

The impact of supply chain fit on business and innovation performance in Brazilian companies

The impact of supply chain fit

141

Ricardo Zimmermann
INESC TEC, Porto, Portugal

Luis Miguel D.F. Ferreira
Department of Mechanical Engineering, CEMMPRE, Univ Coimbra, Coimbra, Portugal

Antonio Carrizo Moreira
DEGEIT and GOVCOPP, Universidade de Aveiro, Aveiro, Portugal

Ana Cristina Barros
INESC TEC, Porto, Portugal, and

Henrique Luiz Correa
Crummer Graduate School of Business, Rollins College, Winter Park, Florida, USA

Received 29 January 2020

Revised 25 June 2020

3 August 2020

Accepted 4 August 2020

Abstract

Purpose – This paper investigates the effect of the fit between supply and demand uncertainty (SDU) and supply chain responsiveness (SCR) (SC fit) on business and innovation performance in Brazilian companies.

Design/methodology/approach – The study presented an analysis carried out on an empirical study based on a sample of 150 manufacturing companies. Business and innovation performance of companies with different types of SC fit (high-high and low-low fits) and misfit (positive and negative) are compared and discussed.

Findings – The results indicated that SC fit had a positive effect on both business and innovation performance. Further analyses suggested that companies with SC fit present similar business performance, independent of the level of SDU that characterizes the environment where they compete, while companies in environments with higher levels of uncertainty tend to present superior innovation performance. Companies with positive and negative misfit present similar performance.

Originality/value – An analysis of the literature showed that there is no consensus when it comes to the definitions and measurements of SC fit. The paper investigates the effects of SC fit on business and innovation performance, while previous empirical studies have mainly addressed its impact on financial performance. Moreover, this study compares the effects of two types of fit and two types of misfit and assesses SC fit in Brazilian manufacturing companies, analyzing the context of an under-researched reality.

Keywords Supply chain fit, Supply and demand uncertainty, Supply chain responsiveness, Business performance, Innovation performance, Brazil

Paper type Research paper

1. Introduction

The importance of supply chain management (SCM) and its effects on performance are broadly recognized by practitioners and researchers. Consequently, the challenging task of

This work is financed by National Funds through the Portuguese funding agency, FCT – *Fundação para a Ciência e a Tecnologia*, within project UIDB/50014/2020. This research is sponsored by FEDER funds through the program COMPETE – Programa Operacional Factores de Competitividade – and by national funds through FCT – *Fundação para a Ciência e a Tecnologia* –, under the project UIDB/00285/2020.



designing the right supply chain (SC) according to the internal and external characteristics of companies is a topic that has been widely addressed by researchers and managers (Fisher, 1997; von Falkenhausen *et al.*, 2019; Zimmermann *et al.*, 2020). More recently, the importance of integrating supply and demand characteristics and SC features gave rise to the concept of SC fit (Wagner *et al.*, 2012; Gligor, 2017), derived from Fisher's (1997) seminal work and from the concept of strategic fit (Venkatraman, 1989). SC fit refers to the compatibility of the demand characteristics of the environment where companies operate, considering their products and services, with their SC design, strategies and practices (Esper *et al.*, 2010; Wagner *et al.*, 2012; Gligor, 2017).

Previous empirical studies have discussed and tested the effect of SC fit on performance, suggesting that the higher the degree of SC fit, the higher the performance of companies (Wagner *et al.*, 2012; Hallavo, 2015; Gligor, 2016, 2017). Most of these studies have discussed and assessed the effects of SC fit on financial performance (Wager *et al.*, 2012; Gligor, 2016, 2017), while its effects on other relevant aspects of companies' performance are still under research. The aim of this paper is to specifically address business and innovation performance using the concept of SC fit, which is understood as the degree of compatibility between supply and demand uncertainty (SDU) and SC responsiveness (SCR), which would complement previous knowledge, a need defended by Wagner *et al.* (2012). This paper also compares the effects of two types of fit (high uncertainty–high responsiveness, high–high fit on performance and conversely, low uncertainty–low responsiveness, low–low fit) and two types of misfit (positive and negative misfit–characterized by high/low uncertainty and low/high responsiveness). A part of this investigation has been done as a complement to previous studies that assessed the effect of SC fit on performance (Wagner *et al.*, 2012; Gligor, 2016, 2017; Luo and Yu, 2016; Sabri, 2019), contributing to the generalizability (external validity) of the previous findings, by assessing similar subjects under different conditions (Goldsby and Autry, 2011). Moreover, as stated by Goldsby and Autry (2011) and by van Weele and van Raaij (2014), replication of previous studies should be more frequent in SCM research as it helps to increase the validity, credibility and relevance of theory developed in the field. Additionally, Block and Kuckertz (2018) argued that replication studies, defined as “*studies that put published empirical results to an additional empirical test*” (p. 355), are needed to close the gap between theory and practice.

Therefore, this study contributes by adding to existing knowledge regarding the effect of SC fit on performance by pursuing the following main research objectives: (1) to analyze the impact of SC fit on business and innovation performance; (2) to compare the effects of two types of fit (high–high and low–low fits) and two types of misfit (positive and negative); (3) to assess SC fit in companies located in a country that is not part of the group of the most highly industrialized countries in the world and that has not yet received significant attention from researchers when it comes to SC fit. Further, few studies have shown the particular aforementioned features and their effects on SCM in Latin America (previous studies on SC fit have mainly focused on companies in Europe and the USA). The roles of environmental uncertainty and company size are also considered. The research question that will be addressed in the present paper is how does the fit between SDU and SCR (SC fit) impact business and innovation performance?

This paper contributes to theory as it analyzes a set of characteristics related to SC fit that have not been tested together before and by replicating and extending previous studies. This paper also contributes to practice as its results may help managers perform the challenging task of achieving/improving their company's degree of fit between supply and demand characteristics and SC features. A set of recommendations is presented following the guidelines proposed by Svanberg (2020) in order to ensure its relevance and feasibility.

The resource-based view (RBV) and contingency theory (CT) are used as the theoretical foundations for this paper. The RBV is widely applied in strategic management literature and

has been used in operations management research and more specifically in SCM in recent years (Fawcett *et al.*, 2012; Sjoerdsmaand van Weele, 2015; Yan and Azadegan, 2017; Chahal *et al.*, 2020). According to the RBV, resources and capabilities of companies are the key sources of sustainable competitive advantage (Barney, 1991; Menguc *et al.*, 2014). The consistent pursuit of compatibility between the design characteristics of the SC and the way that companies manage SC activities by seeking higher degrees of fit can be considered as the adoption and development of capabilities that cannot be easily imitated or acquired by competitors. The said capabilities influence key competitive outcomes, such as business and innovation performance. CT is also widely used in studies on SCM as well as in studies that analyze the fit between variables (MerschmannandThonemann, 2011; Acur *et al.*, 2012; Wankeand Correa, 2012; Prajogo *et al.*, 2018). According to CT, there is no universally superior strategy for all environments. The context and structure must be adjusted (or fitted) in order to favor business performance (Drazinand Van de Ven, 1985; Sousa and Voss, 2008; Grottsch *et al.*, 2013).

The rest of the paper is organized as follows: section 2 presents the theoretical foundations of the topics under analysis. Section 3 provides the conceptual framework and the research hypotheses. Section 4 presents the methodology used in the study, including data collection and measures. Section 5 presents the results of the data analysis and discussion about the effects of SC fit on different types of performance. Conclusions and implications of the study are then provided in section 6.

2. Theoretical foundations

The concept of fit has gained attraction in the literature over the last few years (Acur *et al.*, 2012; Wong *et al.*, 2012; Wu *et al.*, 2014). Fit indicates consistency and harmony between two or more variables (Venkatraman, 1989). The term “SC fit” has been used following Fisher’s (1997) study that discussed the match or mismatch of SCs regarding the characteristics of a company’s products and markets targeted, mainly in terms of demand predictability. This concept is based on the idea of “fit as matching”; according to the notion, that fit is a theoretically defined match between two variables (Venkatraman, 1989).

It is widely recognized that the perfect strategic consistency for products with predictable demand and long product life cycles (so-called “functional” products) is theoretically achieved when companies adopt an efficient SC strategy. Conversely, those companies with products that face unpredictable demand (so-called “innovative” products), short life cycles and high innovation and fashion content should adopt a responsive SC strategy to achieve strategic fit (Fisher, 1997). However, companies rarely have only one product line and oftentimes they have both functional and innovative products in their portfolios. Additionally, companies are frequently developing new products or getting into new markets, which makes these strategic choices even more relevant and, at the same time, more complex and challenging (Lee, 2002; Wagner *et al.*, 2012).

