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**WHEN SUPPLY CHAINS ARE DIGITALIZED:  
EXAMINING STRUCTURES, RESOURCES AND  
INTER-ORGANIZATIONAL INTEGRATION  
THROUGH DIGITAL TRANSFORMATION**

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When supply chains are digitalized: examining structures, resources and inter-organizational integration through digital transformation

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*“Is the theory which decides  
what we can observe.”  
Albert Einstein*

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## RESUMO

A literatura reconhece que uma cadeia de suprimentos integrada pode melhorar a eficiência, aumentar a visibilidade e reduzir custos. No entanto, alcançar a integração pode ser um desafio devido à complexidade das redes da cadeia de suprimentos, diferentes fontes de dados e à necessidade de colaboração entre diferentes atores. Tecnologias digitais como inteligência artificial, *Internet* das Coisas (*IoT*) e computação em nuvem podem ajudar a superar esses desafios. Entretanto, ainda requer um planejamento cuidadoso e a colaboração das partes interessadas. Portanto, esta tese analisa a estrutura de uma cadeia de suprimentos para integrar as atividades externas e internas, os recursos necessários para realizar a integração digital e como ocorrem as relações interorganizacionais em uma integração digital da cadeia de suprimentos. Para realizar essas análises, primeiro a tese investiga, a partir das teorias da Contingência e Configuracional, se o setor de compras é uma importante área da empresa para conectar as atividades externas com as internas de uma cadeia de suprimentos. Como resultado, foi encontrado que a configuração dos processos de compras de uma empresa afeta diretamente o seu desempenho, e que a gestão de conhecimento possui um papel importante nessa configuração. Na sequência, examina, por meio da teoria do Paradoxo, se as empresas precisam lidar com um paradoxo em relação aos recursos que permitem a transformação digital na sua cadeia de suprimentos. As descobertas sugerem que existe um paradoxo entre criar seus próprios recursos digitais e comprá-los, e que as empresas devem aceitar e conviver com esse paradoxo, gerenciando as contradições e usando ambos os recursos digitais para alcançar uma melhor integração da cadeia de suprimentos. Por fim, explora, a partir das lentes teóricas da teoria da Troca Social e da estrutura Tecnologia-Organizacional-Ambiente, como ocorrem as relações entre os parceiros da cadeia de suprimentos ao se integrarem digitalmente. Como resultado, apresenta-se uma estrutura final que mostra ações necessárias para garantir recompensas a partir da integração digital da cadeia de suprimentos. Portanto, esta tese traz luz à literatura importantes questões sobre a integração das cadeias de suprimentos por meio de tecnologias digitais, examinando estruturas, recursos e relações interorganizacionais, além de fornecer *insights* para gerentes e formuladores de políticas públicas.

**Palavras-chave:** Integração da cadeia de suprimentos. Transformação digital. Desempenho da empresa.

## ABSTRACT

The literature recognizes that an integrated supply chain can improve efficiency, increase visibility and reduce costs. However, achieving integration can be challenging due to the complexity of supply chain networks, diverse data sources and the need for collaboration between different actors. Digital technologies such as artificial intelligence, the Internet of Things (IoT) and cloud computing can help overcome these challenges. However, it still requires careful planning and stakeholder collaboration. Therefore, this thesis analyzes the structure of a supply chain to integrate external and internal activities, the resources needed to carry out digital integration and how inter-organizational relationships occur in a digital supply chain integration. To carry out these analyses, the thesis first investigates, based on Contingency and Configurational theories, whether the purchasing sector is an important company area to connect external activities with internal ones in a supply chain. As a result, it was found that the configuration of a company's purchasing processes directly affects its performance and that knowledge management plays an important role in this configuration. Next, it examines, through the theory of Paradox, whether companies need to deal with a paradox concerning the resources that allow digital transformation in their supply chain. The findings suggest a paradox exists between creating their own digital assets and buying them. Companies must accept and live with this paradox, managing the contradictions and using both digital assets to achieve better supply chain integration. Finally, it explores how the relationships between supply chain partners occur when digitally integrated from the theoretical lens of Social Exchange theory and the Technology-Organizational-Environment structure. As a result, a final structure is presented that shows actions needed to ensure rewards from the digital integration of the supply chain. Therefore, this thesis sheds light on important issues in the literature about integrating supply chains through digital technologies, examining structures, resources and inter-organizational relationships, and providing insights for managers and public policymakers.

**Key words:** Supply chain integration. Digital transformation. Firm performance.

## LISTA DE FIGURAS

Figure 2.1- Conceptual research model.....	35
Figure 2.2- Slope for the moderating role of knowledge management (KNOWLEDGE) on Customer vs Purchasing Assessment Management.....	47
Figure 5.1- Relationship among the three articles of the thesis.....	67

## LISTA DE TABELAS

Table 1.1 Structure of the research development.....	17
Table 2.1 Sample composition .....	36
Table 2.2 Results of confirmatory factor analysis .....	38
Table 2.3 Results of the regression analysis(a).....	45
Table 2.4 Indirect effects (bootstrapping outcome) .....	46
Table 2.5 K-means cluster analysis and firm performance across the clusters profile .....	48

# SUMÁRIO

<b>1 INTRODUCTION.....</b>	<b>12</b>
1.1 Theme and Objectives.....	14
1.2 Justification of the research problem .....	14
1.3 Research structure.....	16
1.3.1 Research method.....	16
1.3.2 Research design .....	16
1.4 Limitations .....	19
1.5 Thesis structure.....	20
References .....	20
<b>2 PAPER 1 - A CONTINGENCY-CONFIGURATIONAL VIEW OF PURCHASING OPERATIONS: THE MEDIATING ROLE BETWEEN SUPPLIER RELATIONSHIP AND FIRM PERFORMANCE .....</b>	<b>24</b>
2.1 Introduction .....	25
2.2 A contingency-configurational view of Purchasing Operations.....	27
2.3 Hypotheses development .....	29
2.3.1 The mediating role of purchasing operations .....	29
2.3.2 The moderating role of knowledge management activities in purchasing operations .....	32
2.3.3 Purchasing operations patterns on performance .....	34
2.3.4 Conceptual research model .....	34
2.4 Research method.....	35
2.4.1 Sampling .....	35
2.4.2 Measures and survey instrument .....	36
2.4.3 Reliability and validity of measures .....	38
2.4.4 Response bias and common method variance .....	40
2.4.5 Endogeneity.....	40
2.4.6 Data analysis .....	41
2.5 Results.....	43
2.6 Discussion and conclusion .....	48
2.6.1 Theoretical contribution.....	51
2.6.2 Managerial and practical implications .....	52

2.6.3 Limitations and future research .....	53
References .....	54
Appendix A: Questionnaire.....	61
Appendix B: Rotated matrix of the Exploratory Factor Analysis (Varimax Rotation).....	63
Appendix C: Bivariate correlation matrix .....	64
<b>3 PAPER 2 - MANAGING PARADOXES FOR DIGITAL TRANSFORMATION IN SUPPLY CHAIN INTEGRATION.....</b>	<b>65</b>
<b>4. PAPER 3 - WHEN SUPPLY CHAINS ARE DIGITALIZED: EXAMINING THE SOCIAL EXCHANGE STRUCTURE BEHIND THE INTER-ORGANIZATIONAL INTEGRATION THROUGH DIGITAL TRANSFORMATION .....</b>	<b>66</b>
<b>5. FINALS CONSIDERATIONS.....</b>	<b>67</b>
5.1. Theoretical contributions .....	68
5.2. Practical contributions .....	69

# 1 INTRODUCTION

Different studies have shown that it is increasingly necessary for the supply chains (SC) to be more integrated and operate better in the face of market uncertainties and turbulence (Wong, Boon-Itt and Wong, 2011a; Ataseven and Nair, 2017). Improved connectivity between suppliers and customers within SC offers enhanced flexibility, rapid response to market demands, and other benefits culminating in high company performance (Flynn, Huo and Zhao, 2010). Recent studies have shown that digital transformation (DT) is an important way to achieve this since technology and data analytics can create a comprehensive and real-time view of the supply chain (Frederico et al., 2020; Zekhnini et al., 2021). For example, a retail business can implement a cloud-based inventory management system through digital transformation, enabling seamless communication with suppliers and real-time visibility of stock levels.

DT refers to incorporating Industry 4.0 technologies into operations management activities, fundamentally changing how the business operates and delivering value to stakeholders (Nadkarni and Prügl, 2020). Incorporating digital technologies into supply chain processes can result in a more efficient and transparent supply chain, enhancing operational performance in turbulent environments (Enrique et al., 2022). Several digital tools, including the Internet of Things (IoT), Big Data, Cloud Computing, and artificial intelligence, have been proposed to increase integration in the supply chain (Wu et al., 2016; Frank, Dalenogare and Ayala, 2019). Nevertheless, achieving high performance in supply chain integration through DT entails much more than merely utilizing digital technologies since it involves several challenges that can significantly affect the successful implementation of digital solutions.

Despite progress in studying DT within SC, numerous challenges remain. The main obstacle arises from the complexity of managing and implementing DT within SC, necessitating a greater and deeper understanding of supply chain integration (SCI) (Volberda et al., 2021). This is because the successful DT implementation mandates robust collaboration among supply chain partners (Song, Shi and Song, 2021). Due to this, it is necessary to integrate actors involved in the SC and a clear understanding of the interface operations (purchasing operations) between their external and internal processes. Some studies only look at the internal, while others only look at the external (Benitez et al., 2022; Elia et al., 2021). As in modern business, competition is no longer between organizations, but among supply chains (Wu et al., 2014), companies must know which area is the interface between internal and external activities. And when it comes to information flow, purchasing is the area that makes this interface, as it collects production planning information and contacts suppliers to supply raw materials to production

without failures. Besides, a well-done purchasing operation still needs to be attentive to customers; that is, it requires purchasing knowledge management to make the suited purchases and improve this SC integration. There is a lot in the literature about purchasing strategies (Cavinato, 1999; Paulraj et al., 2006; Revilla & Knoppen, 2015) but not about operational purchasing processes. And for that reason, this is an important area of study for SC integration. It is worth noting that the SC processes are frequently carried out in silos rather than in an integrated manner, whereas DT requires an integrated process approach.

Moreover, there are challenges related to comprehending the management of digital resources, such as data security, scalability, and technological obsolescence. For example, the existing systems may not be compatible with modern technologies and require extensive reconfiguration to work with digital solutions. Besides, as supply chains become more digitized, they become more vulnerable to cyber-attacks (Creazza et al., 2022). Thus, companies can develop digital technologies internally or/and outsource them but must ensure good management of digital resources (Smith and Beretta, 2021). Acquiring external digital resources can be cost-cutting and a strategy, as Relational View Theory observes (Dyer and Singh's 1998). However, developing the digital resource internally can elevate the competitive advantage as viewed by the Resource-based view theory (Barney, 1991). Therefore, companies must understand whether managing these digital resources is a dilemma of choosing a digital resource or facing a paradox that requires the proper management of digital resources with ambidexterity to obtain better operational performance.

