	0.800	0.839	0.670
MMean	4.1705	3.8636	3.9167	3.5091	4.2008
S.D.	0.58533	0.81475	0.72235	0.87226	0.62974

Note: A.C. – Cronbach's Alpha; Mean – mean of the dimension; S.D. – standard deviation of the dimension (standard deviation). 1 – Collaborative Culture; 2 – Joint Planning; 3 – Joint Problem Solving; 4 – Sharing of resources and information; 5 – Operational Performance. Source: Survey data (2019).

Given Table 2 - Cronbach's Alpha of the Operational Performance dimension, it is evident that the "Operational Performance" dimension presented a Cronbach's Alpha below 0.7, whose parameter is given by the literature (Hair et al., 2005). Thus, implying the removal of one of the construct's assertions, as evidenced in Table 2.

Table 2. Dimension Cronbach Alpha Operational Performance.

Assertive	Cronbach's Alpha if the item is deleted
Costs	0.521
Quality	0.678
Reliability	0.582
Flexibility	0.748
Innovation	0.529

Source: Survey data (2019).

It was evidenced that the removal of the assertion that deals with the "Reliability" of the construct "Operational Performance", Cronbach's Alpha would change from 0.670 to 0.748. This becomes the new value of Cronbach's Alpha of the "Operating Performance" construct. Another implication of the removal of the assertion "Flexibility" was new mean and standard deviation values. The mean became 4.0848 and the standard deviation was 0.60568.

Given the withdrawal of the assertion that measured the "flexibility" of the "operational performance" construct, it is noteworthy that it started to be measured only by the following parameters "Quality, Reliability, Costs, and Innovation". "Flexibility", in turn, keeps companies prepared to meet new market demands, generating quick responses to new situations and adapting processes, helping to increase organizational competitiveness in the face of the market and customer needs (Barreto & Pozo, 2011).

The participants' perception of the "Collaborative Culture" factor corroborates the studies by Kumar et al. (2017), who claim that attitudes and behaviors produce a constructive environment conducive to collaborative initiatives over time.

"Joint planning" is important to align operations and capabilities between partners (Min et al., 2005) and improve planning between customers and suppliers (Soosay et al., 2008).

For Min et al. (2005), collaborative partners must solve their process problems and constantly propose improvements to achieve more effective processes for both.

Regarding the "resource and information sharing" dimension, Mathuramaytha (2011) states that there is a need to share important information for better planning and control of operations.

4.1 Impact of collaborative practices on operational performance

After performing the descriptive analysis and reliability tests, multiple linear regression was performed to analyze the impact of collaborative practices in the supply chain on operational performance. It is noteworthy that at first, the data worked were from both industrial, textile, and metalworking activities. The criteria used to measure the statistical significance of the variables that make up the model were the t-value >2 and sig <0.05 (Hair et al., 2009), as well as the variance inflation factor (VIF), where the accepted parameter is between 1 and 10 (Corrar et al., 2007).We chose to run the analysis using the stepwise method, which resulted in two models. Table 3 - Model Summary first demonstrates the summary of both models.

Table 3. Model Summary.

Model	Variables entered	R	R square	R square adjusted	ANOVA
1	Joint planning	0.478[a]	0.228	0.216	0.000
2	Collaborative culture	0.535[b]	0.287	0.264	0.000

Note: Model 1. Predictors: (Constant), Joint planning; Model 2. Predictors: Predictors: (Constant), Joint Planning, Collaborative Culture. Source: Survey data (2019).

Both models presented an ANOVA test of 0.000, evidencing the validity of both. The first model presented the "joint planning" dimension as a predictor, explaining "operational performance" in 22.8%. The second model, in addition to the "joint planning" dimension, also added the "collaborative culture" dimension, which both explain the "operational performance" by 28.7%. Continuing with the analysis, Table 4 shows the t-test coefficients, significance, and VIF for each of the two models.

Table 4. Coefficients.

Model		Non-standard coefficients		Standardized coefficients	t	Sig.	VIF
		B	Standard model	Beta			
1	(Constant)	2.774	0.335		8.280	0.000	
	Joint planning	0.369	0.085	0.478	4.350	0.000	1.000
2	(Constant)	1.934	0.492		3.931	0.000	
	Joint Planning	0.266	0.094	0.344	2.824	0.006	1.308
	Collaborative Culture	0.297	0.131	0.276	2.272	0.027	1.308

Note: Model 1. Predictors: (Constant), Joint planning; Model 2. Predictors: Predictors: (Constant), Joint Planning, Collaborative. B= Beta Coeficient; t=T-tests, Sig.=Stands for Significance Level; VIF=Variation Inflation Factor. Source: Survey data (2019).