SC fit refers to the adjustment of SC features (such as structure, design and strategies) to product and demand characteristics. Ideally, the definition of these features should allow for the right balance between responsiveness and efficiency to respond to market needs (Esper *et al.*, 2010). Wagner *et al.* (2012, p. 441) defined SC fit as “*the perfect strategic consistency between a product’s supply and demand characteristics (such as demand predictability, life-cycle length, product variety, service, lead-times, and specific market requirements) and supply chain design characteristics (such as inventory strategy, product design strategy, and supplier selection aspects).*”

Previous studies have examined SC fit in a variety of ways, as shown in Table 1. The earliest articles that highlighted the need to combine SCM characteristics with market needs, addressing the importance of responsiveness, arose from the approximation between SCM

Paper	Methodology/ context	Main objective(s)	Measure of SC fit	Measure of performance	Main result(s)
Fisher (1997)	Theoretical/ discussion of cases, the USA	Discuss the match or mismatch of SCs regarding the characteristics of companies' products and targeted markets in terms of demand predictability	Match and mismatch between type of product (functional and innovative) and SC strategy (efficient and responsive)	Business performance (not specified)	Functional products match with an efficient SC strategy, while innovative products match with a responsive SC strategy
Christopher (2000)	Theoretical, the UK	Discuss the fit of SC strategies according to the volatility of the market	Alignment between SC strategies (lean and agile) with the level of volatility of the market	Not specified	The adoption on an agile SC strategy is beneficial to companies that compete in turbulent and volatile markets
Li and O'Brien (2001)	The optimization model, the UK	Analyze the relationships between product types and SC strategies	Match and mismatch between type of product (functional and innovative) and SC strategy (efficient and responsive)	Weighted sum of values related to profit, lead time and delivery promptness	Presents the variances of performance in relation to SC strategies (manufacturing to order, manufacturing from stocks and manufacturing to stocks),and product characteristics (value-adding and demand uncertainty)
Lee (2002)	Theoretical/ discussion of cases, the USA	Examine the alignment between SC strategies and products uncertainty	Match and mismatch between SDU and SC strategy (efficient, responsive, risk- hedging and agile)	SC performance (not specified)	Supply uncertainty, besides product uncertainty, helps to define the right SC strategy
Juttner <i>et al.</i> (2007)	Theoretical/ workshop and focus group discussions, the UK	Demonstrate how demand chain management can leverage the strengths of marketing and SCM and meet the challenges of customer value creation	Integration between demand and supply processes	Financial and SC performance (not specified)	Integration between SCM and marketing helps to create more responsive SCs according to market needs
Selldin and Olhager (2007)	Survey research/ 128 manufacturing companies, Sweden	Test the relationships between product and SC designs (and the impact on financial performance)	Match and mismatch between type of product (functional and innovative) and SC strategy (efficient and responsive)	Cost, quality, delivery speed, delivery dependability, volume flexibility, product mix flexibility and profitability	The results confirm the relationships between product and SC types

Table 1.
Summary of previous
studies on supply
chain fit

(continued)

Paper	Methodology/ context	Main objective(s)	Measure of SC fit	Measure of performance	Main result(s)
You and Grossmann (2008)	Optimization model/two cases on polystyrene SCs, the USA	Examine the optimization of SC design and planning according to responsive and economic criterion with the presence of demand uncertainty	Optimization of SC design and planning	SC performance (not specified)	A multiperiod-mixed integer nonlinear programming model was developed for the bi-criterion optimization of economics and responsiveness, while considering customer demand uncertainty
Chi et al. (2009)	Survey research/ 202 manufacturing companies from the textile industry, the USA	Analyze the relationships between business environment characteristics, competitive priorities, SC structures and company's business performance	Alignment between SC strategy and the characteristics of the business environment	Business performance (market share, sales growth, profit margin, ROI and ROA)	The results indicate differences in both strategic and SC responses to business environment between high- and low-performing companies
Esper et al. (2010)	Theoretical, the USA	Discuss how demand and supply integration impacts performance	Integration between demand-focused processes and supply-focused processes	Organizational performance (not specified)	The adoption of strategies (including SC strategies) that respond to market needs (demand) contributes to improving long-term performance
Lo and Power (2010)	Survey research/ 107 manufacturing companies, Australia	Investigate the relationship between product nature and SC strategy (using Fisher's model)	Match and mismatch between type of product (functional and innovative) and SC strategy (efficient and responsive)	Not considered in the model	The results suggest that the link between product nature and SC strategy is not significant
Wagner et al. (2012)	Survey research/ 259 manufacturing companies, Europe and the USA	Understand the link between SC fit (consistency between supply and demand characteristics and SC design characteristics) and financial performance of the company	SC fit is calculated by the difference between supply and demand uncertainty and SC responsiveness (SDU – SCR)	Return on assets (ROA)	The findings indicate that the higher the S fit, the higher the Return on assets (ROA) of the company and that companies with a negative misfit show a lower performance than companies with a positive misfit
Hallavo (2015)	Survey research/ 875 manufacturing companies, Russia	Examine how the moderating effect of uncertainty impacts the relationship between operational responsiveness and company performance	Relationship between demand uncertainty and technological uncertainty and responsiveness	Operational and organizational performance	Operational responsiveness leads to superior organizational performance if the relationship is moderated by uncertainty and SC responsiveness

(continued)

Table 1.

Paper	Methodology/ context	Main objective(s)	Measure of SC fit	Measure of performance	Main result(s)
Morita <i>et al.</i> (2015)	Survey-based experimental analysis/238 manufacturing companies, Australia, Europe, Japan and the USA	Understand the relationship between product characteristics and the SC process and analyze how their alignment should be constructed	Alignment between product characteristics and the SC process	Not considered in the model	Introduce the concept of absolute SC orientation strategy
Nakano (2015)	Survey research/ 129 manufacturing companies, Japan	Provide empirical evidence of the relationship between strategy (efficient, responsive, efficient/responsive and traditional) and structure/processes in SCs	Match between SC strategy and SC structure/processes	Not considered in the model	Present patterns of structure/processes that fit efficient and responsive strategy
Gligor (2016)	Survey research/ 242 manufacturing companies, the USA	Examine the link between a company's environmental characteristics and its level of SC fit. The author tests the effects on financial performance (ROA)	SC fit is calculated by the difference between supply and demand uncertainty and SC responsiveness (SDU – SCR)	Return on assets (ROA)	As the level of environmental uncertainty increases it becomes increasingly challenging to match supply and demand characteristics with SC design characteristics. The author introduces agility as a capability that helps mitigate the negative relationship between aspects of environmental uncertainty and SC fit
Luo and Yu (2016)	Survey research/ 212 manufacturing companies, China	Compare the effects on performance of two types of misfits (overfit vs underfit) as well as two types of fits (high-high vs low-low fit) between environmental uncertainty and SC flexibility	Fit between environmental uncertainty and SC flexibility	Customer loyalty	Reveal the asymmetric effects of the fits and misfits between environmental uncertainty and SC flexibility

Table 1.

(continued)

Paper	Methodology/ context	Main objective(s)	Measure of SC fit	Measure of performance	Main result(s)
Gligor (2017)	Survey research/ 242 manufacturing companies, the USA	Evaluate the moderating effects of six dimensions of environmental uncertainty (e.g. munificence, market dynamism, technological dynamism, technical complexity, product diversity and geographic dispersion) on the relationship between SC fit and financial performance	SC fit is calculated by the difference between supply and demand uncertainty and SC responsiveness (SDU – SCR)	Return on assets (ROA)	The results help to understand the environmental conditions in which companies benefit the most from SC fit and show that companies do not always benefit from a better SC fit (in terms of financial performance – ROA)
Sabri (2019)	Case study research/two corporate groups, Italy and Sweden	Study the interaction between organizational structure (decision-making centralization and internal coordination) and the relationship between SC fit and company performance	Match between supply, demand and innovation uncertainty and SC strategy	Financial and operational performance	Identify decision-making centralization and internal coordination mechanisms as the internal uncertainty factors that are the most relevant to SC fit research

Table 1.

and strategic management research and/or between SCM and marketing research (Fisher, 1997; Christopher, 2000; Lee, 2002; Juttner *et al.*, 2007). These articles, generally theoretical ones, were more focused on the demand side of the SCs. Christopher (2000), for instance, discussed the fit of SC strategies (lean and agile) with different degrees of market volatility, while Juttner *et al.* (2007) concluded that the integration between SCM and marketing helps to create SCs that are more responsive and aligned with market needs. Various authors have dedicated their studies to test Fisher's (1997) model empirically (e.g. Li and O'Brien, 2001; Selldin and Olhager, 2007; Lo and Power, 2010). Most of these studies supported Fisher's model (at least partially), while a few of them (e.g. Lo and Power's, 2010) contradicted it.

Lee (2002) suggested adding the notion of supply uncertainty, which refers to the degree of stability of the supply process, to the concept of demand uncertainty proposed by Fisher (1997) and which had been followed by a great number of authors. A stable supply process is characterized by mature manufacturing processes and a well-established supply base, while an evolving supply process displays manufacturing processes which are still at a development stage and a limited supply base (Lee, 2002). Therefore, SDU refers to both the predictability/unpredictability of demand and stability/instability of supply.

Following the theoretical bases provided by the "pioneers" of this topic, more recent papers have made attempts to test and analyze the impact of SC fit on performance (usually financial performance), empirically by considering its relationship with a variety of aspects. Wagner *et al.* (2012) were the first to support the idea that the higher the SC fit, the higher the performance (in terms of return on assets – ROA) of the company, empirically. Hallavo (2015) tested the moderator effects of demand and technological uncertainty on the relationship

between responsiveness and (operational and organizational) performance, concluding that the operational responsiveness leads to superior performance if the relationship is moderated by uncertainty and SC responsiveness. Nakano (2015) analyzed the link between SC strategies (efficient, responsive, efficient/responsive and traditional) and the structure and processes of the SCs, presenting a set of patterns of structure/processes that fit efficient and responsive strategy. Gligor (2016, 2017) examined the role of environmental uncertainty (munificence, dynamism and complexity) on the level of SC fit (2016) and as a moderator of the relationship between SC fit and performance (2017). The author highlighted agility as a capability that helps mitigate the negative relationship between aspects of environmental uncertainty and SC fit. Sabri (2019) explored a new perspective on the topic, assessing the interaction between organizational structure (the centralization of decision-making and internal coordination) and the relationship between SC fit and company performance (financial and operational). Table 1 presents a summary of the previous studies on SC fit.

As shown in Table 1, there is no consensus when it comes to the definition and measurement of both SC fit and performance. Moreover, as discussed before, some of the previous studies have presented contradictory results regarding the effects of the alignment between demand characteristics and SC strategies. The present paper differs from previous studies and contributes to the topic in three main aspects: (1) performance measure; (2) comparison between two types of fit and two types of misfit; (3) geographic coverage.