In addition to these technological challenges, digital transformation in supply chains, specifically to make the integration between partners, also involves addressing several organizational and cultural opposition. Resistance to change is an issue that can affect the adoption of digital solutions, as employees may be hesitant to adopt new technologies or lack awareness about the benefits of digital transformation (Song, Shi and Song, 2021). Also, specialized digital skills are required to implement digital solutions, such as data analytics and software development, necessitating sweetening human resources (Dornelles, Ayala and Frank, 2022). Finally, a lack of trust issues within supply chain partners also affects the implementation of digital integration solutions (Mirkovski et al., 2019). Addressing these social challenges requires a comprehensive strategy considering technological, organizational, and environmental factors (TOE framework). Therefore, the Social Exchange Theory can be used within the TOE framework to understand how stakeholders' pursuit of value creation and rewards can influence their willingness and ability to implement DT to integrate the SC.

Accordingly, the present research investigates the integration of the SC through the DT within the lenses of processes, resources, and relationships among the actors to ascertain essential requirements for successful DT implementation.

Therefore, from a theoretical point of view, three research questions arise for the present thesis: *(i) What is the contribution of purchasing operations when companies manage their relationship with suppliers to improve firm performance? (ii) Should companies develop internal digital resources or acquire external digital resources for DT aiming at SCI? Can be these digital resources integrated as a paradox that require managing them with ambidexterity? (iii) How does the social exchange along the supply chain when digital integration is implemented?* Considering this, this thesis proposes to deepen SCI knowledge by closely examining these issues. As a final point, this thesis also offers managers and practitioners practical solutions to problems faced by companies.

### **1.1 Theme and Objectives**

The research field of this thesis concentrates on the intersection between Technology Management and Operations Management. The theme of this study focuses on the integration of supply chain management and the digital transformation of supply chains.

The general objective of this thesis is to explain how SC can be integrated through DT, considering processes, resources, and relationships. To achieve the general goal of this work, the following specific objectives are proposed:

- a) Understand the contribution of purchasing operations in SCI, as it is an interface area between SC's internal and external activities weakly studied in the literature.
- b) Understand how internal and external digital resources contribute to integrating the supply chain and how a company needs to manage them.
- c) Understand the social aspects of inter-organizational integration when digital transformation is implemented.

### **1.2 Justification of the research problem**

This dissertation focuses on SCI through Industry 4.0 technologies. This integration became especially important after the COVID-19 pandemic since it significantly impacted

supply chains worldwide, disrupting global trade and causing widespread disruptions in the flow of goods and services (Ivanov and Dolgui, 2020). This fact boosted the research on the topic since it has exposed vulnerabilities in global supply chains and highlighted the need for greater flexibility, resilience, and risk management.

In addition, the COVID-19 pandemic has not only affected the operations of organisations dramatically but also their endeavours to evolve digitally faster (Jones, Hutcheson and Camba, 2021). This necessity affected from education to manufacturing to created opportunities for innovation and adaptation in the face of adversity, exploring new ways to digitalise their operations. Technology is now seen as a strategic and necessary weapon that is expected to ensure operational performance and sustainability through process integration by creating smart factories (Shao *et al.*, 2021). The pandemic also taught companies that they would require digital technologies to be protected against any other possibility of supply chain disruption (Erboz, Yumurtacı Hüseyinoğlu and Szegedi, 2022). In this regard, digital technologies are particularly important, especially those associated with Industry 4.0, as they are implemented, visibility is enhanced, risks are minimised, and SCI capabilities are improved (Flynn, Huo and Zhao, 2010; Prajogo and Sohal, 2013). However, to fully reap the benefits of Industry 4.0, companies will have to utilise digital resources and capabilities to achieve a seamless flow and exchange of transparent and continuous information (Eslami *et al.*, 2021).

Although some studies about Industry 4.0 technologies are applied in the supply chain, there needs to be more in implementing these technologies, especially studies that explore which resources and capabilities are necessary to take advantage of technologies' benefits. Also, to integrate supply chains through digital transformation, the companies need to have capabilities to manage the interface between internal and external activities, such as purchasing operations configured; studies that explore these interface operations are limited in the literature. Moreover, the literature has studies that show the importance of Industry 4.0 technologies for supply chain performance. However, empirical studies about where these technologies come from, how companies need to manage them, and which capabilities companies must have to implement the DT and improve the supply chain operation performance still need to be completed in the literature. Finally, the relationship between companies in a supply chain is necessary to research to implement an integration between tiers. To understand the real dynamics of the interfaces between companies, customers, and suppliers when DT is implemented, aiming at integrating the parties is crucial and needs to be improved in the literature.

## **1.3 Research structure**

### **1.3.1 Research method**

The research developed in this thesis can be classified as mixed-method research (Castro et al., 2010) since it presents both qualitative and quantitative methods. According to Marconi and Lakatos (2010), the inductive method is a study in which the researcher concludes a general truth after considering enough cases; and the deductive method is the proposal and testing of hypotheses.

This thesis contains three articles, and each article can be classified as a different research approach. The first part of the thesis, the explanatory part (articles 1 and 2), can be classified as a deductive method since they are based on hypotheses tested using statistical techniques. Concerning the method applied, this part of the research is classified as a survey in the explanatory part, once quantitative data on the characteristics and opinions of practitioners was collected (Fowler, 2013). The collected data was analyzed through regression and cluster analyses, widely adopted methods in operations management research (Peng and Lai, 2012). On the other hand, the inductive approach was used in the exploratory part (article 3) since it aims to generalize results from the study of ample cases. In this part, the research is classified as a case study, as specific case studies are investigated to comprehend the phenomena (Ketokivi and Choi, 2014; Yin, 2014). Generally, the research has a conceptual nature since it mainly presents an argumentative analysis of research observations, extending the comprehension of identified research gaps and using existing concepts in the literature.

### **1.3.2 Research design**

To accomplish the general objective of the thesis, this research was divided into three stages to achieve the specific objectives. These three steps are presented in article format. Based on three articles, the thesis structure is presented in Table 1.1, detailing its research questions, goals, and methods, with a subsequent description of the articles.

**Table 1.1 Structure of the research development**

	Research question	Research goals	Theoretical lens	Method
Paper 1	What is the contribution of purchasing operations when companies manage their relationship with suppliers to improve firm performance?	Understand the contribution of purchasing operations in SCI, as it is an interface area between SC's internal and external activities weakly studied in the literature.	Contingency-configurational view	Quantitative Research – Survey 1. Confirmatory factor analysis (CFA) 2. Linear regression with moderating and mediating effects test 3. Cluster analysis
Paper 2	Should companies develop internal digital resources or acquire external digital resources for DT aiming at SCI? Can be these digital resources integrated as a paradox that require managing them with ambidexterity?	Understand how internal and external digital resources contribute to integrating the supply chain and how a company needs to manage them.	Paradox Theory	Quantitative Research – Survey 1. Exploratory and Confirmatory factor analysis (EFA and CFA) 2. Cluster analysis and ANOVA test 3. Linear regression with moderating and mediating effects test
Paper3	How does social exchange occur along the supply chain when digital integration is implemented?	Understand the social aspects of inter-organizational integration when digital transformation is implemented.	Social Exchange Theory and TOE framework	Qualitative research – Case study 1. Interviews 2. Technical Visits 3. Document review

**Paper 1** - “A contingency-configurational view of purchasing operations: the mediating role between supplier relationship and firm performance”. This paper aims to identify the main dimensions that structure the essential operations of the supply chain and how they contribute to the performance. The literature claims purchasing differs from the functional sector that manages the strategic supplier relationship. However, there is a growing trend towards their integration. This paper looked at the connection between suppliers and purchasing operations from the perspective of two combined theories: contingency and configurational theories. The argument is that the configuration of purchasing operation – an internal process that establishes the modus operandi for transactions with suppliers – is an important business activity that demands articulation with the contingency effect of external relationships with suppliers to enhance firm performance (financial, customer, and delivery). The mediating role of purchasing operations (purchasing transaction, document management, and assessment management)

between supplier relationship management and firm performance was analysed. It was also considered how purchasing knowledge management moderates between purchasing operations and performance. Then, the configuration of purchasing operations were analysed the configuration of purchasing operation patterns through cluster analysis. These hypotheses were tested using data from a survey of 234 companies. Our findings show how purchasing operations should be structured when dealing with suppliers. We also show the relevance of knowledge management routines in the purchasing operations structure. Some often-overlooked tactical aspects of purchasing are considered to help scholars explain how a lack of focus on purchasing operations may sometimes lead to limited effectiveness in increasing performance.

**Paper 2** - *“Managing paradoxes for digital transformation in supply chain integration”*. Considering the findings in Paper 1, in which the SC structure considers internal and external operations aspects, this second paper investigates what resources (internal X external) should be employed to better integrate this structure through digital transformation. Whereas some authors claim that the resources need beyond companies guarantee the exclusive advantage, other authors argue that the relations between companies will improve the performance through knowledge sharing, especially when the resources are in their essential innovation, such as the digital transformation resources. So, based on paradox theory, this study shows that companies need the ambidexterity capacity to manage the resources and improve performance. Contrary to Transaction Cost Economics thinkers, companies that explore opposites resources, exploiting the benefits of each resource, will achieve higher performance than companies that focus on only one resource. Besides, this paper claim that that is a positive interaction effect between external and internal digital resources development on supply chain digital integration, representing an ambidextrous capacity of companies to support supply chain integration when dealing with paradox resources. These hypotheses were tested using data from a survey of 379 companies. The findings confirm the hypothesis by exploring the data with cluster analysis, ANOVA test and OLS regression. As the main result, this article shows the paradox existing in digital resources and the need for ambidexterity capability for companies to achieve higher supply chain performance.

**Paper 3** - *“When supply chains are digitalized: examining the social exchange structure behind the inter-organizational integration through digital transformation”*. To achieve a successful DT across the SC, besides the comprehended of how to manage the digital resources, it is essential to establish strong relationships and collaborations between SC partners. Social aspects, such as establishing trust, commitment and governance structure

among the actors in the contexts of technology, organisation and environment, must be considered in the DT process in a SC. It allows a more comprehensive view of the possibility of supporting different actors in integrating their business processes. Therefore, using the theoretical lens of Social Exchange Theory within the TOE framework was aimed to understand how partners interact and the difficulties faced in the relationship when implementing the DT. To achieve the objective, a case study was carried out in a focal company and the first levels of its supply chain, encompassing four suppliers and four customers. The data were collected over 12 months from four suppliers, the focal firm, and four customers through document review, assessment of existing systems, visit in loco and field observation in all the actors, also several discussion meetings and project follow-up with the work team from the focal company. Furthermore, semi-structured interviews were employed as a tool to gather data. The data collected in the interviews provided information to understand how stakeholders' pursuit of value creation and rewards can influence their willingness and ability to implement DT to integrate the SC. As a main result, this article presents a final framework which shows actions to ensure rewards from the digital integration of SC. It can help managers to anticipate and know what to do for all the SET elements in the context of technology, organization and environment when implementing DT in SC.