"Joint planning" is advocated by Soosay et al. (2008) as a way to improve planning between partners, resulting in factors such as reduced inventories (costs) and better service between supply and demand. Burnette and Dittmann pointed to other benefits

in operational performance, resulting from joint planning out (2018) as an increase in quality and help in creating new products (innovation).

The "collaborative culture" reflects the organizational interest in applying collaborative practices in its supply chain. Burnette & Dittmann (2018) claim that installing and maintaining a collaborative culture in their organizations requires long-term thinking in the search for results that will not be immediate.

However, the other collaborative practices listed in the literature (joint problem solving and sharing of resources and information) did not show relevance and influence on operational performance indicators in the present study. Thus, showing that there are also factors in both industrial, textile and metalworking activities that explain the operational performance of these activities.

4.2 Impact of collaborative practices on operational performance by sector

Continuing with the analysis, the individual scenario of the research segments were verified. Therefore, it was decided to divide the next two analyzes by industrial segment. Therefore, as the sample was subdivided, there was a new execution of the Cronbach's Alpha test.

Some inquiries were made about the assertion that measured the operational performance construct, thus, another interest in the analysis by the industrial segment referred to this assertion. In this way, as the separation of the sample impacts new reliability tests, the related assertion of flexibility was inserted again in the operational performance dimension. Table 5 - Cronbach's Alpha Reliability Test by sector presents the result of the reliability test by sector.

Table 5. Cronbach's Alpha Reliability Test by Sector.

	1	2	3	4	5
textile	0.783	0.851	0.828	0.866	0.714
Metalmechanics	0.731	0.811	0.814	0.788	0.624

Note.: 1 – Collaborative Culture; 2 – Joint Planning; 3 – Joint Problem Solving; 4 – Sharing of resources and information; 5 – Operational Performance. Source: Survey data (2019).

It was found that in the textile industry the reliability test occurred satisfactorily in all constructs (Hair et al., 2005). In metal mechanics, the operational performance presented a parameter below 0.7, implying the removal of one assertion from the construct, as shown in Table 6 - Alpha of Cronbach for the operational performance of the metalworking industry.

Table 6. Cronbach's Alpha for the operational performance of the metalworking industry.

Assertive	Cronbach's Alpha if an item is deleted
Costs	0.476
Quality	0.669
Realibility	0.493
Flexibility	0.716
Inovation	0.456

Source: Survey data (2019).

The verification of Cronbach's Alpha of the operational performance of the metalworking industrial activity resulted in the assertion's elimination that measures the flexibility of this construct, changing Cronbach's Alpha from 0.624 to 0.716. After this step, we proceeded with the multiple linear regression by industrial activity. Firstly, by the textile industry and later by the metalworking industry, as follows.

The stepwise model established multiple linear regressions that aimed to verify the influence of collaborative practices on the operational performance in the textile industry. The model summary is checked next in Table 7 - Model summary.

Table 7. Model Summary.

Model	Variables entered	R	R square	R square adjusted	ANOVA
1	Joint Problem Solving	0.478[a]	0.228	0.202	0.002

Note: Model 1. Predictors: (Constant), Joint Problem Solving. Source: Survey data (2019).

The generated model explains only joint problem solving as an impact variable on the operational performance of medium and large textile industries, demonstrating an explanatory power of 22.8% in this factor. The ANOVA test also showed a satisfactory result, indicating the validity of the model. Table 8, below, shows the coefficients.

Table 8. Coefficients.

Model	Non-standard coefficients		Standardized coefficients	t	Sig.	VIF
	B	Standard model	Beta			
1 (Constant)	2.942	0.453		6.495	0.000	
Joint Problem Solving	0.340	0.116	0.478	2.929	0.007	1.000

Note: Model 1. Predictors: (Constant), Joint Problem Solving. B= Beta Coeficient; t=T-tests, Sig.=Stands for Significance Level; VIF=Variation Inflation Factor. Source: Survey data (2019).

The result obtained indicates a joint problem solving as a predictor of operational performance in the textile industry. This collaborative practice is pointed out in the literature as a factor resulting from several benefits, such as cost reduction, greater reliability in deliveries, and development of new products (Min et al., (2005).

Solving problems together with partners is an indicator of a successful partnership, and there must be coordination and participation among members in the search for the best solution to any problems caused (Kohli & Jensen, 2010).

As the last step, multiple linear regression was carried out to verify the influence of collaborative practices on the operational performance of the metalworking industry. The regression model was stepwise. The model summary can be found in Table 9.

Table 9. Model Summary.