First, most of the previous studies have discussed and tested the effect of SC fit on financial performance, while this paper addressed business and innovation performance. Business performance has been analyzed and measured in a great variety of ways (Rauch *et al.*, 2009). A measure of business performance can be understood as a set of metrics used to quantify both the efficiency and effectiveness of firms' actions (McAdam and Bailie, 2002; Franco-Santos *et al.*, 2007). Contemporary knowledge suggests that financial and economic issues need to be combined with market-based assets in order to generate a more composite assessment of business performance attributes (Morgan and Strong, 2003). Gonzalez-Benito (2007) suggested the use of items related to commercial performance and to economic and productivity performance to measure business performance. Innovation performance is also a complex and nonconsensual issue. Based on the *Oslo Manual* (OECD and Eurostat, 2005), an important reference in the field, Alegre and Chiva (2008) proposed the measure of product and process innovation performance. Nowadays, many innovation-related studies use this widely validated scale (Alegre and Chiva, 2013). Although the concept of SC fit is related to innovation (SDU is influenced by the degree of innovativeness of a company's products), previous works have not explored its impact on innovation performance. The relationship between innovation and SCM has attracted increased attention from researchers in recent years (Fawcett *et al.*, 2012; Narasimhan and Narayanan, 2013; Cheng *et al.*, 2014; Stentoft and Rajkumar, 2018; Zimmermann *et al.*, 2019) and many authors have highlighted the impact of SC features on the innovation process and performance (Zimmermann *et al.*, 2016).

Second, this paper compares the effects of two types of fit (high-high and low-low fits) and two types of misfit (positive and negative misfit) on performance. Luo and Yu (2016) have used a similar approach, but they tested the relationship between SC flexibility and environmental uncertainty (instead of SDU and SCR). Finally, previous studies on SC fit have mainly focused on companies from Europe and the USA, while this paper analyzed SC fit in a relatively under-researched context (Brazil).

Thus, besides adding new knowledge to the topic, this paper contributes to the generalizability of the previous findings as replication and extension help to increase the rigor and relevance not only of the research study itself but also of the whole field of operations management and SCM (Van Weele and Van Raaij, 2014). In order to assure its relevance as a replication study, the paper follows the principles proposed by Block and Kuckertz (2018) to develop replication studies.

3. The conceptual framework and development of hypotheses

SC fit can be understood as the balance between two characteristics related to the SCs: (1) SDU and (2) SCR (Wagner *et al.*, 2012; Gligor, 2016). SDU refers to the degree of uncertainty of the supply and demand, which can be measured for the following elements: the average length of the products' life cycle, quantity of product design variations, forecast error, number of sales locations and frequency of change in customers' orders. SCR, in its turn, is related to the strategic choices of a company when it comes to its capacity to respond to changes in supply and demand. Figure 1 represents the conceptual framework of the paper.

According to previous studies, it is expected that SC fit, or the adjustment between SDU and SCR, has a positive effect on performance (Fisher, 1997; Wagner *et al.*, 2012; Gligor, 2016, 2017). In this study, the effect of SC fit on business performance will be tested. Thus, the first hypothesis is proposed as follows:

H1. SC fit is positively related to business performance.

As depicted in Figure 2, companies may present two types of fit (positioned on the main diagonal of the figure) and two types of misfit (above the diagonal and below the diagonal). A company is considered to have a high-high fit when it presents high levels of SDU and high levels of SCR, while companies with low levels of both SDU and SCR are considered to have a low-low fit (Luo and Yu, 2016). Recognizing that uncertainty and responsiveness are often linked to opportunities, it is expected that a high-high fit shows better performance than a low-low fit. In this sense, the second hypothesis to be tested is as follows:

H1.1. High-high fit (between high SDU and high SCR) leads to a better business performance than low-low fit (between low SDU and low SCR).

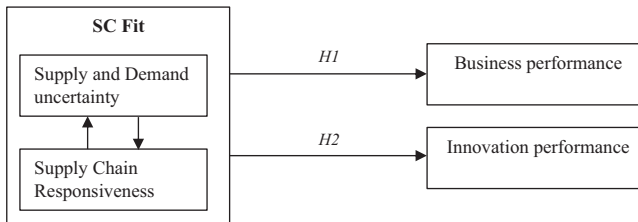


Figure 1. The conceptual framework

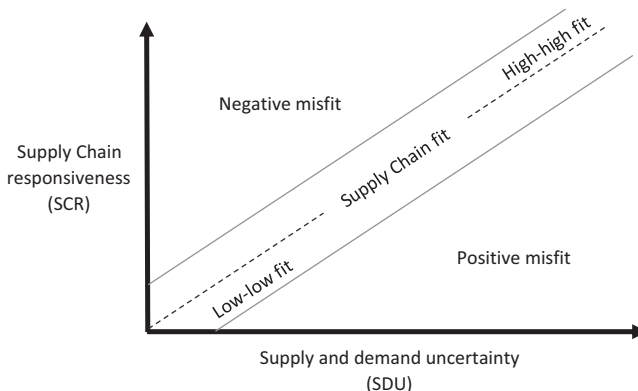


Figure 2. Representation of supply chain fit (adapted from Wagner *et al.*, 2012 and Luo and Yu, 2016)

On the other hand, companies that present high levels of SDU and low levels of SCR have a positive misfit and companies with low levels of SDU and high levels of SCR present a negative misfit (Wagner *et al.*, 2012; Luo and Yu, 2016). Companies with negative misfit (positioned above the diagonal) design their SCs to respond to uncertainty, even though they function in predictable environments and therefore, they waste resources and risk being inefficient when compared to competitors. Conversely, companies with positive misfit (positioned below the diagonal) operate in environments/contexts with higher levels of SDU (theoretically, companies in these environments are presented with more opportunities), while displaying low levels of responsiveness. Thus, the third hypothesis is as follows:

H1.2. Positive misfit (between high SDU and low SCR) leads to better business performance than negative misfit (between low SDU and high SCR).

In this study, the relationship between SC fit and innovation performance will also be tested. Following previous studies (Wagner *et al.*, 2012; Gligor, 2017) that have established that the SC fit positively impacts on performance, the next hypothesis is presented as follows:

H2. SC fit is positively related to innovation performance.

Previous studies (Sheng, 2017; Pérez-de-Lema *et al.*, 2019) have highlighted that companies acting in more competitive and turbulent markets need to innovate in order to survive. These companies tend to invest efforts and resources in their innovation process and these efforts are expected to have positive effects on innovation performance. Actually, uncertainty (in our case, specifically SDU) is often linked to opportunities; thus, it is expected that a high–high fit is more beneficial to innovation performance than a low–low fit. Hypothesis 2.1 is as follows:

H2.1. High–high fit (between high SDU and high SCR) leads to a better innovation performance than low–low fit (between low SDU and low SCR).

Finally, companies with a negative misfit act in more predictable environments and companies with positive misfit operate in environments with higher levels of uncertainty, often linked to dynamism and innovation. Companies acting in the latter type of environment tend to be keener on innovation as the market demands novelty (Pérez-de-Lema *et al.*, 2019). In this sense, despite presenting a misfit, this group of companies would tend to invest more efforts in innovation, which leads to the last hypothesis.

H2.2. Positive misfit (between high SDU and low SCR) leads to a better innovation performance than a negative misfit (between low SDU and high SCR).

4. The research methodology

The methods applied to collect and analyze data are presented in this section. As mentioned before, the RBV and CT are used as the theoretical bases for this paper.

4.1 Data collection

Data were collected from manufacturing companies operating in Brazil. Brazil is the ninth largest world's economy and the first in Latin America (World Bank, 2020), as well as the fifth largest country in terms of population and geographic area (United Nations Statistics Division, 2020, July 28). Brazil also has a particular market and social characteristics that bring specific challenges and opportunities related to SCs and innovation (Batista *et al.*, 2019). Although considered a leader in Latin America in many indicators related to manufacturing and innovative activities, the country faces many limitations and constraints (e.g. low levels of R&D investments and low capacity to generate new

technologies) (Frank *et al.*, 2016). Thus, Brazilian companies were chosen as the source of data for this study due to the aforementioned characteristics and the relatively reduced amount of studies on their reality.

The questionnaire was developed from a variety of sources to measure the constructs investigated, and it was made available as an online survey on the platform LimeSurvey. Following Zhao *et al.* (2007), a combination of methods was employed to ensure the reliability and validity of the questionnaire. The first version of the document was reviewed by two professionals in the field and answered by two potential respondents. This version, developed in English, was then translated to Portuguese and back-translated to English. The back-translated English version was checked against the original English version by a different expert. Adjustments were made. The questionnaire was also pilot-tested with five companies. Besides answering the questionnaire, the respondents were asked to make comments on the understandability and clarity of the items. After minor changes suggested by the respondents during the pilot test, the final version was reviewed by two academic experts and was considered ready to be sent to a larger sample for data collection.

Following the guidelines proposed by Craighead *et al.* (2011) and the principles discussed by Krause *et al.* (2018) and Flynn *et al.* (2018), the questionnaire was designed to be answered by two respondents in each company: the part concerning SCR exclusively by an SC manager; the section on innovation performance by an innovation manager; the parts concerning SDU and business performance by both. The answers relating to SDU and business performance were compared, ensuring the reliability of the information. When significant differences between the answers were found, the respondents were contacted again. The companies that had incomplete answers were rejected. The most common functional responsibilities of the respondents in the companies included operations directors/managers; purchasing directors/managers; SC directors/managers; innovation and new product development directors/managers.

The sample, composed of 1,000 companies in Brazil, was randomly selected from the database provided by Neoway (a big data company that collects and provides information about companies). The sample included companies from various industrial sectors, such as food and beverages, automotive and parts, construction and materials, machinery and plant construction and industrial metals. Data were collected from September 2017 to January 2018 and totalized 150 complete and useable responses. The response rate was 15.0%, which is not unusual when the unit of analysis is a company and when the research study involves an extensive organizational-level survey. Table 2 presents the composition of the sample.