#### **1.4 Limitations**

For the development of the research, some limitations are proposed. First, this thesis focuses on integrating the SC, concentrating on how companies can integrate through DT with customers and suppliers but do not consider other actors or the whole value chain. Thus, the studies developed in this thesis focus always on the primary actor and respect suppliers and customers, being primary or secondary. Other actors considering a bigger ecosystem, such as government, associations and universities, are not included, although other papers address this (Dalenogare *et al.*, 2022).

Second, these studies consider the relations between companies and the integration of the supply chain but do not address the dynamism that may exist as environmental turbulences, such as technological and market, as well as aspects of the disruptive supply chain that can generate instability. Third, this thesis studies the perspective of the supply chain, looking at how the internal operations integrate with external, not emphasizing the internal logistics. Finally, this thesis addresses the relations structures and the technologies used. However, it does not cover an extremely relevant aspect in-depth: the necessary investments to achieve horizontal

integration. Regardless, this study provides the basis for studies with this characteristic that can be deployed.

### 1.5 Thesis structure

This thesis is organized into five main chapters. In this first chapter, the work's context and objectives were presented, justifying the importance of this research from an academic and practical point of view. This chapter also presented the study method, structure, and limitations. The next sections, from two to four, give the proposed articles. The fifth chapter presents the final considerations of the present doctoral thesis.

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## **2 PAPER 1 – A CONTINGENCY-CONFIGURATIONAL VIEW OF PURCHASING OPERATIONS: THE MEDIATING ROLE BETWEEN SUPPLIER RELATIONSHIP AND FIRM PERFORMANCE**

### **Abstract**

The literature has considered purchasing and supply management activities from a strategic perspective, but the tactical role of purchasing operations has yet to be explored. Purchasing operations represent the internal *modus operandi* for transactions with suppliers, comprising three main activities – purchasing transactions, purchasing document management, and purchasing assessment – and supportive activities like purchasing knowledge management. Following the contingency theory, we hypothesize that these *internal* activities mediate between *external* supplier relationship management and firm performance (financial, customer and delivery performance). Complementarily, we adopt the configurational theory to hypothesize that this link between *external* and *internal* activities can be combined to increase firm performance. To test this contingency-configurational view of purchasing operations, we conducted a quantitative survey with 234 companies. The regression results of the contingency analysis show that purchasing operations activities have a full mediation role in most relationships between supplier relationship management and firm performance, while knowledge management positively moderates the association between purchasing assessment and customer performance. Moreover, the cluster analysis for the configurational analysis shows that supplier relationship management and purchasing operations follow maturity levels of joint implementation of internal and external activities. Our findings shed light on the purchasing operations by defining the activities representing this concept and showing their role in supply management. We also contribute to practice by proposing an integrative system that helps managers organize the firm's purchasing and supply management activities.

**Keywords** Purchasing operations, Firm performance, Contingency Theory, Configurational Theory.

## 2.1 Introduction

The literature has demonstrated that supplier relationship management is important to increase firm performance (Amoako-Gyampah et al., 2020). Therefore, several studies have considered integrating external suppliers with internal production processes (Chen et al., 2004; He et al., 2017). Such integration has been explored through different approaches like integrating information and knowledge with suppliers (Benitez et al., 2022), establishing long-term relationships based on trust and reciprocity (Fynes et al., 2008), and sharing risks through the involvement of suppliers in product development activities (Ayala et al., 2020; Merminod et al., 2021). However, the findings of such studies rely on one main assumption: that the company's transaction processes with suppliers – the purchasing operations – work according to the requirements. This assumption may be flawed in several contexts, especially when supplier relationship management and purchasing activities are not well aligned. Purchasing is not necessarily the same functional sector that takes care of the strategic relationship with suppliers, which can create more misalignments (Monczka et al., 2016). Therefore, there is a growing trend in companies to integrate supplier relationship management and purchasing operations (Patrucco et al., 2021). However, when such integration happens, purchasing does not necessarily assume a relevant role in the relationship with suppliers as a part of an integrative management system (Carr & Pearson, 2002).

While the purchasing process is configured in strategic and tactical dimensions (Dobler & Burt, 1996), the literature often analyzes it only from the strategic perspective (Cavinato, 1999; Paulraj et al., 2006; Revilla & Knoppen, 2015). A narrow stream of research has considered the tactical aspect of purchasing, including the way purchasing routines are executed or documented and the way purchasing knowledge is managed, which may deeply impact the whole supply management system (Patrucco et al., 2021; Ramsay & Croom, 2008; Sjøgaard et al., 2019). Different dimensions have been proposed in the literature to summarize purchasing operations (e.g., Monczka et al., 2016; Pohl & Kai, 2011; Tchokogué & Merminod, 2021). We follow such studies and synthesize them in three main activities that need to be considered in purchasing operations: (i) purchasing transaction, which comprises the negotiation, exchange of information with suppliers, and price analysis, ensuring alignment with the strategic planning of the company (Tchokogué & Merminod, 2021); (ii) purchasing document management since the formalization of activities carried out in purchasing operations and the management of procedures that support purchasing operations lead to a formalized system of activities with explicit definition of the purchasing process (Monczka et al., 2016);

and (iii) purchasing assessment, consisting in the assessment of purchasing activities to provide feedback and analyze whether purchasing operations are aligned with the interest of the company as a whole to ensure efficient operations (Pohl & Kai, 2011). We also consider purchasing knowledge management a supportive activity for purchasing operations (Fugate et al., 2009). These activities of purchasing operations find a connection with prior studies (e.g., Chen et al., 2004; Foerstl et al., 2016; Luzzini & Ronchi, 2016), although a detailed view of them has not been addressed yet, especially when connecting with a supplier integration and performance perspective.

In this study, we look at the connection between the relationship with suppliers and these different activities of purchasing operations from the perspective of two combined theories: contingency and configurational theories (Flynn et al., 2010). While the contingency theory considers external factors like supply relationships that influence internal organizational design (Thompson, 1967; Child, 1972; Donaldson, 2001), the configurational theory holds that companies' performance depends on the configuration of organizational dimensions (Miller, 1987). Both theories propose that companies' external and internal activities and processes are interdependent and thus need to be deeply interconnected, but they emphasize different perspectives on such interdependency (Flynn et al., 2010). We adopt the *contingency theory* by arguing that purchasing operations comprise important business activities that demand articulation with the external process of managing supplier relationships to enhance firm performance (Chen & Paulraj, 2004). Complementarily, we adopt the *configurational theory* to hypothesize that this link between *external* supplier relationship management and *internal* purchasing operations can be organized according to specific implementation patterns that increase firm performance. These two perspectives are englobed in our main research question that we aim to answer: *What is the contribution of purchasing operations when companies manage their relationship with suppliers to improve firm performance?*

We analyze this question through complementary theories (Flynn et al., 2010). From the contingency perspective, we investigate the mediating role of purchasing operations (purchasing transaction, purchasing document management, and purchasing assessment) between the external relationship with suppliers and firm performance (financial, customer and delivery performance) and the moderating role of knowledge management as a supportive activity of purchasing operations. To this aim, we conducted a quantitative survey with 234 industrial companies and investigated these relationships using regression analysis with mediating and moderating effects. We empirically demonstrate that the configuration of

purchasing operations plays a key role in managing the relationship with suppliers (contingency factors). However, our results show that purchasing operations have different contributions to financial, customer, and delivery performance when this operation acts as a mediator between the relationship with suppliers and firm performance. We also show that knowledge management positively moderates the association between purchasing assessment and customer performance. Complementarily, from the configurational perspective, we investigate the implementation patterns of supplier relationship management and purchasing operations activities to increase firm performance. To this aim, we employ cluster analysis of the quantitative data collected and show that supplier relationship management and purchasing operations follow maturity levels of joint implementation of the external and internal supply and purchasing activities. The results show that this joint implementation is related to higher levels of firm performance. Our findings contribute to the theory by defining the activities representing this concept and showing their role in supply management. We show the tactical aspects of purchasing, which can help scholars explain how a lack of focus on purchasing operations may sometimes lead to the limited effectiveness of supply management. We also contribute to practice by proposing an integrative system that helps managers organize the firm's purchasing and supply management activities.

## **2.2 A contingency-configurational view of Purchasing Operations**

Many studies in the literature have adopted the resource-based view to explain how firms can achieve performance in operations (e.g., Foerstl et al., 2016; Sjoerdsma & van Weele, 2015; Zimmermann et al., 2020). As previously debated by Bromiley and Rau (2016), the resource-based view is a very popular theory in strategy and operations management research because it has an extremely compelling logic. However, this theory has some limitations for some types of investigation in the supply and purchasing context. This context considers a wide set of external and internal activities necessary for organizing and managing the complexity of the suppliers and inputs (Chen & Paulraj, 2004). The resource-based view focuses on what the company needs to own and manage to obtain a competitive advantage against competitors (Barney, 1991), but not how the company needs to arrange and align the external and internal activities of the supply and purchasing operations. Resource-based view assumes that performance is affected by the pool of resources and how companies manage them. At the same time, it does not consider that performance can also be affected by how the processes and activities are interconnected to operate in the whole management system (Chen & Paulraj, 2004). In this context, the combined analysis of the contingency and configurational views

emerges as an alternative to explain firm performance when different processes and activities need to be better aligned and connected to improve operations (Flynn et al., 2010; Huo et al., 2015; Cao et al., 2015; Lerman et al., 2022).

*Contingency theory* assumes that the organizational design is influenced by contingency factors (e.g., size, external environment, and technology) (Thompson, 1967; Child, 1972; Donaldson, 2001). Companies that modify their internal business dimensions to fit the external environment would be more likely to have better performance and, hence, better survival chances (Thompson, 1967; Donaldson, 2001). This theory assumes companies as open systems with inflows and outflows of knowledge and resources with the business environment that affect internal conditions (Thompson, 1967; Mintzberg et al., 1998). On the other hand, *Configurational theory* assumes that the organizational structure is defined through the interaction of parts as a whole. In other words, the elements are strongly interdependent and support each other, so their existence and importance are grounded on the entire configuration (Miller, 1987). Thus, interrelated activities configure a firm, and the better these activities are aligned, the more the company will gain a competitive advantage (Huo et al., 2015). In other words, Configurational theory states that a firm's performance depends on the configuration and interrelationships between elements (Hult et al., 2006). Both perspectives have been used as alternative lenses for supplier integration analysis. This is because contingency theory considers linear associations between external and internal elements and how they affect performance, while configurational theory considers a set of interrelated activities that can enhance performance (Merminod et al., 2021; Lerman et al., 2022).