Model	Variáveis inseridas	R	R square	R square adjusted	ANOVA
1	Joint planning	0.508	0.258	0.236	0.002

Note: Model 1. Predictors: (Constant), Joint Problem Solving. Source: Survey data (2019).

The generated model explains the joint planning of problems as an impact variable on the operational performance of the medium and large-sized metalworking industries,

demonstrating an explanatory power of 25.8% in this factor. The ANOVA test also showed a satisfactory result. This collaborative practice was also identified as an impact variable when treating the two unified segments in the same data analysis. However, in this case, the collaborative culture does not represent a factor that influences performance. Next, in Table 10, the coefficients are observed.

Table 10. Coefficients.

	Model	Non-standardized coefficients		standardized coefficients	t	Sig.	VIF
		B	**Standard model**	**Beta**			
	(Constant)	2.405	0.516		4.662	0.000	
1	Joint Problem Solving	0.439	0.130	0.508	3.388	0.002	1.000

Note: Model 1. Predictors: (Constant), Joint Problem Solving. B= Beta Coeficient; t=T-tests, Sig.=Stands for Significance Level; VIF=Variation Inflation Factor. Source: Survey data (2019).

5 Final considerations

The present study aimed to evaluate the influence of collaboration in the supply chain on the operational performance of the medium and large-sized textile and metalworking industries in the Vale do Itajaí (SC), through data collected directly in the supply area of the referenced companies.

Four collaborative practices in the supply chain were considered, namely the collaborative culture, joint planning, joint problem solving, and sharing of resources and information. Therefore, the main operational performance measurement factors were listed, defined as quality, reliability, flexibility, costs, and innovation.

Through linear regression, it was possible to meet the objective of identifying the influence of collaboration on operational performance. The collaborative practices that demonstrated an effect on this indicator were "joint planning" and "collaborative culture". In turn, the other components mentioned in the literature, such as "joint problem solving" and "resource and information sharing" did not materialize. Such a result may come from the characteristics of the industrial activities in which the data were collected or even from how organizations manage their collaborative practices regarding the supply chain.

In a complementary sense, multiple linear regression was performed for each of the industrial activities in the sample. In the textile industry, the influence of the collaborative practice "joint problem solving" was evidenced as an impact variable on operational performance. However, when analyzing only the metalworking industry, the practice of "joint planning" acted as a variable that impacts operational performance.

The assertion within the "flexibility" construct was reflected since it was part of the operational performance construct and was removed in two of the reliability tests performed. The operational flexibility of a company encompasses factors such as a rapid change in the mix of parts (without involving high costs of setup or investments), alternative processes, versatile machines (which can produce different products), and greater ease in transporting materials (Aloise, 2018).

The textile industry considers itself flexible in its processes, based on the responses collected and compiled. This result corroborates Carvalho (2010), who claims that the segment has great flexibility in the organization of production due to discontinuities in

its operations, with several companies in the market with different production scales and technological levels.

Garcia et al. (2005) describe the flexibility of the Textile Industry as a need to quickly meet the frequent changes in demand and fashion fluctuation, and for that, the authors suggest the construction of a network of specialized suppliers to work together in the service and quick responses to the market.

Metalworking, on the other hand, is characterized by high tooling costs and the production of parts of significant size, involving the need for projects and prior assessment of the expected production volume, in addition to requiring adequate physical space for any instantaneous needs (Cassel & Vaccaro, 2007). Therefore, flexibility was removed from the operational performance items in this segment for the following analysis.

Based on the results of the present study, some contributions can be identified, these based on empirical evidence and theoretical discussions, in this sense it is possible to highlight the role, importance, and impacts of collaboration on the operational performance of companies, through the supply chain.

In practical terms, it can be said that through collaboration, companies can establish, identify and develop joint strategies to create value in supply chains and additionally promote actions aimed at innovation.

In the understanding that the set of activities developed within the scope of the supply chain become fundamental for the definition and establishment of practices and actions that generate a level of performance in terms of customer service, the collaboration presents itself as a fundamental element in the building favorable relationships in the pursuit of excellence in terms of performance, considering the degree of interdependence of the partners in this chain.

Additionally, through collaboration, interdependent organizations in the supply chain can find joint strategies aimed at reducing excess inventories between the various links, and, in this sense, the possibilities of seeking common goals for all partners in the supply chain can be expanded supplies.

The limitations of the research are presented to the extent that the results are applicable only to the textile and metalworking segments and additionally consider only a stratum of companies by their size.

As an opportunity for future work, it is suggested to expand the research sample to micro and small companies in the segments studied, as well as to expand the segments of operation.

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