Nonresponse bias was assessed by contacting a random sample of 15 nonrespondents and asking them to respond to a set of non-demographic questions, as suggested by Mentzer and Flint (1997). No statistical differences were found between the answers of respondents and nonrespondents. Nonresponse bias was also tested by examining the differences between early ($n = 89$) and late respondents ($n = 61$), considering that late respondents have some similar characteristics to nonrespondents as they took more time and effort to answer the questions. The differences in the mean and factor loading values (in factor analysis performed) were not significant for the constructs analyzed. These results indicated that nonresponse bias does not appear to be a concern in the present study.

Procedural and statistical methods were adopted to minimize potential common method bias. Besides the two replies from each company, the respondents' anonymity was protected, the respondents were assured that there were no right or wrong answers and the ambiguity of the items was reduced during the pilot test.

4.2 Measures

The main measures used are as follows: SC fit (SDU and SCR), business and innovation performance. SDU and SCR were measured following the items used by Wagner *et al.* (2012)

and Gligor (2016). The respondents were asked to answer ten questions regarding the main product line of the company on a five-point scale (1 = low and 5 = high): five questions related to SDU and five questions related to SCR. SC fit was calculated following the concept of fit as matching and the model proposed by Wagner *et al.* (2012), where

$$SCF_{it} = |SDU - SCR|$$

As stated by Wagner *et al.* (2012, p. 343), “the deviation score captures the degree of misfit on a continuum between a total misfit and a perfect fit, where lower values indicate greater fit. When $SCFit = 0$, perfect supply chain fit is achieved.”

The model used by Gonzalez-Benito (2007) was applied to measure business performance. A total of five items measured commercial performance and three items were related to ratios based on accounting data and they referred to the economic benefits and productivity of the company. The respondents were asked to evaluate their company’s performance in comparison with their competitors for each of the aspects on a seven-point Likert scale (1 = lower, 4 = equal and 7 = higher). The items measured are as follows: sales growth, reputation and image, customer satisfaction, market share (of the main product), success of new product launches (commercial success), return on investment (ROI), profits as a percentage of sales and labor productivity (economic and productivity performance).

Innovation performance was measured using the concepts of product and process innovation effectiveness, proposed by Alegre and Chiva (2013). The respondents were asked to compare their company’s performance to that of their competitors over the last three years using a seven-point Likert scale (1 = much worse, 4 = at the same level and 7 = much better).

Variable	Number (150)	%
<i>Number of employees</i>		
<50	10	6.7
50–100	27	18.0
101–500	68	45.3
501–1,000	19	12.7
> 1,000	26	17.3
Total	150	100.0
<i>Industrial sector</i>		
Food and beverages	26	17.3
Automotive and parts	15	10.0
Construction and materials	14	9.3
Machinery and plant construction	15	10.0
Industrial metals	13	8.7
Textiles and apparel	11	7.3
Household goods and personal care	11	7.3
Chemical	10	6.7
Electronic and electrical equipment	8	5.3
Forestry and paper	5	3.3
Pharmaceuticals and biotechnology	5	3.3
Electricity	5	3.3
Oil and gas	4	2.7
Medical equipment	3	2.0
Mining	2	1.3
Technology hardware and equipment	2	1.3
Aerospace	1	0.7
Total	150	100.0

Table 2.
Composition of the
sample

The control variables used were environmental uncertainty (EU) and company size (measured by the number of employees). EU was measured as proposed by Aldrich (1979) and Dess and Beard (1984), who classified environmental uncertainty according to three dimensions: environmental munificence, environmental dynamism and environmental complexity. Environmental munificence refers to the capacity of the environment to support sustained growth; environmental dynamism is related to the extent to which the environment is characterized by changes that are hard to predict; environmental complexity refers to the extent to which the environment is characterized by great uncertainty and a great information-processing requirement (Dess and Beard, 1984). The respondents were asked to indicate their perception on the statements concerning the company's business environment on a seven-point Likert scale with 1 = strongly disagree and 7 = strongly agree. Table 3 presents the constructs used in the study.

5. Results and discussion

The data collected through the online questionnaire were analyzed as described in this section. SPSS Statistics 25 was used to perform most of the analyses, while IBM SPSS Amos 24 was used to test the validity of the measurement model.

5.1 Reliability and validity of the constructs

Several methods were applied to assess the reliability and validity of the constructs. First, exploratory factor analyses were conducted for each construct as proposed by Qi *et al.* (2009). The complete results of the factor analyses are presented in the Appendix. The first analysis was done to analyze the constructs for SC fit. All items were maintained as the results indicate that they measure what they were designed to measure (SDU1 to SDU5 – SDU and SCR1 to SCR5 – SCR). Regarding business performance, DC1 to DC5 were designed to measure commercial performance, while DF1 to DF3 measured economic and productivity performance. All items were also maintained. The next factor analysis assessed the constructs for innovation performance. Items DIPT1 to DIPT5 measured product innovation performance and DIPS1 to DIPS10 measured process innovation performance. Items DIPS8, DIPS9 and DIPS10 were excluded due to the presence of high cross-loading values (higher than 0.4), following the suggestion of Hair *et al.* (2010).

Cronbach's alpha results for the SC fit, business and innovation performance are also presented in the Appendix as they help to assess the internal consistency of the constructs (Hair *et al.*, 2010; Peng and Lai, 2012). All the results of Cronbach's alpha presented are greater than 0.7, suggesting that the constructs have sufficient reliability (Peng and Lai, 2012).

Eigenvalues were also analyzed for the constructs. The analysis of the constructs for SC fit showed that the scale for SDU explains 26.6% of the variance (eigenvalue = 2.66/5 items) and the scale for SCR explains 26.3% of the variance (eigenvalue = 2.63/5 items). The factor analysis for business performance also resulted in two factors: (1) commercial performance – which explains 34.67% of the variance (eigenvalue = 2.77/5 items) – and (2) economic and productivity performance – which explains 27.86% of the variance (eigenvalue = 2.23/3 items). Innovation performance also presents two factors, where product innovation performance explains 32.1% of the variance (eigenvalue = 4.28/6 items) and process innovation explains 25.4% (eigenvalue = 3.30/7 items).

Convergent and discriminant validity are presented in Table 4. All composite reliability (CR) measures are above 0.7, exceeding the minimum values of 0.6 (Bagozzi and Yi, 1998). Regarding the average variance extracted (AVE) values, the results indicate that all constructs exceed the estimates of 0.50, except SCR. However, following Fornell and Larcker (1981), the convergent validity of the construct was considered adequate as the CR is higher

Construct	Source
Supply chain fit	
Supply and demand uncertainty	SDU1: How long is the average life cycle of the products in the main product line? SDU2: How many different variants are available for the main product line? SDU3: What is the average margin of error in the forecast based on units at the time production is committed? SDU4: What is the number of sales locations for the main product line? SDU5: What is the frequency of change in order content for the main product line?
SC responsiveness	<i>Please indicate the strategic supply chain priorities for the main product line</i> SCR1: Improve delivery reliability SCR2: Maintain buffer inventory of parts or finished goods SCR3: Retain buffer capacity in manufacturing SCR4: Respond quickly to unpredictable demand SCR5: Increase frequency of the introduction of new products
Business performance	
Commercial performance	DC1: Sales growth DC2: Reputation and image DC3: Customer satisfaction DC4: Market share (of the main product) DC5: Success of new product launches
Economic and productivity performance	DF6: Return on investment – ROI DF7: Profits as percentage of sales DF8: Labor productivity
Innovation performance	
Product innovation	DIPT9: Replacement of products being phased out DIPT10: Extension of the product range within the main product field through new products DIPT11: Extension of the product range outside the main product field DIPT12: Development of environment-friendly products DIPT13: Opening of new markets abroad DIPT14: Opening of new domestic target groups
Process innovation	DIPS15: Improvement of production flexibility DIPS16: Reduction of production costs by cutting labor cost per unit DIPS17: Reduction of production costs by cutting material consumption DIPS18: Reduction of production costs by cutting energy consumption DIPS19: Reduction of production costs by cutting rejected production rate DIPS20: Reduction of production costs by cutting design costs DIPS21: Reduction of production costs by cutting production cycle DIPS22: Improvement of product quality DIPS23: Improvement of labor conditions DIPS24: Reduction of environmental damage
Control variables	
Environmental uncertainty	CM1: The environment in which the company competes can support sustained growth and sustainability (environmental munificence) CD2: The environment in which the company competes is characterized by changes that are hard to predict and that heighten uncertainty for key organizational members (environmental dynamism) CC3: The environment in which the company competes is characterized by great uncertainty and a great need for information processing (environmental complexity)
Company size	Number of employees

Table 3.
Constructs used in
the study

than 0.6. This approach has been used in previous studies on management and operations management research (Jaafar and Rafiq, 2005; Lam, 2012).

The fit indices of the structural model were tested and the results obtained were satisfactory ($p < 0.001$, IFI = 0.914, TLI = 0.900, CFI = 0.912 and RMSEA = 0.056) [1], providing support for the nomological validity of the measurement model hypothesized.

5.2 Supply chain fit

A descriptive analysis of the SC fit of the companies was made in order to understand their position in one of the following groups: SC fit (high–high or low–low fit), positive or negative misfit. Table 5 presents the mean and standard deviation values for the constructs of the SC fit, showing that the mean values for all the items that measure SCR are higher than the mean values of the items that measure SDU (highlighting SCR4 – respond quickly to unpredictable demand as the higher mean).

An analysis of the frequency of the differences between SDU and SCR shows that the majority of the companies (119 or 79.3%) present negative misfit ($SDU < SCR$). These results are consistent with previous studies (Wagner *et al.*, 2012), showing that companies tend to “play it safe” when it comes to their degree of responsiveness. In other words, many companies act in environments with a lower degree of uncertainty than they are prepared to face. A total of ten companies (6.7% of the total) presented a “perfect” SC fit ($SDU - SCR = 0$). These companies have a theoretically perfect balance between the internal characteristics of their SCs and the features of their products and the environment where they compete. The remaining 21 companies (14%) had a positive misfit ($SDU > SCR$). This group of companies competes in environments with higher degrees of uncertainty than their level of responsiveness.