The seminal work from Flynn et al. (2010) showed the complementary between Contingency and Configurational theories to analyze supplier integration. According to the authors, the Contingency theory explains the connections between supply relationships – a form of contingency factor – and internal supply management activities. In this sense, supplier relationships will affect how a company organizes its internal supply management activities. At the same time, Flynn et al. (2010) acknowledge that companies can adopt different ‘configurations’ of practices and activities to develop their internal supply management to respond to these contingency factors. Therefore, they propose the Configurational theory as a complementary view to analyze how supply management activities can be organized. Other studies on supplier integration have also adopted this view (e.g., Huo et al., 2015; Cao et al., 2015).

Herein we adopt the contingency-configurational theory to address this interconnection between the *external* relationship with suppliers and the *internal* organization of purchasing operations (Lerman et al., 2022; Flynn et al., 2010; Droge et al., 2004). Our study considers supply chain management as one managerial function of operations management, which comprises two important activities that we investigate: the management of relationships with suppliers and the purchasing activities to acquire inputs from the suppliers (Paulraj et al., 2006). We argue that companies need to align and interconnect both activities to perform better using the contingency theory. At the same time, we aim to analyze how such activities should be interconnected using the configurational theory. Purchasing management has been investigated before through the contingency or configurational theory (Rozemeijer et al., 2003; Fernández & Kekäle, 2005; Mikalef et al., 2015). However, there is no evidence in the literature on the use of Flynn's et al. (2010) integrated perspective to connect these external relationships with suppliers with the internal operationalization of the purchasing activity in the supply chain management system. Although supplier relationships and purchasing activities may be intimately related and developed by the same department, it is important to stress that they are two different activities that might be treated separately (Monczka et al., 2016). Depending on the company's degree of development of the supply and purchasing system, it may have emphasis (or not) on the relationship with suppliers and connection (or not) between purchasing and the relationship with suppliers (Monczka et al., 2016). Patrucco et al. (2021) investigated the role of the purchasing department in innovation projects involving suppliers. They tangentially analyzed the alignment of external and internal activities of supply and purchasing, pointing to the key role of purchasing in improving firm performance. This was one of the first attempts to integrate such perspectives. However, they adopted innovation and qualitative perspectives rather than quantitative and operations management approaches. This paper advances this integration by analyzing the association between supplier relationships – a contingency external factor – and purchasing operations' activities and the configuration patterns of purchasing operations to obtain higher performance.

## **2.3 Hypotheses development**

### **2.3.1 The mediating role of purchasing operations**

The literature acknowledges that managing the relationship with suppliers is essential to increase performance since it helps a key resource to support firms' operations (Amoako-gyampah et al., 2020). The literature has considered this relationship with suppliers as a

contingency element in the internal organizational design (Huo et al., 2015; Flynn et al., 2010). In this sense, a long-term and transparent relationship with suppliers will facilitate the transaction activities of the purchasing process, which should reflect the company's overall performance (Flynn et al., 2010). On the other hand, purchasing operations impact the whole manufacturing and delivery process, consequently directly influencing customers (Tchokogué & Merminod, 2021). Therefore, it is worth mentioning that a well-developed relationship with suppliers in purchasing operations would directly influence firms' customer performance. Ayala et al. (2018) showed the importance of supplier support to achieve better customer performance. In addition, structured purchasing operations may increase the agility of negotiation and avoid a disruption of supply, directly affecting the company's delivery performance (Foerstl et al., 2016). Therefore, close relationships with suppliers, as Doney and Cannon (1997) discussed, lead companies to acquire purchasing experience and reach delivery performance. However, the majority of studies refer to purchasing as a strategic activity within the supply management structure, considering its structure solely from the perspective of strategic elements like strategic focus, strategic involvement, and status and visibility of the purchasing professionals (Arora et al., 2020; Brandon-jones & Knoppen, 2018). Strategic purchasing implies that the purchasing department has a formally written long-term plan, that the purchasing function has substantial knowledge of the firm's strategic goals, and that the purchasing department is represented in top-level management (Arora et al., 2020). These aspects are certainly important to enhance firm performance. Still, we argue that purchasing should have a well-defined tactical activity, namely purchasing operations, that will ensure that managing supplier relationships increase the company's performance (Patrucco et al., 2021; Søggaard et al., 2019).

Previous studies show that the internal transactions process is important for companies to manage the supply system (Luzzini & Ronchi, 2016). Therefore, when a company neglects this activity, it may jeopardize the relationship with suppliers and cause delays in operations. This could lead to breakdowns alongside the supply chain and to the consequent hampering of firm performance (Chen & Paulraj, 2004). For instance, a firm with a good relationship with suppliers may concurrently have several internal losses due to an inefficient purchasing process that will culminate in poor financial performance or delays in product delivery and product quality issues. Such inefficiencies due to the purchasing process may be particularly expressive when a firm prioritizes costs and pricing negotiation instead of balancing its external relationships with the internal operational purchasing targets (Handfield et al., 2015). Therefore, the greater the interconnection between internal operational and external supplier relationships activities, the better the performance outcomes will be. This has also been qualitatively argued

in a recent study by Patrucco et al. (2021), who showed that purchasing activity plays a key role when a company aims to increase performance in the supply and purchasing system. Although they provided evidence in the open innovation domain, we extend their view to other supplier relationship management, as synthesized in the following hypothesis:

**Hypothesis H1.** *Purchasing operations mediate between the relationship with suppliers and firm performance.*

We deploy this general hypothesis on the external effects (contingency) of suppliers' relationship on purchasing operations and performance. We deploy purchasing operations into the configuration of three main tactical purchasing activities: *purchasing transactions*, *purchasing documentation* and *purchasing assessment* (Monczka et al., 2016; Perner et al., 2014).

The main operational activity of purchasing considers the transaction process, which comprises several activities, including identification of vendors, communication with suppliers, pricing and requirement negotiations, and, finally, the economic transaction activity (Tchokogué & Merminod, 2021). These activities include planning and executing purchasing operations, using resources, and controlling transactions with suppliers (Patrucco et al., 2021; Revilla & Knoppen, 2015). The purchasing transaction process is also responsible for controlling and monitoring operations, changes, and potential issues/errors which may arise during a purchase. From this perspective, the transaction process is part of operationalizing a company's strategic planning (Chen et al., 2004). Focusing on aligning with the company's strategic planning will also ensure that purchasing operations align with supplier selection strategies. Thus, the transaction process allows outlining a strategy to control purchasing operations, which should improve performance (Patrucco et al., 2021). Therefore, we propose:

**Hypothesis H1a.** *The purchasing transaction process mediates the association between the relationship with suppliers and firm performance.*

*Purchasing document management* is the formalization of activities carried out in purchasing operations. Companies can conduct purchasing activities informally when the process is not well-defined, and purchases happen based on each specific negotiation (Monczka et al., 2016). However, such a lack of structured procedures creates inefficiencies in the process and jeopardizes the company's quality management system (Perner et al., 2014). Purchasing document management offers a formalized system of activities with an explicit definition of the purchasing process, including the continuous review of activities, registration of purchasing

outputs, and establishing a process control system (Lau et al., 1999; Perner et al., 2014). It also aims to create historical data, suppliers' records, and other relevant information on the transaction system to reduce inefficiencies in purchasing operations (Perner et al., 2014). Consequently, document management is a necessary purchasing activity that may mediate the relationship with suppliers and firm performance, acting as the formal procedural bridge of transactions between suppliers and the company (Monczka et al., 2016; Patrucco et al., 2021). Therefore, we propose the following sub-hypothesis:

**Hypothesis H1b.** *The purchasing document management process mediates the association between the relationship with suppliers and firm performance.*

*Purchasing assessment management* evaluates all purchasing activities to provide feedback for the management system (Revilla & Knoppen, 2015). The performance of purchasing operations is measured by indicators and assessed against predefined targets (e.g., transaction costs) (Monczka et al., 2016). This process improves purchasing operations activities (Hult et al., 2000). The assessment also measures if purchasing operations are aligned with the firm's strategic planning (Pohl & Kai, 2011). Consequently, the assessment process is critical to improving firm performance since it evaluates the relationship with suppliers by assessing the purchasing operations (Patrucco et al., 2021). Besides, with constant evaluation, the trend is for a continuous improvement process to be established, culminating in positive impacts on firm performance (Monczka et al., 2016). In this sense, we argue that purchasing assessment management is a substantial activity for a company's performance since it allows to keep purchasing activities aligned with the company's interests and helps define whether the relationship with suppliers is helping to obtain the performance targeted by the company (Patrucco et al., 2021). Therefore, we propose the following sub-hypothesis:

**Hypothesis H1c.** *The purchasing assessment management mediates the association between the relationship with suppliers and firm performance.*

### **2.3.2 The moderating role of knowledge management activities in purchasing operations**

When making decisions regarding supplier selection and defining pricing and requirements, purchasing professionals are challenged to foresee market changes (Kienzler et al., 2021). Purchasing knowledge management may help them by providing a dynamic view of the market and supply chain (Yang et al., 2021). Knowledge management routines enable companies to identify signals pointing to changes in customer demand and technological trends

(Frank et al., 2022), working as a pivot that balances the market side with the supply side of the operations (Hock-Doepgen et al., 2021). When the company does not manage knowledge about the transaction activities, purchasing professionals can overpay to guarantee suppliers' provision and avoid supply uncertainties (Kienzler et al., 2021). Knowledge management activities can support purchasing operations with knowledge obtained from past purchasing experiences and from market reactions to the inputs purchased from a supplier to reduce process inefficiencies and increase performance (Abbas, 2020; Flöthmann et al., 2018; Handfield et al., 2015). Thus, companies need to apply the obtained knowledge to increase competitiveness (Fugate et al., 2009).