	CR	AVE	MSV	MaxR (H)	1	2	3	4	5	6
1. SCR	0.776	0.415	0.104	0.795	0.644					
2. Commercial	0.865	0.622	0.448	0.919	-0.220	0.789				
3. Eco prod	0.798	0.580	0.373	0.883	-0.322	0.606	0.761			
4. Product in	0.794	0.564	0.448	0.808	-0.031	0.669	0.543	0.751		
5. Process in	0.872	0.578	0.373	0.875	-0.127	0.332	0.611	0.561	0.760	
6. SDU	0.832	0.502	0.159	0.853	0.282	0.348	0.306	0.399	0.253	0.708

Note(s): $n = 150$; the square roots of the AVE values are presented along the diagonal

Table 4. Convergent and discriminant validity

Constructs	Mean	Std. deviation
SDU	2.77	0.69
SDU1	2.53	0.96
SDU2	2.74	0.97
SDU3	2.77	1.06
SDU4	2.89	0.92
SDU5	2.91	0.89
SCR	3.41	0.63
SCR1	3.24	0.90
SCR2	3.48	0.88
SCR3	3.17	0.81
SCR4	3.65	0.91
SCR5	3.53	0.86

Table 5. Supply and demand uncertainty and supply chain responsiveness' mean and standard deviation values

Following [Chopra and Meindl \(2010\)](#) and [Wagner et al. \(2012\)](#), a zone of strategic fit was defined, comprising companies with one standard deviation from the perfect SC fit. Besides the ten companies with perfect SC fit, 21 companies were added to the strategic fit zone. Within this group of 31 companies, high–high fit was defined as companies with mean values for SDU and SCR higher than or equal to 3 (14 companies), while companies with low–low fit present mean values lower than 3 (17 companies). The zones of positive and negative misfits have been redrawn outside the strategic fit zone. [Table 6](#) presents the composition of the groups.

There are no significant differences among the groups regarding the number of employees. The companies are relatively equally distributed among the different groups, following the patterns presented in [Table 2](#). In relation to the industrial sectors, the high number of companies operating in the sectors of construction and materials and automotive and parts among the companies that are positioned in the SC fit zone should be emphasized. These sectors represent 23% (seven companies) and 19% (six companies), respectively, of the companies with SC fit, while representing 9% and 10% of the total number of companies in the sample.

[Figure 3](#) shows the position of the companies in the graph representative of SC fit. Most of the companies are positioned above the diagonal (negative misfit), reflecting the values previously described. The points on the dashed diagonal of the figure represent the companies where SDU and SCR present a perfect SC fit (ten companies), while those between

	SC fit (strategic fit zone) 31				Misfit 119			
	High–high fit	%	Low–low fit	%	Positive misfit	%	Negative misfit	%
<i>Companies</i>	14		17		16		103	
<i>Number of employees</i>								
<50	1	7	0	0	0	0	7	7
50–100	0	0	6	35	3	19	20	19
101–500	7	50	5	29	7	44	49	48
501–1,000	2	14	4	24	3	19	10	10
>1,000	4	29	2	12	3	19	17	17
<i>Industrial sector</i>								
Food and beverages	2	14	5	29	1	6	18	17
Automotive and parts	3	21	3	18	2	13	7	7
Machinery and plant construction	1	7	0	0	1	6	13	13
Construction and materials	5	36	2	12	2	13	6	6
Industrial metals	1	7	2	12	0	0	10	10
Household goods and personal care	0	0	1	6	1	6	9	9
Textiles and apparel	1	7	1	6	1	6	8	8
Chemical	0	0	0	0	0	0	10	10
Electronic and electrical equipment	1	7	2	12	1	6	4	4
Electricity	0	0	0	0	1	6	4	4
Forestry and paper	0	0	1	6	0	0	3	3
Pharmaceuticals and biotechnology	0	0	0	0	1	6	4	4
Others	0	0	0	0	5	31	7	7

Table 6.
Distribution of the
companies according
to the degree of supply
chain fit and misfit

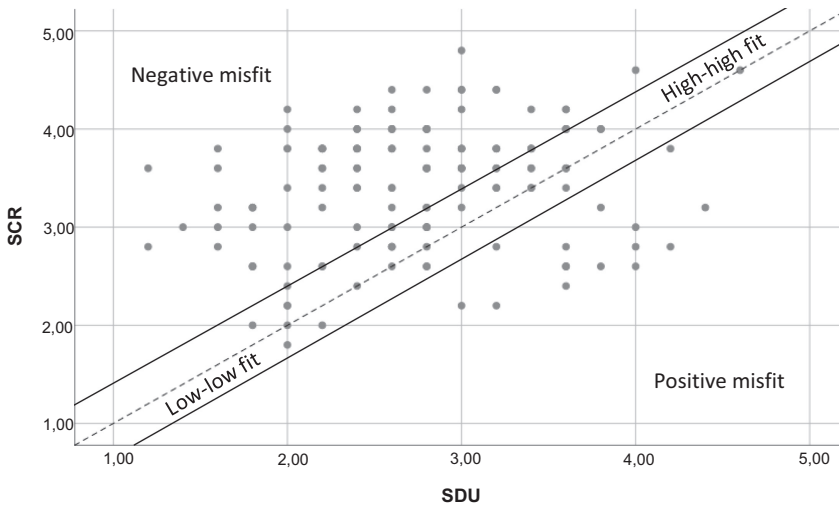


Figure 3. Supply chain fit distribution of the companies

the two other diagonals are positioned in the strategic fit zone. The points below the diagonals represent the companies with a positive misfit.

5.3 Supply chain fit and performance

Linear regression analyses were used to test hypotheses 1 and 2. The results obtained supported H1 ($\beta = 0.23$; $p < 0.001$), that is to say SC fit is positively related to business performance and H2 ($\beta = 0.24$; $p < 0.001$), that is to say SC fit is positively related to innovation performance. Table 7 presents the results of the regression analyses.

The results are in line with Fisher's (1997) theory and reinforce the findings of previous studies that SC fit has a positive impact on performance (Wagner *et al.*, 2012; Hallavo, 2015; Gligor, 2016, 2017). Among the previous studies, Wagner *et al.* (2012) and Gligor (2016, 2017) provided evidence of the impact of SC fit on financial performance, while Hallavo (2015) and Nakano (2015) concluded that SC fit positively influences operational performance. As highlighted before, SC fit refers to the match between the supply and demand characteristics of the context where companies compete and their capacity to respond to different degrees of uncertainty. The results indicate that the consistency between these characteristics of the SCs

Variables	Model 1 Business performance	Model 2 Innovation performance
Company size	0.000	0.000
Environmental munificence	0.085**	0.113**
Environmental dynamism	0.014***	-0.013***
Environmental complexity	-0.020***	0.036***
SC fit	0.226*	0.242*
R^2	0.216	0.213
Adjusted R^2	0.189	0.197
F	7.942	3.302

Note(s): $n = 150$; unstandardized regression coefficients are reported; company size is measured by the number of employees; * $p < 0.001$; ** $p < 0.01$; *** $p < 0.05$

Table 7. Regression analyses for business and innovation performance

is beneficial to different types of performance, in line with the principles of CT, to which companies must match their internal characteristics (such as structure and processes) to their environment in order to obtain superior performance (Venkatraman, 1989; Grotsch *et al.*, 2013; Flynn *et al.*, 2016).

These results can also be examined through the lens of the RBV, to which different resources generate different results. According to the RBV, companies should seek to develop a set of characteristics that are valuable, rare, difficult to imitate and not easily substitutable (Barney, 1991; Hong *et al.*, 2011; Laosirihongthong *et al.*, 2014). SC fit is related to the best deployment, development and management of a company's resources and assets and to specific SC practices that enable the company to face specific challenges presented by its environment. SC fit is unlikely to be achieved by "best practices" and strategies (one size does not fit all here) (Kharlamov *et al.*, 2020).

As shown in Table 7, environmental munificence among the control variables has proven to be the most significant in the two models ($\beta = 0.085$ to business performance and $\beta = 0.113$ to innovation performance). Environmental dynamism and complexity have a lower impact on the models and both present contrasting results regarding each type of performance. Environmental dynamism has a positive effect on business performance (as the value of the dynamism increases, the mean of the business performance tends to increase as well) and a negative effect on innovation performance (as dynamism increases, innovation performance tends to decrease). Environmental complexity displays the opposite behavior, while the results do not indicate that company size has any influence in the models.

5.4 Different types of supply chain fit and misfit

Further analyses were conducted in order to test and discuss hypotheses 1.1, 1.2, 2.1 and 2.2 that referred to the impact of the different types of fit and misfit on business and innovation performance. Mann–Whitney's *U* tests were performed in order to analyze the significance of the differences among the performance of the groups of SC fit and misfit. Table 8 compares the performance of the companies that have different types of SC fit.