Knowledge management applied to operational routines like purchasing operations is usually deployed into knowledge creation, acquisition, sharing, and application practices or routines (Abbas et al., 2020; Frank et al., 2015). Such practices can be used through informal activities related to tacit knowledge or through formalized activities oriented towards the capitalization of explicit knowledge (Frank and Ribeiro, 2012). Since purchasing operations are considered formal processes (Monczka et al., 2016; Perner et al., 2014), we emphasize the explicit knowledge of purchasing. In this sense, the new knowledge created can be formalized through documentation of new operations, the development of a body of best practices, and the formalization of existing knowledge about the ongoing processes (Abbas et al., 2020; Flöthmann et al., 2018). Knowledge creation and knowledge acquisition can also be stimulated through the formal comparison of changes made in the process and the outputs obtained, which can also result in sharing knowledge through best practices and lessons learned (Frank et al., 2015). Finally, an important routine of knowledge management is also the formal institution of knowledge reuse practices, which includes revisiting developed solutions and lessons learned for a formal knowledge application in the new routines (Frank and Ribeiro, 2012). All these initiatives create a reinforcing cycle of improvement in the organizational routines that can be useful also in purchasing operations. These knowledge management routines should support tactical purchasing activities by connecting the knowledge accumulated from documented purchasing activities (Handfield et al., 2015). Companies with knowledge management in the purchasing process further improve supplier transactions (Brandon-jones & Knoppen, 2018) and can consolidate a base of suppliers through better purchasing operations (Hult et al., 2000). This inclusion of knowledge management in purchasing should, therefore, enhance firm performance (Patrucco et al., 2021). Therefore, we propose the following moderating hypothesis:

**Hypothesis H2.** *Purchasing knowledge management moderates positively the association of (a) Purchasing Transaction, (b) Purchasing Document Management, and (c) Purchasing Assessment with firm performance (Financial, Customer, and Delivery).*

### 2.3.3 Purchasing operations patterns on performance

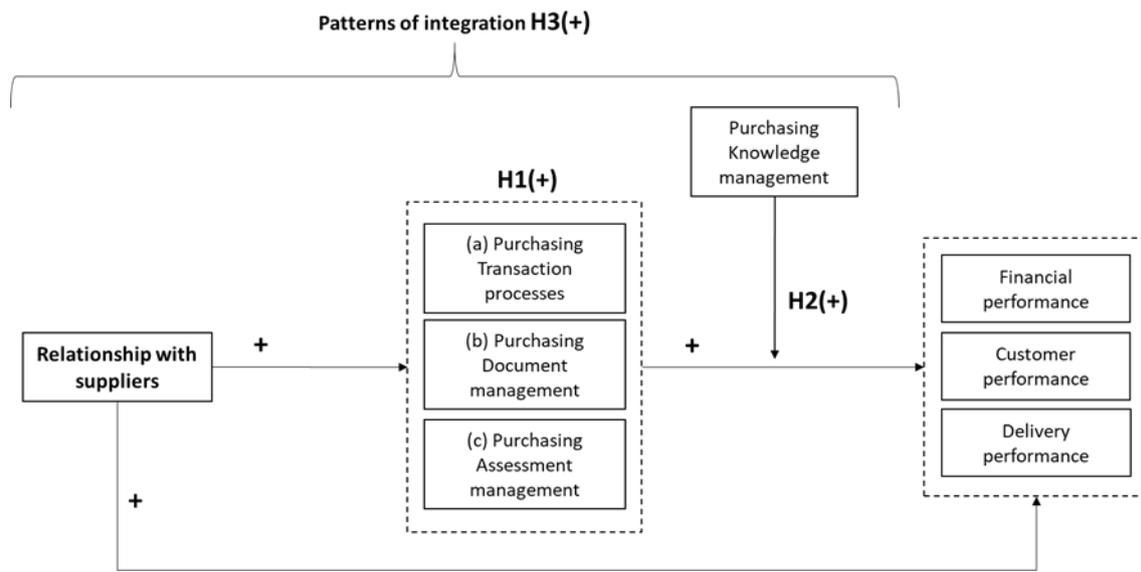
Flynn et al. (2010) showed that patterns of supplier integration are related to firm performance when using a configurational approach complementary to the contingency view. This has also been demonstrated by Huo et al. (2015) when studying supplier coordination and performance. In the same vein, the implementation of purchasing operations should consider patterns of implementation together with supplier relationships when influencing firm performance. Prior studies have shown different purchasing activity configuration patterns without considering their connection with supplier relationships and performance (Mikalef et al., 2015). We argue that purchasing operations should be aligned with external relationship management to increase performance (Sogaard et al., 2019). Although the configurational perspective considers the possibility of obtaining different patterns with similar benefits for organizational activities (Merminod et al., 2021), we argue that purchasing operations should operate in a coherent, interrelated management system, representing a cohesive pattern of growth among its different dimensions, considering maturity levels of purchasing operations (Sogaard et al., 2019). This is because such activities should support the internal operation of the supply and purchasing process, being necessary to configure a higher pattern of operations that increases performance (Lerman et al., 2022). Consequently, we propose the following hypothesis:

**Hypothesis H3.** *Supplier relationship management and purchasing operations are part of an interrelated management system configurated in patterns that follow maturity levels associated with increasing firm performance.*

### 2.3.4 Conceptual research model

We summarize the hypotheses and sub-hypotheses proposed in the conceptual research model in Figure 2.1. As shown in the conceptual model, purchasing operations comprise three main activities: purchasing transaction, purchasing document management, and purchasing assessment, which mediates (H1) the association of the relationship with suppliers with firm performance. Moreover, purchasing operations also comprise a support activity: purchasing knowledge management (H2). This activity moderates the relationship of the three purchasing activities with firm performance. We consider three different forms of firm

performance: financial, customer satisfaction, and delivery performance. Our proposed model also assumes a potential partial mediating effect of purchasing operations between the relationship with suppliers and firm performance. Finally, we consider that the integration of supplier relationship management with purchasing operations follows implementation patterns associated with firm performance levels (H3).



**Figure 2.1- Conceptual research model**

## 2.4 Research method

### 2.4.1 Sampling

We conducted a cross-industry survey with companies represented in the Brazilian Council of Purchasing Executives (CBEC). The target respondents were top executives of this council acting as purchasing or supply management directors or managers. Since our main goal was to measure both the relationship with suppliers and the operational purchasing, we selected, as the respondent target, executives with a systemic view of the company's supply and purchasing management. As previously suggested by Ketokivi (2019), the more intuitive situation when measuring a system (i.e., purchasing department) is selecting a general manager who can evaluate the whole system. This should be less biased than selecting experts of specific sectors to analyze an organizational system (Ketokivi, 2019). To this end, the questionnaire items are all related to activities that only managers with a holistic view of the process would answer.

The initial sample was composed of 1,500 executives from all Brazilian regions. From the initial 242 responses obtained, after excluding incomplete and duplicated questionnaires, we obtained 234 final valid responses. In the final sample, 18% of respondents are from small firms (20 to 99 employees), 24% represent medium-sized firms (100 to 500 employees), and 58% are from large firms (more than 500 employees), following the classification of the Brazilian Institute of Geography and Statistics (IBGE, 2015). The overall respondent profile was composed of managers or directors (71%) or other executive levels (19%). Table 2.1 details the composition of the sample.

Table 2.1 Sample composition

Description	(%)	Category	Description	(%)
Services	25%	Company size	Small (<100 employees)	18%
Consumer goods	15%		Medium (100 - 500 employees)	24%
Transport	9%		Large (>500 employees)	58%
Wholesale and retail	8%	Respondent's profile	Managers or directors	71%
Automotive	7%		Coordinators	10%
Construction	7%		Supervisors	5%
Electro-electronic	6%		Other similar positions	14%
Energy	6%			
Steel and Metallurgy	3%			
Capital goods	3%			
Telecommunications	3%			
Mining	2%			
Others	8%			

#### 2.4.2 Measures and survey instrument

The questionnaire was developed from prior constructs in the literature. The items used to measure each construct are shown in Appendix A. The construct 'relationship with suppliers' [SUPPLIERS] uses a four-item scale that considers the establishment of long-term relationships, the use of a cooperative approach to deal with suppliers, and the trust in suppliers' deliveries (Amoako-gyampah et al., 2020; Koufteros et al., 2012; Liu et al., 2009; Revilla & Knoppen, 2015; Yang et al., 2021). We also considered the need to integrate information and knowledge with suppliers, which is highly necessary, especially when product development activities are conducted (Ayala et al., 2018; Ayala et al., 2020).

Four constructs defined purchasing operations, three of them related to the purchasing activity – Purchasing Transaction Management [TRANSACTION], Purchasing Document

Management [DOCUMENT], Purchasing Assessment Management [ASSESSMENT] – and one related to support for the operational routines: Purchasing Knowledge Management [KNOWLEDGE]. The TRANSACTION construct is represented by six items that analyze aspects related to the level of control of the purchasing process (Dobler & Burt, 1996; Monczka et al., 2016; Weele, 2009). The DOCUMENT construct includes four items to measure whether the company manages purchasing documentation, including operations records and the positive and negative outcomes of each purchasing transaction (Pemer et al., 2014). For ASSESSMENT, we considered four items that reflect the importance of using performance measurements in the purchasing process as a form of feedback on operations activities, including the establishment of targets, the use of indicators and measuring approaches, as well as the alignment with the company's stakeholders (Monczka et al., 2016; Pohl & Kai, 2011). Lastly, regarding the support of knowledge management activities in purchasing operations [KNOWLEDGE], we considered the adoption of procedures for knowledge reuse in purchasing activities (Abbas, 2020; Frank & Ribeiro, 2012). This construct is measured through six items that include the documentation of well-established and new process-related knowledge and the registration and reuse of solutions, lessons learned, best practices, and past problems review (Abbas, 2020; Flöthmann et al., 2018; Frank et al., 2015; Frank & Ribeiro, 2012).

Regarding the dependent variables, we considered three company outcomes: financial performance [FINANCIAL], customer performance [CUSTOMER], and delivery performance [DELIVERY]. For FINANCIAL, we measured two aspects: profit increase and cost reduction (Asare et al., 2013; Jayaraman et al., 2013). CUSTOMER measures the company's ability to attract new customers, the level of satisfaction of current customers, and their loyalty (Asare et al., 2013; Ayala et al., 2018). Finally, DELIVERY measures whether the company delivers orders in time and whether the company has been successful in reducing the delivery lead-time (Fynes & Búrca, 2005; Marodin et al., 2016).

As control variables, we included the industry segment which can affect the company's behavior regarding supply activities. We followed the classification proposed by Chudnovsky et al. (2006), who organized industry controls into four main groups of industry profiles: natural resources, labor-intensive, scale, and R&D, which we represent through three dummy variables: [Labor: 1 = Yes; 0 = no], [Scale: 1 = yes; 0 = no] and [R&D: 1 = yes; 0 = no], while 'natural resources' is represented when the three variables assume a zero value. Company size was also controlled because the smaller the company, the more likely it will be to have integrated supply and purchasing activities. Company size was measured through the number of

employees, represented in two main dummy categories: 1 = Large size; 0 = Medium or Small size. Additionally, we also controlled the size of the company's purchasing departments using the natural logarithm of the number of employees. Lastly, the company revenue was also controlled because this could affect performance metrics, which were classified into two dummy variables: Sales\_low (less than US\$ 20 million): 1 = yes; 0 = no, and Sales\_medium (between US\$ 20 million and 100 million): 1 = yes; 0 = no, with high sales volume (more than US\$ 100 million) being represented when the two variables assume a zero value.

We measured all the constructs' items using a ten-point Likert scale ranging from 1 (strongly disagree) to 10 (strongly agree), since this was the most used scale by the business association that provided us access to the sample of companies. Although a 7-point scale may be more commonly adopted in academic studies, Dawes (2008) contrasted different Likert scale formats (5-, 7- and 10-point) and did not observe appreciable differences in standard variation, nor a difference in asymmetry or kurtosis that would be either managerially or statistically significant. Also, the author noted that no scale format produced data with markedly lower variances about the mean. All this information suggests that none of the three forms analyzed by Dawes (2008) is less desirable to obtain data for usage in regression analysis.