The results indicate that the two groups, high–high and low–low SC fit, present higher performance when compared with the mean of all the 150 companies in both business and innovation performance. Looking at the business performance, economic and productivity performance have the highest deviation from the total sample mean value (29% and 22%), while commercial performance is 16% above the global average for both groups. However, the analysis of the results does not support H1.1, that is to say high–high SC fit is more beneficial to business performance than low–low SC fit, as both groups are not statistically different ($p = 0.218$; $p > 0.05$). These results indicate that, when it comes to business

	Total (<i>n</i> = 150)	High–high fit (<i>n</i> = 14)	Low–low fit (<i>n</i> = 17)	<i>p</i> -value (*)
Economic and productivity performance	4.73 (4.58)	6.10 (6.22)	5.79 (5.94)	0.162
Commercial performance	3.49 (3.63)	4.06 (4.11)	4.06 (4.14)	0.653
<i>Business performance</i>	4.11 (4.09)	5.08 (5.24)	4.92 (4.97)	0.218
Product innovation performance	4.35 (4.33)	5.04 (5.33)	4.75 (4.50)	0.066
Process innovation performance	4.61 (4.50)	5.43 (5.70)	5.02 (4.80)	0.023
<i>Innovation performance</i>	4.40 (4.31)	5.12 (5.16)	4.76 (4.54)	0.035

Note(s): Mean and median values (between parentheses) are presented; *significance based on Mann–Whitney *U* tests ($p < 0.05$)

Table 8.
Comparison between
different types of
supply chain fit

performance, the efforts of companies to achieve SC fit is rewarded, independent of the level of SDU that characterizes their SC environment. That is, companies competing in environments with lower levels of uncertainty (low SDU) have similar possibilities of being successful than those companies in more dynamic environments (high SDU). This does not, in this case, support the theoretical assumption that uncertainty is more related to more opportunities, leading to superior performance. These results are in line with the findings of Selldin and Olhager (2007) and Hallavo (2015) and can be explained by both CT and the RBV in the sense that companies must match their practices, strategies and resources with their specific contextual requirements.

The results support H2.1, i.e. high–high SC fit is more beneficial to innovation performance than low–low SC fit ($p = 0.035$; $p < 0.05$). The two groups, high–high and low–low, perform above the total mean value in both product (16% and 9%, respectively) and process innovation (18% and 9%). However, when it comes to innovation, the results indicate that companies competing in more uncertain environments perform better than companies in more stable environments. These results support the findings of previous studies (Sheng, 2017; Pérez-de-Lema *et al.*, 2019) that companies respond to uncertain, turbulent, dynamic and complex environments by investing efforts and resources to be more innovative, even for the sake of survival. The allocation of efforts and resources based on market needs can once again be explained by CT and the RBV.

The results presented in Table 9 indicate that the two groups of companies, with positive and negative misfit, present performance below the mean values of all companies in both business and innovation performance. Regarding business performance, economic and productivity, and commercial performance present slightly inferior levels in the positive misfit group (–8% and –6% in comparison with the general mean) than in the negative misfit group (–6% and –4%). Thus, the results ($p = 0.277$; $p > 0.05$) do not support H1.2, that is to say a positive misfit is less detrimental to business performance than a negative misfit. On the contrary, the results indicate that there is evidence that companies with a negative misfit show better results than companies with a positive misfit. However, the differences between the two groups (–2% and –3%) and the significance of the statistical tests ($p = 0.277$) are not significant to support H1.2. One possible interpretation of the results is that the lack of fit between SDU and SCR tends to be detrimental to business performance, regardless of the level of uncertainty of the environment.

The results do not support H2.2, that is to say a misfit between high SDU and low SCR leads to better innovation performance than a misfit between low SDU and high SCR ($p = 0.098$; $p > 0.05$). As well as in business performance, companies with positive and negative misfit perform below the mean value in both product (–6% and –3%) and process innovation (–5% and –3%). Although the results indicate that companies with a negative

	Total ($n = 150$)	Positive misfit ($n = 16$)	Negative misfit ($n = 103$)	p -value (*)
Economic and productivity performance	4.73 (4.58)	4.33 (4.26)	4.43 (4.41)	0.246
Commercial performance	3.49 (3.63)	3.27 (3.30)	3.36 (3.43)	0.324
<i>Business performance</i>	4.11 (4.09)	3.79 (3.71)	3.89 (3.88)	0.277
Product innovation performance	4.35 (4.33)	4.07 (4.00)	4.24 (4.33)	0.066
Process innovation Performance	4.61 (4.50)	4.39 (4.25)	4.47 (4.40)	0.122
<i>Innovation performance</i>	4.40 (4.31)	4.17 (4.01)	4.28 (4.23)	0.098

Note(s): Mean and median values (between parentheses) are presented; *significance based on Mann–Whitney U tests ($p < 0.05$)

Table 9. Comparison between different types of misfit

misfit have superior performance in product and process innovation comparative to companies with a positive misfit, the differences (−4% and −2%) are not statistically significant. Nevertheless, it is worth pointing out that the superior performance of companies with a negative misfit, especially in product innovation performance ($p = 0.066$; $p > 0.05$), can be explained by the high levels of uncertainty faced by this group, where innovation, rather than being a matter of performance, is a matter of survival.

The poorer performance of the companies that present misfit in contrast with those with SC fit can be analyzed and explained by CT and the RBV as these companies tend to make worse decisions when deploying their resources and defining their strategies.

6. Conclusions

The aim of this paper was to analyze and discuss the effects of SC fit on business and innovation performance using data gathered from Brazilian manufacturing companies. The paper was designed with the underlying logic of replicating and extending previous studies, thus possibly contributing to increase the generalizability of previous findings and to advance knowledge by including new elements and approaches to the topic. As discussed before, SC fit has been assessed in a variety of ways in the literature and different results have been reported regarding the effects of the alignment between environment characteristic and SC strategies. This study contributes to enriching this discussion, providing new evidence and adding to the knowledge on the relationship between SC fit and performance.

Most of the previous studies have analyzed the effect of SC fit on financial performance, while the present paper analyzes the effect of SC fit on business and innovation performance. This study compares the effects of two types of fit and two types of misfit on performance, which has not, so far, been done in previous research. Moreover, the replication (and extension) of previous studies in Brazil, an arguably under-researched developing country, also contributes to advancing knowledge in the field by increasing the generalizability, validity and relevance of the previous findings.

A total of six hypotheses were developed, tested and discussed. The results supported [hypotheses 1](#) and [2](#), that is to say SC fit is positively related to business and innovation performance, and [hypothesis 2.1](#), that is to say high–high fit leads to better innovation performance than low–low fit. On the other hand, the analyses carried out did not support [hypotheses 1.1](#), concerning the different effects of high–high and low–low SC fit on business performance, as well as [1.2](#) and [2.2](#), related to the comparison between the business and innovation performance of companies presenting positive and negative misfit.

The results indicated that SC fit has a positive effect on both business and innovation performance ([H1](#) and [H2](#), respectively), supporting and extending the assumption that SC fit has positive impacts on performance. Our results suggested that companies need to understand the context where they compete, the characteristics of the demand and supply of their products/markets and the characteristics and capabilities of their SCs. This is important in order to be able to analyze the trade-offs between SC efficiency and responsiveness carefully and to make the right decisions when it comes to their own SC strategies and practices. By doing this, companies may be rewarded with improved performance in their economic and productivity, commercial or innovation (product and process) results. These findings indicate that even in scenarios with higher levels of uncertainty, which is what Brazilian companies have notoriously been facing in the last few years, the pursuit of a better fit between SC environmental features and internal practices tends to be compensated.

The effects of two types of SC fit on business ([H1.1](#)) and innovation performance ([H2.1](#)) were analyzed and compared. Within the group of companies that show an SC fit, those with high levels of SDU and SCR present what is called a high–high SC fit, while those with low levels of SDU and SCR present a low–low SC fit. The results did not indicate statistically

significant differences between the business performance of the two groups, confirming that achieving SC fit has positive effects on the business performance of companies, independent of the levels of uncertainty and responsiveness. The results confirmed, only at a significance level of 10%, that high–high SC fit is more beneficial to innovation performance than low–low SC fit, suggesting that companies tend to respond to uncertainty by investing efforts in innovation, which is reflected in superior performance.

The achievement of SC fit is a difficult and challenging task, which is evident by the fact that most of the companies analyzed are positioned in the misfit zones, which is in line with previous studies. Among these companies, most of them have lower levels of SDU and higher levels of SCR (negative misfit), meaning that these companies have developed an exaggerated response to the level of uncertainty they face. The other companies (with positive misfit) act in uncertain environments and adopt practices that are, theoretically, more suitable to stability. In order to get closer to the SC fit zone, these companies need to balance their levels of uncertainty and responsiveness. SDU reflects the characteristics of the market, the intrinsic nature of a company's products (e.g. life-cycle length and variants of the products) as well as its business and marketing strategies (e.g. number of locations where sales occur). On the other hand, SC responsiveness includes characteristics that are more manageable and can be changed in a relatively short time, such as building up buffer inventories of parts and finished goods and/or buffer capacity. Thus, it is advisable that companies that aspire to reach higher levels of SC fit should manage these processes in order to adapt their strategies to the requirements of their products and markets. In our sample, among the group of companies with negative misfit, the constructs with higher mean values, that is, those that contribute the most to increasing SC responsiveness are SCR2 (buffer inventory of parts or finished goods) and SCR4 (respond quickly to unpredictable demand). These companies should consider reducing their efforts/investments related to those processes (e.g. increasing buffer capacity) in order to balance their practices to the actual needs. The comparison between the performance of both groups (positive and negative misfit) did not show significant differences, indicating that the mismatch between SDU and SCR tends to be detrimental to performance, no matter the level of uncertainty of the environments where companies compete. However, it is worth pointing out that the results seem to show a tendency (not confirmed statistically) that companies with a negative misfit present better business and innovation performance (especially product innovation) than companies with a positive misfit.

CT and the RBV supported the development of the hypotheses and the analyses of the results as both have been applied in SCM research, as well as in the study of different kinds of strategic fit in recent years. The two theories were used in a complementary way, as CT suggests that the context and structure of companies must be harmonized in order to favor performance, while the RBV supports the concept that the resources and capabilities of companies are the key sources for them to obtain sustained competitive advantage.

Besides the theoretical contributions previously discussed, this paper also presents a variety of managerial implications. Companies need to understand their context profoundly and adopt the appropriate SC practices and strategies to achieve superior performance. The results can be used to help managers in the challenging quest for SC fit as it demonstrates the effects of their choices on performance.

While making significant contributions to SCM literature and having important implications in terms of theory and practice, some limitations and opportunities for future studies can be highlighted. The limited sample size means that any generalization of the conclusions should be made cautiously. Complementarily, in terms of the geographic coverage of the sample, at the same time that the focus on companies from Brazil represents a contribution and opens new avenues for research in order to confirm that the conclusions made in the developed world also hold in broader geographic spheres, it can also be seen as a

limitation of the study. Future research studies using data from different countries could add to the discussion. Moreover, future research studies could analyze the mediation and/or moderation effects of other constructs, such as innovation capabilities and SC governance, on the relationship between SC fit and performance.

Note

1. Incremental fit, Tucker–Lewis and comparative fit indexes (good models > 0.90); root mean square error of approximation (good models < 0.06) (Hu and Bentler, 1995).

References

- Acur, N., Kandemir, D. and Boer, H. (2012), "Strategic alignment and new product development: drivers and performance effects", *Journal of Product Innovation Management*, Vol. 29 No. 2, pp. 304-318.
- Aldrich, H.E. (1979), *Organizations and Environments*, Prentice-Hall, Englewood Cliffs.
- Alegre, J. and Chiva, R. (2013), "Linking entrepreneurial orientation and firm performance: the role of organizational learning capability and innovation performance", *Journal of Small Business Management*, Vol. 51 No. 4, pp. 315-326.
- Barney, J. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99-120.
- Bagozzi, R. and Yi, Y. (1998), "On the evaluation of structural equation models", *Journal of the Academy of Marketing Science*, Vol. 16, pp. 74-94.
- Batista, L., Gong, Y., Pereira, S., Jia, F. and Bittar, A. (2019), "Circular supply chains in emerging economies – a comparative study of packaging recovery ecosystems in China and Brazil", *International Journal of Production Research*, Vol. 57 No. 23, pp. 7248-7268.
- Block, J. and Kuckertz, A. (2018), "Seven principles of effective replication studies: strengthening the evidence base of management research", *Management Review Quarterly*, Vol. 68, pp. 355-359.
- Chahal, H., Gupta, M., Bhan, N. and Cheng, T.C.E. (2020), "Operations management research grounded in the resource-based view: a meta-analysis", *International Journal of Production Economics*, Vol. 230, p. 107805.
- Cheng, J.H., Chen, M.C. and Huang, C.M. (2014), "Assessing inter-organizational innovation performance through relational governance and dynamic capabilities in supply chains", *Supply Chain Management-an International Journal*, Vol. 19 No. 2, pp. 173-186.
- Chi, T., Kilduff, P. and Gargeya, V. (2009), "Alignment between business environment characteristics, competitive priorities, supply chain structures, and firm business performance", *International Journal of Productivity and Performance Management*, Vol. 58 No. 7, pp. 645-669.
- Chopra, S. and Meindl, P. (2010), *Supply Chain Management: Strategy, Planning, and Operation*, 4th ed., Pearson Education, Inc., Upper Saddle River, NJ.
- Christopher, M. (2000), "The agile supply chain: competing in volatile markets", *Industrial Marketing Management*, Vol. 29 No. 1, pp. 37-44.
- Craighead, C.W., Ketchen, D.J., Dunn, K.S. and Hult, G.T.M. (2011), "Addressing common method variance: guidelines for survey research on information technology, operations, and supply chain management", *IEEE Transactions on Engineering Management*, Vol. 58 No. 3, pp. 578-588.
- Dess, G.G. and Beard, D.W. (1984), "Dimensions of organizational task environments", *Administrative Science Quarterly*, Vol. 29 No. 1, pp. 52-73.
- Drazin, R. and Van de Ven, A.H. (1985), "Alternative forms of fit in contingency theory", *Administrative Science Quarterly*, Vol. 30, pp. 514-539.
- Esper, T.L., Ellinger, A.E., Stank, T.P., Flint, D.J. and Moon, M. (2010), "Demand and supply integration: a conceptual framework of value creation through knowledge management", *Journal of the Academic Marketing Science*, Vol. 38, pp. 5-18.

- Fawcett, S.E., Jones, S.L. and Fawcett, A.M. (2012), "Supply chain trust: the catalyst for collaborative innovation", *Business Horizons*, Vol. 55 No. 2, pp. 163-178.
- Fisher, M.L. (1997), "What is the right supply chain for your product?", *Harvard Business Review*, Vol. 75 No. 2, pp. 105-126.
- Flynn, B., Koufteros, X. and Lu, G. (2016), "On theory in supply chain uncertainty and its implications for supply chain integration", *Journal of Supply Chain Management*, Vol. 52 No. 3, pp. 1-46.
- Flynn, B., Pagell, M. and Fugate, B. (2018), "Editorial: survey research design in supply chain management: the need for evolution in our expectations", *Journal of Supply Chain Management*, Vol. 54 No. 1, pp. 1-15.
- Fornell, C. and Larcker, D. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.
- Franco-Santos, M., Kennerley, M., Micheli, P., Martinez, V., Mason, S., Marr, B., Gray, D. and Neely, A. (2007), "Towards a definition of a business performance measurement system", *International Journal of Operations and Production Management*, Vol. 27 No. 8, pp. 784-801.
- Frank, A.G., Cortimiglia, M.N., Ribeiro, L.D. and Oliveira, L.S. (2016), "The effect of innovation activities on innovation outputs in the Brazilian industry: market-orientation vs. technology-acquisition strategies", *Research Policy*, Vol. 45, pp. 577-592.
- Gligor, D.M. (2016), "The role of supply chain agility in achieving supply chain fit", *Decision Sciences*, Vol. 47 No. 3, pp. 524-553.
- Gligor, D.M. (2017), "Re-examining supply chain fit: an assessment of moderating factors", *Journal of Business Logistics*, Vol. 38 No. 4, pp. 253-265.
- Goldsby, T.J. and Autry, C.W. (2011), "Toward greater validation of supply chain management theory and concepts: the roles of research replication and meta-analysis", *Journal of Business Logistics*, Vol. 32 No. 4, pp. 324-331.
- Gonzalez-Benito, J. (2007), "A theory of purchasing's contribution to business performance", *Journal of Operations Management*, Vol. 25 No. 4, pp. 901-917.
- Grotsch, V.M., Blome, C. and Schleper, M.C. (2013), "Antecedents of proactive supply chain risk management a contingency theory perspective", *International Journal of Production Research*, Vol. 51 No. 10, pp. 2842-2867.
- Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2010), *Multivariate Data Analysis: A Global Perspective*, 7 ed., Pearson Education, Upper Saddle River, NJ.
- Hallavo, V. (2015), "Superior performance through supply chain fit: asynthesis", *Supply Chain Management: An International Journal*, Vol. 20 No. 1, pp. 71-82.
- Hong, P., Doll, W.J., Revilla, E. and Nahm, A.Y. (2011), "Knowledge sharing and strategic fit in integrated product development projects: an empirical study", *International Journal of Production Economics*, Vol. 132, pp. 186-196.
- Hu, L.T. and Bentler, P. (1995), "Evaluating model fit", in Hoyle, R.H. (Ed.), *Structural Equation Modeling. Concepts, Issues, and Applications*, Sage, London, pp. 76-99.
- Jaafar, H. and Rafiq, M. (2005), "Customers' perceptions of service quality by TPL service providers in the United Kingdom - a confirmatory factor Analysis", in Kotzab, H., Seuring, S., Müller, M. and Reiner, G. (Eds), *Research Methodologies in Supply Chain Management - in Collaboration With Magnus Westhaus*, Physica-Verlag, Heidelberg, p. 187.
- Juttner, U., Christopher, M. and Baker, S. (2007), "Demand chain management-integrating marketing and supply chain management", *Industrial Marketing Management*, Vol. 36, pp. 377-392.
- Kharlamov, A., Ferreira, L. and Godsell, J. (2020), "Developing a framework to support strategic supply chain segmentation decisions: a case study", *Production Planning and Control*, Vol. ahead of print No. ahead of print, doi: [10.1080/09537287.2019.1707896](https://doi.org/10.1080/09537287.2019.1707896).
- Krause, D., Luzzini, D. and Lawson, B. (2018), "Building the case for a single key informant in supply chain management survey research", *Journal of Supply Chain Management*, Vol. 54 No. 1, pp. 42-50.