### 2.4.3 Reliability and validity of measures

To examine unidimensionality, we used confirmatory factor analysis (CFA) with STATA 13.0. Our model showed good fit, since the reference values – i.e., Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), Average Variance Extracted (AVE), Composite Reliability (CR), and Cronbach's alpha – were all above the threshold values (Hair et al., 2018). These values are shown in Table 2.2. All the constructs' items showed high factor loading (Appendix A). Also, the final, complete model reported good of fitness (CFI: 0.881; RMSEA: 0.082;  $\Delta\chi^2$ : 1040.96).

Table 2.2 Results of confirmatory factor analysis

<b>Construct</b>	<b>CFI</b>	<b>RMSEA</b>	<b>AVE</b>	<b>CR</b>	<b>Cronbach's <math>\alpha</math></b>
[SUPPLIERS]	0.997	0.061	0.699	0.991	0.897
[KNOWLEDGE]	0.985	0.077	0.608	0.992	0.898
[TRANSACTION]	0.980	0.077	0.544	0.989	0.874
[DOCUMENT]	0.995	0.077	0.664	0.978	0.885
[ASSESSMENT]	0.997	0.071	0.781	0.994	0.933
[PERFORMANCE]	0.985	0.064	0.608	0.991	0.824

We also conducted an exploratory factor analysis (EFA) with Varimax rotation of the constructs for the independent variables to compare with the CFA results (Hair et al., 2018). Kaiser-Meyer-Olkin (KMO) test, Bartlett's test of sphericity, and the measure of sampling adequacy (MSA) suggested that the variables proposed are suitable for an EFA. The results were: KMO = 0.921 (i.e., lower than the recommended 0.5 threshold value), Bartlett's test approx.  $\chi^2 = 4.4253,99$  (p-value  $<0.001$ , i.e., lower than the suggested 0.05 significance level), and the MSA test indicated that all variables had values higher than 0.85 (i.e., much higher than the required 0.5 by this test) (Hair et al., 2018). The complementary results of the EFA are presented in Appendix B. We present the number of factors to be extracted and compare them with the latent root criterion to obtain factors near the cutoff of 1.0. As shown in the results (Appendix B), five factors were obtained. They represent 73.76% of the variance explained and high communalities (all  $>0.558$  and 75% higher than 0.7). When the factor loadings of the rotated matrix are analyzed, they evidence a high load of the items ( $>0.5$ ) on the same constructs proposed through the CFA. Therefore, the EFA results converge with the CFA showing high reliability of the constructs.

Discriminant validity was verified using a series of two-factor model estimations (Bagozzi et al., 1991). We compared two CFA models for each construct, looking for their respective goodness of fit. In the first model, the correlation between the two constructs was restricted to a unit, while in the second model, this restriction was freed, and we calculated the goodness of fit for the original constructs. In this test, all the results showed discriminant validity ( $\Delta\chi^2 > 3.84$ , p-value  $p < 0.01$ ) (Bagozzi et al., 1991). Additionally, we followed Fornell and Larcker (1981) to double-check discriminant validity by comparing the square root of the average variance extracted (AVE) of the constructs (reported in Appendix A) with the correlation between the constructs reported in the correlation matrix (Appendix C). This test also confirmed discriminant validity since the square root of the AVE was higher than the correlations.

Finally, we tested the normality of the data by examining the skewness and kurtosis values. The results (Appendix C) suggest that the overall data are normally distributed since these values were between the thresholds of  $\pm 2.58$  ( $\alpha = 0.01$ ) (Hair et al., 2018). Only the data for one construct [FINANCIAL] presented a value slightly above the threshold (2.895) in its kurtosis measure. So, we plotted the data to understand the distribution and found symmetric patterns. Furthermore, we applied the Anderson-Darling test to verify whether a normal distribution adequately describes a data set since it is one of the most powerful statistical tools

to detect most departures from normality (Scholz & Stephens, 1987). The results showed that the data are normally distributed ( $p$ -value=0.992), so the null hypothesis of the normal distribution cannot be rejected. All the descriptive statistics, correlations, and normality results are summarized in Appendix C.

#### **2.4.4 Response bias and common method variance**

We employed procedural and statistical remedies to attenuate potential response bias (Podsakoff et al., 2012). For procedural remedies, we pre-tested the questionnaire with 23 executives to verify the clarity of writing and interpretation. Then, the order of the questionnaire blocks was randomized to prevent potential associations between the variables. The questionnaire was forwarded to high-level managers in the supply or the purchasing department of companies to ensure the collection of reliable data through the survey questions. For statistical remedies, we employed Harman's single-factor test and the marker variable technique (Podsakoff et al., 2012). Harman's test suggested that common method bias should not be a concern in this dataset since the total variance extracted by one factor is 41.185%, below the recommended threshold of 50% (Podsakoff et al., 2012). We also used the marker variable technique, which consists of adding a variable to the questionnaire that is expected to be theoretically unrelated to the substantive variables (Lindell & Whitney, 2001). We chose one item to assess whether decision-making is concentrated on top management since it has no theoretical correlation with our constructs. We included this item in all estimations necessary for hypothesis testing, and the results were compared with the outputs without markers. The results remained stable with adding a marker variable, which means no significant changes present in the model. Hence, we concluded that response bias should not be a concern in this dataset.

#### **2.4.5 Endogeneity**

Endogeneity can bias regression results because regression is based on the assumption of exogenous independent variables (Bascle, 2008). To test the presence of endogeneity, we ran a two-stage least squares (2SLS) regression model using instrumental variables (Bascle, 2008). To this aim, we instrumented the relationship with suppliers. According to Lau and Lo (2015), the company's geographical location, i.e., whether they are near or far from suppliers, can affect the level of relationship with them. Therefore, we considered the respondents' locations an instrument variable since companies concentrated in larger industry clusters may have more opportunities for close collaboration with suppliers. Furthermore, the level of human resources

development in the firm is associated with a higher predisposition to collaborate with external partners (Jiang et al., 2012), which may also affect the level of collaboration of a company. Therefore, we used both regional localization and the company's human resources development as instrumental variables. According to our initial tests, the explanatory variables showed that our instruments are strong (i.e., the p-values  $< 0.001$ , and the minimum F-value is 3.77,  $p=0.000$ ). In the first stage of the 2SLS, SUPPLIERS was regressed on the instrumental and control variables. In the second stage of the 2SLS, the dependent variables TRANSACTION, DOCUMENT, and ASSESSMENT were regressed on the resulting corrected effects of the independent variable SUPPLIERS and the control variables.

We tested the instrument's strength with the estimators of the first stage of the regression using Stata's *first stage*. The variable SUPPLIERS showed valuable instrumentation since all p-values associated with the three F-statistics for the first regressions were  $p < 0.001$ . Next, we verified whether the explanatory variable should be treated as endogenous and therefore need to be instrumented as proposed in the 2SLS regression model. We performed Stata's *estat endogenous* procedure using Durbin and Wu-Hausman statistics. These tests showed that the hypothesis that the explanatory variable is exogenous cannot be rejected (TRANSACTION: Durbin = 3.095,  $p=0.078$ ; Wu-Hausman = 3.003,  $p = 0.084$ ; DOCUMENT: Durbin = 1.657,  $p=0.198$ ; Wu-Hausman = 1.598,  $p = 0.208$ ; ASSESSMENT: Durbin = 5.415,  $p=0.020$ ; Wu-Hausman = 5.306,  $p = 0.022$ ). Finally, we performed three post-estimation procedures using Stata 13.0. First, we checked the validity of the instrumental variables using Sargan's and Basman's tests (Stata's *stat overid* procedure). For TRANSACTION we obtained a Sargan  $\chi^2$  test p-value = 0.965 and Basman  $\chi^2$  test p-value = 0.967, for DOCUMENT Sargan  $\chi^2$  test showed a p-value = 0.222 and Basman  $\chi^2$  test p-value = 0.235, and for ASSESSMENT we obtained a Sargan  $\chi^2$  test p-value = 0.447 and Basman  $\chi^2$  test p-value = 0.461. Since only ASSESSMENT had presented low values, we used the instrument correction to report all results related to this construct in our final model. After this correction, the overall results in our endogeneity tests suggest the appropriateness of the OLS procedure for testing the hypothesized relationships.

#### **2.4.6 Data analysis**

We performed our analysis in two steps. The first step followed the contingency view to test hypotheses H1 and H2 through hierarchical regression analysis, and the second followed the configurational view to test hypothesis H3 through cluster analysis (Flynn et al., 2010).

In the first stage of the ordinary least squared (OLS) hierarchical regression model, we examined the effects of SUPPLIERS on each of the three purchasing process dimensions (TRANSACTION, DOCUMENT, and ASSESSMENT). In the second stage, we examined the direct effect of SUPPLIERS on FINANCIAL, CUSTOMER, and DELIVERY. Then, we added the moderating effect of KNOWLEDGE to these models. Finally, in the third stage, we regressed the dependent variables on both the independent variable (SUPPLIERS) and the mediators (TRANSACTION, DOCUMENT, and ASSESSMENT). To assess the mediation effect, we used a bootstrapping method through the PROCESS macro in SPSS, as proposed by Hayes (2013). To test the moderation effects (H1a, H1b, and H1c), we standardized the independent and moderating variables using a mean-centering (Z-score) and multiplying the moderator by each independent variable. Thus, we created a multiplicative score for the interaction effect.

We tested the normality using skewness and kurtosis as described in section 3.3 (Appendix C), linearity, and homoscedasticity (Hair et al., 2018). We tested the linearity using partial regression plots. We examined homoscedasticity by plotting standardized residuals against predicted values and examining them visually. These tests confirmed the required assumptions for OLS regression models (Hair et al., 2018). Besides, we tested the statistical power of the models and partial coefficients (Cohen et al., 2003).

After obtaining the results reported in Section 5, we also verified the robustness of the model through complementary tests. First, we tested the models by excluding the control variables. The removal of the control variables showed that the predictor variables are not artifacts of the control variables. Then, for the model with a significant moderating effect, we verified the inclusion of each interaction term individually and evaluated if they changed the results for the interactions. The results remained stable. Finally, we tested a competitive model by considering the SUPPLIER as a dependent variable. We did not find statistical support for these models. Overall, the competitive model did not show statistical significance at  $p=0.05$ .

In the second step, following the configurational view, we performed a two-stage cluster analysis, starting with a hierarchical cluster procedure followed by a K-means procedure (Hair et al., 2018). We used as entry variables those that represent purchasing operations and supplier relationships (SUPPLIER, TRANSACTION, DOCUMENTS, ASSESSMENT, KNOWLEDGE), which we used to define the clusters. For the hierarchical cluster analysis, we adopted Ward's method in the clustering process with the Euclidian distance to measure the similarity among observations. As an output of this stage, we obtained the dendrogram, which

allowed us to define the best range of cluster numbers. We used the Silhouette Index to determine the ideal number of clusters from this range of options visualized in the dendrogram. The number of clusters that provides the closest Silhouette Index to 1 will represent the best fit (Marcon et al., 2021). We used the number of clusters defined by the Silhouette Index in the K-means procedure to determine the final cluster membership of the survey respondents (Hair et al., 2018). K-means also allow defining which entry variables help discriminate the different clusters. Then, we analyzed each cluster's firm performance metric behavior through a cross-tab analysis (Marcon et al., 2021). With this procedure, we can identify different patterns of purchasing operations (clusters) and then relate them with the firm performance metrics, as proposed in hypothesis H3.

## 2.5 Results

The OLS regression results to test H1 and H2 are summarized in Table 2.3. In the first and second main stages, the hierarchical regression models were run in two steps. In the first step, we included only the control variables. In the second step, we included SUPPLIER in the three purchasing operations models (TRANSACTION, DOCUMENT, and ASSESSMENT). In the second stage, we tested the direct effect of SUPPLIER on three performance metrics (firstly including only the controls and then including the SUPPLIER independent variable). In the third main stage, we added all the purchasing operations dimensions to assess their effects on the performance measurements (FINANCIAL, CUSTOMER, DELIVERY, and KNOWLEDGE).

In the third stage (Table 2.3), we also included a step with the moderation effect of KNOWLEDGE on TRANSACTION, DOCUMENT, and ASSESSMENT for the performance metrics. In this step, each of the hierarchical regression models was set in three steps (for simplification purposes, we did not include the results from the first step with controls only). In the second step, the constructs SUPPLIER, KNOWLEDGE, TRANSACTION, DOCUMENT, and ASSESSMENT were included. Finally, we included the moderation effect of KNOWLEDGE. As shown in Table 2.3, the final model with KNOWLEDGE as moderator was statistically significant for FINANCIAL ( $F = 5.786$ ;  $p < 0.01$ ), CUSTOMER ( $F = 13.196$ ;  $p < 0.01$ ), and DELIVERY ( $F = 15.088$ ;  $p < 0.01$ ), explaining 23.6%, 44.0%, and 47.6% of the variance, respectively. However, the only statistically significant moderation of KNOWLEDGE was in the relationship between ASSESSMENT and CUSTOMER.

For the first main stage, regarding SUPPLIERS, our findings showed a statistical association with TRANSACTION ( $B = 0.437, p < 0.0001$ ), DOCUMENT ( $B = 0.502, p < 0.0001$ ), and ASSESSMENT ( $B = 0.876, p < 0.0001$ ). For the second main stage, Table 2.3 shows that the direct effect of SUPPLIER on constructs of firm performance is statistically supported (FINANCIAL:  $B = 0.426, p = 0.002$ ; CUSTOMER:  $B = 0.561, p < 0.0001$ ; DELIVERY:  $B = 0.512, p < 0.0001$ ).

As shown in our results for the second and third stages, the purchasing operations dimension suggests a full mediation effect on the relationship between SUPPLIER and FINANCIAL ( $F = 5.786; p < 0.01$ ). When these variables are introduced in the last stage, TRANSACTION and ASSESSMENT become the only two statistically significant variables in the model. Moreover, our results also suggest a partial mediation effect on the relationship between SUPPLIER and CUSTOMER ( $F = 13.196; p < 0.01$ ). However, to assess mediation, indirect effects must be calculated (Preacher & Hayes, 2008). Thus, we adopted the procedure proposed by Hayes (2013) called PROCESS to check our hypotheses on mediation effects. PROCESS considers a bootstrapping procedure to examine the conditional indirect effects, a more powerful procedure than Sobel's z test to test for mediation effects (Zhao et al., 2010). We set 5,000 bootstrap samples as suggested by Preacher and Hayes (2008). Table 2.4 presents the estimates, standard errors, significance level, and corresponding lower (LLCI) and upper level (ULCI) confidence intervals.

Table 2.3 Results of the regression analysis(a)

	1 <sup>st</sup> main stage				2 <sup>nd</sup> main stage				3 <sup>rd</sup> main stage									
	TRANSACTION		DOCUMENT		ASSESSMENT		FINANCIAL		CUSTOMER		DELIVERY		FINANCIAL		CUSTOMER		DELIVERY	
Dummy_scale	-0.166	-0.290	-0.169	-0.312	-0.314	-0.563	-0.004	-0.124	-0.350	-0.509	-0.803	<b>-0.949*</b>	0.118	0.081	-0.252	-0.279	<b>-0.732*</b>	-0.633
Dummy_labor	0.093	0.051	-0.478	-0.525	-0.279	-0.362	-0.018	-0.058	-0.312	-0.365	-0.739	<b>-0.788*</b>	0.015	-0.012	-0.250	-0.349	<b>-0.686*</b>	<b>-0.666*</b>
Dummy_R&D	-0.115	-0.168	0.518	0.457	-0.151	-0.257	-0.557	-0.608	-0.566	-0.634	-0.080	-0.143	-0.444	-0.425	-0.527	<b>-0.587*</b>	-0.069	-0.135
Ln_employees_purch	<b>0.207*</b>	0.137	0.227	0.147	<b>0.353**</b>	<b>0.212*</b>	0.012	-0.056	0.122	0.032	<b>0.343**</b>	<b>0.261**</b>	-0.088	-0.086	-0.015	-0.029	0.165	0.171
Dummy_sales_low	-0.154	-0.311	-0.123	-0.304	-0.213	-0.528	0.561	0.408	0.198	-0.004	-0.234	-0.418	<b>0.629*</b>	<b>0.603*</b>	0.238	0.170	-0.234	-0.301
Dummy_sales_medium	0.496	0.401	0.161	0.052	0.378	0.187	0.062	-0.030	0.075	-0.046	0.194	0.083	-0.093	-0.097	-0.121	-0.155	-0.071	-0.083
Dummy_firm_size	0.109	-0.002	0.576	0.449	0.485	0.263	0.520	0.412	0.241	0.099	-0.255	-0.385	0.415	0.399	0.060	0.026	-0.494	<b>-0.603*</b>
SUPPLIERS		<b>0.437**</b>		<b>0.502**</b>		<b>0.876**</b>		<b>0.426**</b>		<b>0.561**</b>		<b>0.512**</b>	-0.013	-0.001	<b>0.096*</b>	<b>0.105*</b>	<b>0.242**</b>	<b>0.238**</b>
KNOWLEDGE													0.083	0.072	0.064	0.052	0.070	0.072
TRANSACTION													<b>0.170**</b>	<b>0.189**</b>	<b>0.185**</b>	<b>0.167**</b>	<b>0.261**</b>	<b>0.191**</b>
DOCUMENT													-0.105	-0.119	0.009	0.036	0.039	0.139
ASSESSMENT													<b>0.243**</b>	<b>0.248**</b>	<b>0.221**</b>	<b>0.255**</b>	<b>0.206**</b>	<b>0.264**</b>
TRANSACTION x																		
KNOWLEDGE														0.054		-0.141		-0.197
DOCUMENT x																		
KNOWLEDGE																		
ASSESSMENT x																		
KNOWLEDGE														0.072		<b>0.257**</b>		0.176
F-value	2.262*	10.517**	4.537**	13.469**	5.205**	3.77**	1.540	3.770**	1.500	3.770**	3.443**	14.346**	7.134**	5.786**	15.234**	13.196**	16.818**	15.088**
R <sup>2</sup>	0.065	0.272	0.123	0.324	0.139	0.145	0.046	0.145	0.044	0.145	0.096	0.338	0.279	0.285	0.453	0.476	0.477	0.509
Adjusted R <sup>2</sup>	0.037	0.246	0.096	0.300	0.112	0.106	0.016	0.106	0.015	0.106	0.068	0.314	0.24	0.236	0.423	0.440	0.449	0.476
Change in R <sup>2</sup>	0.065*	0.207**	0.123**	0.201**	0.139**		0.046		0.044		0.096**	0.241**	0.234**	0.006	0.408**	0.023*	0.381**	0.032**

(a) Unstandardized beta coefficients are reported, since the main variables were standardized previous to regression

n=234 \*\* p &lt; 0.01; \* p &lt; 0.05

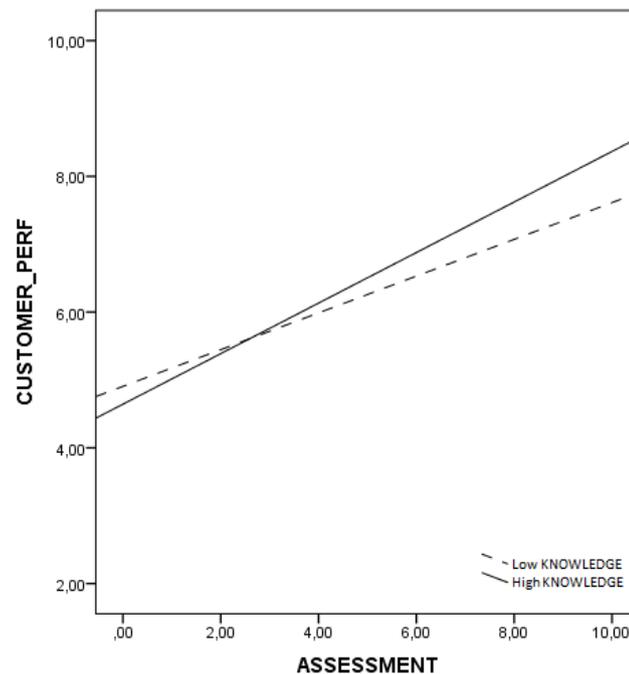
Table 2.4 Indirect effects (bootstrapping outcome)

	Bootstrap outcome			95% confidence interval	
	Mean	SD	Sig.	LLCI	ULCI
SUPPLIERS -> TRANSACTION -> FINANCIAL	0.1251	0.0703	<0.01**	-0.0066	0.2700
SUPPLIERS -> DOCUMENT -> FINANCIAL	-0.0829	0.0556	0.0603	-0.2075	0.0141
SUPPLIERS -> ASSESSMENT -> FINANCIAL	0.2022	0.062	<0.01**	0.0891	0.3333
SUPPLIERS -> TRANSACTION -> CUSTOMER	0.1417	0.0663	<0.01**	0.0199	0.2780
SUPPLIERS -> DOCUMENT -> CUSTOMER	0.0255	0.039	0.5356	-0.0535	0.0983
SUPPLIERS -> ASSESSMENT -> CUSTOMER	0.1934	0.0516	<0.01**	0.0977	0.3000
SUPPLIERS -> TRANSACTION -> DELIVERY	0.1994	0.0796	<0.01**	0.0592	0.3744
SUPPLIERS -> DOCUMENT -> DELIVERY	0.0951	0.0636	0.0658	-0.0135	0.2373
SUPPLIERS -> ASSESSMENT -> DELIVERY	0.1991	0.0567	<0.01**	0.0954	0.3205

Significance level at  $p < 0.01^{**}$ .