- Lam, L.W. (2012), "Impact of competitiveness on salespeople's commitment and performance", *Journal of Business Research*, Vol. 65, pp. 1328-1334.
- Laosirihongthong, T., Prajogo, D. and Adebanjo, I.D. (2014), "The relationships between firm's strategy, resources and innovation performance: resources-based view perspective", *Production Planning and Control*, Vol. 25 No. 15, pp. 1231-1246.
- Lee, H.L. (2002), "Aligning supply chain strategies with product uncertainties", *California Management Review*, Vol. 44 No. 3, pp. 105-119.
- Li, D. and O'Brien, C. (2001), "A quantitative analysis of relationships between product types and supply chain strategies", *International Journal of Production Economics*, Vol. 73, pp. 29-39.
- Lo, S.M. and Power, D. (2010), "An empirical investigation of the relationship between product nature and supply chain strategy", *Supply Chain Management: An International Journal*, Vol. 15 No. 2, pp. 139-153.
- Luo, B.N. and Yu, K. (2016), "Fits and misfits of supply chain flexibility to environmental uncertainty: two types of asymmetric effects on performance", *The International Journal of Logistics Management*, Vol. 27 No. 3, pp. 862-885.
- McAdam, R. and Bailie, B. (2002), "Business performance measures and alignment impact on strategy - the role of business improvement models", *International Journal of Operations and Production Management*, Vol. 22 Nos 9-10, pp. 972-996.
- Menguc, B. and Auh, S. and Yannopoulos, P. (2014), "Customer and supplier involvement in design: the moderating role of incremental and radical innovation capability", *Journal of Product Innovation Management*, Vol. 31 No. 2, pp. 313-328.
- Mentzer, J.T. and Flint, D.J. (1997), "Validity in logistics research", *Journal of Business Research*, Vol. 18 No. 1, pp. 199-216.
- Merschmann, U. and Thonemann, U.W. (2011), "Supply chain flexibility, uncertainty and firm performance: An empirical analysis of German manufacturing firms", *International Journal of Production Economic*, Vol. 130, pp. 43-53.
- Morgan, R.E. and Strong, C.A. (2003), "Business performance and dimensions of strategic orientation", *Journal of Business Research*, Vol. 56 No. 3, pp. 163-176.
- Morita, M., Machuca, J., Flynn, E. and Pérez de los Ríos, J.L. (2015), "Aligning product characteristics and the supply chain process – a normative perspective", *International Journal of Production Economics*, Vol. 161, pp. 228-241.
- Nakano, M. (2015), "Exploratory analysis on the relationship between strategy and structure/processes in supply chains using the strategy-structure-processes-performance paradigm", *International Journal of Logistics Management*, Vol. 26 No. 2, pp. 381-400.
- Narasimhan, R. and Narayanan, S. (2013), "Perspectives on supply network-enabled innovations", *Journal of Supply Chain Management*, Vol. 49 No. 4, pp. 27-42.
- OECD and Eurostat (2005), *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, Organisation for Economic Co-operation and Development and European Statistical Office (Eurostat), Paris.
- Peng, D.X. and Lai, F.J. (2012), "Using partial least squares in operations management research: a practical guideline and summary of past research", *Journal of Operations Management*, Vol. 30 No. 6, pp. 467-480.
- Pérez-de-Lema, D.G., Hansen, P.B., Madrid-Gujjarro, A. and Silva-Santos, J.L. (2019), "Influence of the business environment in the dynamics of innovation and in the performance of SMEs", *International Journal of Innovation Management*, Vol. 23 No. 5, p. 1950044.
- Prajogo, D., Mena, C. and Nair, A. (2018), "The fit between supply chain strategies and practices: a contingency approach and comparative analysis", *IEEE Transactions on Engineering Management*, Vol. 65 No. 1, pp. 168-180.

- Qi, Y., Boyer, K.K. and Zhao, X. (2009), "Supply chain strategy, product characteristics, and performance impact: evidence from Chinese manufacturers", *Decision Sciences*, Vol. 40 No. 4, pp. 667-695.
- Rauch, A., Wiklund, J., Lumpkin, G. and Frese, M. (2009), "Entrepreneurial orientation and business performance: an assessment of past research and suggestions for the future", *Entrepreneurship: Theory and Practice*, Vol. 33 No. 3, pp. 761-787.
- Sabri, Y. (2019), "In pursuit of supply chain fit", *The International Journal of Logistics Management*, Vol. 30 No. 3, pp. 821-844.
- Seldin, E. and Olhager, J. (2007), "Linking products with supply chains: testing Fisher's model", *Supply Chain Management: An International Journal*, Vol. 12 No. 1, pp. 42-51.
- Sheng, M. (2017), "A dynamic capabilities-based framework of organizational sense making through combinative capabilities towards exploratory and exploitative product innovation in turbulent environments", *Industrial Marketing Management*, Vol. 65, pp. 28-38.
- Sjoerdsma, M. and van Weele, A.J. (2015), "Managing supplier relationships in a new product development context", *Journal of Purchasing and Supply Management*, Vol. 21 No. 3, pp. 192-203.
- Sousa, R. and Voss, C.A. (2008), "Contingency research in operations management practices", *Journal of Operations Management*, Vol. 26 No. 6, pp. 697-713.
- Stentoft, J. and Rajkumar, C. (2018), "Does supply chain innovation pay off?", in Moreira, A.C., Ferreira, L.M.D.F. and Zimmermann, R. (Eds), *Innovation and Supply Chain Management - Relationship, Collaboration and Strategies*, Springer, Cham, p. 343.
- Svanberg, M. (2020), "Guidelines for establishing practical relevance in logistics and supply chain management research", *International Journal of Physical Distribution and Logistics Management*, Vol. 50 No. 2, pp. 215-232.
- United Nations Statistics Division (2020), "Population, surface area and density", available at: <https://unstats.un.org/home/>.
- van Weele, A.J. and van Raaij, E.M. (2014), "The future of purchasing and supply management research: about relevance and rigor", *Journal of Supply Chain Management*, Vol. 50 No. 1, pp. 56-72.
- Venkatraman, N. (1989), "The concept of fit in strategy research - toward verbal and statistical correspondence", *Academy of Management Review*, Vol. 14 No. 3, pp. 423-444.
- von Falkenhausen, Fleischmann, M. and Bode, C. (2019), "How to find the right supply chain strategy? An analysis of contingency variables", *Decision Science*, Vol. 504, pp. 726-755.
- Wagner, S.M., Grosse-Ruyken, P. and Erhun, T.F. (2012), "The link between supply chain fit and financial performance of the firm", *Journal of Operations Management*, Vol. 30 No. 4, pp. 340-353.
- Wanke, P. and Correa, H.L. (2012), "Supply chain management and logistics complexity: a contingency approach", *International Journal of Logistics Economics and Globalisation*, Vol. 4 No. 4, pp. 239-271.
- Wong, C., Skipworth, H., Godsell, J. and Achimugu, N. (2012), "Towards a theory of supply chain alignment enablers: asystematic literature review", *Supply Chain Management-an International Journal*, Vol. 17 No. 4, pp. 419-437.
- World Bank (2020), "The World Bank in Brazil", available at: <https://www.worldbank.org/pt/country/brazil>.
- Wu, T., Wu, Y.-C.J., Chen, Y.J. and Goh, M. (2014), "Aligning supply chain strategy with corporate environmental strategy: a contingency approach", *International Journal of Production Economics*, Vol. 147, pp. 220-229.
- Yan, T.T. and Azadegan, A. (2017), "Comparing inter-organizational new product development strategies: buy or ally; supply-chain or non-supply-chain partners?", *International Journal of Production Economics*, Vol. 183, pp. 21-38.

- You, F. and Grossmann, I. (2008), "Design of responsive supply chains under demand uncertainty", *Computers and Chemical Engineering*, Vol. 32, pp. 3090-3111.
- Zhao, X.D., Flynn, B.B. and Roth, A.V. (2007), "Decision sciences research in China: current status, opportunities, and propositions for research in supply chain management, logistics, and quality management", *Decision Sciences*, Vol. 38 No. 1, pp. 39-80.
- Zimmermann, R., Ferreira, L. and Moreira, A.C. (2016), "The influence of supply chain on the innovation process: a systematic literature review", *Supply Chain Management-an International Journal*, Vol. 21 No. 3, pp. 289-304.
- Zimmermann, R., Ferreira, L. and Moreira, A.C. (2019), "Strategic fit between innovation strategies and supply chain strategies: a conceptual study", *International Journal of Value Chain Management*, Vol. 10 No. 3, pp. 258-273.
- Zimmermann, R., Ferreira, L. and Moreira, A.C. (2020), "An empirical analysis of the relationship between supply chain strategies, product characteristics, environmental uncertainty and performance", *Supply Chain Management-an International Journal*, Vol. 25 No. 3, pp. 375-391.

Appendix

Table A1.
The factor analysis for supply chain fit

	SCR eigenvalue = 2.66; Cronbach's alpha = 0.768	SDU eigenvalue = 2.63; Cronbach's alpha = 0.765
SDU1	<i>0.756</i>	0.004
SDU2	<i>0.770</i>	-0.015
SDU3	<i>0.754</i>	0.076
SDU4	<i>0.619</i>	0.204
SDU5	<i>0.659</i>	0.172
SCR1	0.232	<i>0.537</i>
SCR2	-0.084	<i>0.719</i>
SCR3	0.156	<i>0.733</i>
SCR4	0.025	<i>0.791</i>
SCR5	0.135	<i>0.763</i>

Note(s): Numbers greater than 0.50 are presented in italic

Table A2.
The factor analysis for business performance

	Commercial eigenvalue = 2.77; Cronbach's alpha = 0.813	Economic and productivity eigenvalue = 2.23; Cronbach's alpha = 0.787
DC1	<i>0.630</i>	0.275
DC2	<i>0.840</i>	0.229
DC3	<i>0.771</i>	0.212
DC4	<i>0.715</i>	0.154
DC5	<i>0.621</i>	0.334
DF1	0.241	<i>0.858</i>
DF2	0.253	<i>0.851</i>
DF3	0.239	<i>0.678</i>

Note(s): Numbers greater than 0.50 are presented in italic

	Process eigenvalue = 4.28; Cronbach's alpha = 0.832	Product eigenvalue = 3.30; Cronbach's alpha = 0.892
DIPT1	0.344	<i>0.664</i>
DIPT2	0.227	<i>0.781</i>
DIPT3	-0.025	<i>0.647</i>
DIPT4	0.075	<i>0.723</i>
DIPT5	0.015	<i>0.634</i>
DIPT6	0.254	<i>0.742</i>
DIPS1	<i>0.544</i>	0.294
DIPS2	<i>0.795</i>	0.021
DIPS3	<i>0.819</i>	0.029
DIPS4	<i>0.786</i>	0.123
DIPS5	<i>0.851</i>	0.092
DIPS6	<i>0.706</i>	0.230
DIPS7	<i>0.684</i>	0.216
DIPS8*	NA	NA
DIPS9*	NA	NA
DIPS10*	NA	NA

Note(s): Numbers greater than 0.50 are presented in italic; *items excluded from the final construct due to high cross loadings (above 0.40)

Table A3.
The factor analysis for
innovation
performance

Corresponding author

Ricardo Zimmermann can be contacted at: ricardo.a.zimmermann@inesctec.pt