For FINANCIAL, the direct effect of SUPPLIER was not significant ( $p = 0.5371$ ). Regarding the indirect effects, the bootstrapping results showed that they were significant for TRANSACTION ( $p = 0.0059$ ) and ASSESSMENT ( $p < 0.001$ ). However, TRANSACTION falls outside the 95% confidence interval ( $CI = -0.0066, 0.2700$ ). In this case, the mediation hypothesis is rejected by very little, being less than 0.01 below the lower confidence interval. Consequently, this is a case that deserves further investigation to arrive at safer conclusions. For ASSESSMENT ( $CI = 0.0891, 0.3333$ ), the indirect effect was significant within the 95% confidence interval, suggesting a complete mediation for FINANCIAL. For CUSTOMER and DELIVERY, we found partial mediations since the direct effects of SUPPLIERS were both significant at  $p < 0.01$ . Our results show that TRANSACTION and ASSESSMENT were significant ( $p < 0.01$ ) and within the 95% confidence interval, while DOCUMENT was not significant for any of the two models. Therefore, we can support hypotheses H1a and H1c.

For the last stage, concerning the hypothesis of KNOWLEDGE having a moderating effect on the other three dimensions of purchasing operations, the results in Table 2.3 show only one moderating effect of KNOWLEDGE on the relationship between ASSESSMENT and CUSTOMER ( $B = 0.257, p < 0.01$ ), supporting H2c on customer performance. To better understand the effect of this moderation, we plot the slope in Figure 2.2, which shows the positive effect of ASSESSMENT on CUSTOMER when KNOWLEDGE is high in purchasing operations. That is, when a good purchasing assessment management is present, there is better feedback on customer results, improving the value delivered to customers, and it is even better when purchasing knowledge management is present.



**Figure 2.2- Slope for the moderating role of knowledge management (KNOWLEDGE) on Customer vs Purchasing Assessment Management**

We also submitted the regression models to statistical power analysis. We considered the statistical power of the partial coefficients using Cohen's  $f^2$  estimation for the predictors (Cohen et al., 2003) and the range of effects (Cohen et al., 2003, p.95), where 0.02 is a small effect, 0.15 a medium effect, and 0.35 a large effect. We also estimated the population effect size of  $R^2$  using Cohen's  $f^2$  estimation (Cohen et al., 2003, p.91). For the final model of FINANCIAL with moderation effect, we obtained  $f^2 = 0.40$ , which means a statistical power of  $\approx 0.99$  at  $\alpha = 0.01$  and degrees of freedom (d.F.) = 218. For CUSTOMER, we obtained  $f^2 = 0.91$ , which represents a statistical power of  $\approx 0.99$  at  $\alpha = 0.01$  and d.F. = 218. The final model for DELIVERY resulted in  $f^2 = 1.04$ , representing a statistical power of  $\approx 0.99$  at  $\alpha = 0.01$  and d.F. = 218. Overall, our results are above the average statistical power in the management research field (Verma and Goodale, 1995).

To test H3, we first performed a hierarchical cluster analysis followed by a K-means procedure. The resulting dendrogram from the hierarchical cluster analysis suggested a range from 3 to 7 clusters at the cutoff line of 10 distances in the Ward linking method. We choose 3 clusters based on the best fit of the Silhouette Index. Then, we performed a K-means cluster analysis for three clusters, as shown in Table 2.5. The results show that the configuration of purchasing operations activities and supplier relationship management follow maturity levels varying from a generally lower maturity level of all activities in Cluster 1 to the highest maturity level represented by Cluster 3. Thus, the results

show that the implementation patterns are cohesive among the different activities considered as independent variables of the conceptual model. Moreover, when analyzing the cross-tabs of firm performance metrics across the clusters (Table 2.5), the results show that such maturity patterns of purchasing operations are also reflected in the performance metrics. This means that high maturity levels also present higher performance metrics. Therefore, these findings validate hypothesis H3 since they evidence a pattern of purchasing operations and firm performance.

Table 2.5 K-means cluster analysis and firm performance across the clusters profile

<b>K-means results – Clusters centroids</b>				
	<b>Cluster 1</b>	<b>Cluster 2</b>	<b>Cluster 3</b>	<b>ANOVA test</b>
<b>Dependent variables</b>	<b>(Low maturity)</b>	<b>(Intermediate Maturity)</b>	<b>(High maturity)</b>	<b>F-values</b>
SUPPLIER	5.02	7.07	8.53	86.44***
KNOWLEDGE	5.16	6.57	8.38	134.60***
TRANSACTION	3.67	6.11	7.49	127.98***
DOCUMENTS	4.78	6.70	8.84	136.613***
ASSESSMENT	3.44	7.41	8.55	157.84***
<b>Cross-tabs analysis</b>				
<b>Cluster means across firm performance measures</b>				
<b>Firm performance</b>	<b>Cluster 1</b>	<b>Cluster 2</b>	<b>Cluster 3</b>	
FINANCIAL	6.79	7.46	8.00	12.13***
CUSTOMER	5.65	6.96	7.83	52.55***
DELIVERY	4.88	6.80	8.16	62.63***
n=	24	91	119	

## 2.6 Discussion and conclusion

Our results evidenced the complementarity of the contingency and configurational views for analysis purchasing operations, as they allowed validating the hypotheses and supplementing the views from each other. The contingency view showed the mechanisms required to structure the external-internal activities of purchasing operations. On the other hand, the configurational view allowed us to understand how these activities are implemented through patterns to increase performance. We now discuss the implications of this.

Regarding the contingency structure proposed between external and internal activities, our results confirmed our general hypothesis that purchasing operations mediate between suppliers' relationship and firm performance. This means that companies must establish an integrative process involving suppliers and purchasing operations to improve their performance. When both activities are

aligned, companies can select the best suppliers and improve transaction processes, leading to better delivery, customer satisfaction, and firm financial performance.

Our results can explain why some prior studies may not have found significant effects of supply management on performance (e.g., Ellram et al., 2002). These studies only considered the strategic aspects of managing suppliers, overlooking the tactical elements of purchasing operations, which our findings show to be a relevant mediator of this relationship. As a practical example, companies that do not adopt an integrative approach to configure these two business processes may end up having a purchasing department that will base decisions on lower price only or will overspend when unnecessary (Handfield et al., 2015). Other potential problems can emerge when there is an informal purchasing process that creates inefficiencies in the suppliers' management (Sunny et al., 2020); and when the transaction process is not well organized (e.g., bureaucracies, lack of standardized documents and purchasing processes), consuming time and resources despite any efforts to establish a good relationship with suppliers (Addo-Tenkorang & Helo, 2016). Therefore, we show that companies need to manage suppliers while also focusing on efficiency in concretizing the upstream supply management, which is the purchasing operation.

Our study also explored the tactical aspect of purchasing operations by detailing the relevant dimensions for the mediation effect between SUPPLIERS and firm performance. We showed that having good control over the purchasing transactions process (TRANSACTIONS) and establishing a purchasing assessment process (ASSESSMENT) are key aspects of purchasing operations to mediate the effect of SUPPLIERS on all the performance metrics. Therefore, we extend the view of prior studies on the strategic aspects of purchasing (Arora et al., 2020; Brandon-jones & Knoppen, 2018) by emphasizing the importance of these two activities of purchasing involving both tactical and strategic aspects. Ramsay and Croom (2008) had already criticized studies that only address a strategic role of purchasing, while Zimmermann and Foerstl (2014) conducted an empirical investigation and found support for the link between purchasing tactical practices and a firm's performance. Other complementary studies proposed different practices and tactical activities of purchasing to enhance operations management (González-Benito, 2010; Lau et al., 1999). We add to these studies by providing evidence on how these two levels of purchasing operations link upstream supply management and firm performance. In terms of theory, we provide evidence for at least two levels of purchasing operations that should be included when studying the contribution of supply management to operations management. As an example, Marodin et al. (2016) showed that managing suppliers would maximize the impact of lean manufacturing practices on performance. They considered supply management practices such as just-in-time delivery and feedback to suppliers on

their performance. However, manufacturers will not receive 'just-in-time' if the transaction operation is slow to complete the purchasing process, and appropriate feedback to suppliers becomes impossible when a purchasing assessment process is not well established. Therefore, such studies rely on assumptions about tactical aspects that we now bring to light.

We also found evidence on the moderating role of purchasing knowledge management on assessment management when associated with customer performance. Knowledge management practices help to deepen reflection on the causes and consequences of the decision-making process in supply management (Li et al., 2012; Revilla & Knoppen, 2015). This helps better analyze which relationship with suppliers resulted in a good purchase that benefits customers (Patrucco et al., 2021). We understand this as knowledge management in purchasing operations helping the company focus on customer requirements when assessing its potential suppliers. Hock-Doepgen et al. (2021) claim that knowledge management allows companies to identify market changes, working as a pivot that balances suppliers and customers. Our results show what establishes such a balance: the assessment management activity [ASSESSMENT]. We explained this result by showing that the assessment management captures the process data that knowledge management uses to generate and provide feedback, connecting the customer and supplier sides. Thus, the company can implement a customer-oriented supplier-purchasing assessment with knowledge management. Assessment processes in the supply management have been considered from different perspectives in the literature (Prajogo et al., 2012; Visani & Boccali, 2020), but knowledge management to enhance customer focus is a new finding from our study.

Contrary to our expectations, we did not find evidence to support our hypotheses on the mediating role of purchasing documentation and the moderating role of knowledge management in the other activities of purchasing operations besides assessment. Regarding purchasing documentation, we followed a hierarchical structure of the tactical activities in purchasing management (Dobler & Burt, 1996). Therefore, we considered document management an internal activity that could mediate the other relationships. However, a possible explanation is that document management may also operate as purchasing knowledge management by supporting other activities. For instance, purchasing transactions need several documents that require management and assessment activities also involve the analysis of documents about specifications and certifications (Monczka et al., 2016). This possibility is reinforced with the results of the configurational view, since document management is also part of higher maturity levels of purchasing operations, which are associated with higher levels of firm performance. In other words, the development of document management is also part of the patterns of firms that achieve high performance through purchasing operations. On the other hand,

regarding purchasing knowledge management, our results can mean that companies use this activity in the assessment stage of the tactical process. This usually happens in other fields like product development, where lessons learned and best practices tend to be adopted in the stage gates of the product development process (Frank et al., 2015). Although this might be the dominant practice that explains our results, knowledge management practices can contribute stronger when they are also used *during* the process execution (Frank & Ribeiro, 2012), as a permanent practice of the purchasing operation.

Finally, from a configurational point of view, our results supported hypothesis H3, showing a pattern of implementation of purchasing operations and supplier relationship management. Moreover, this pattern is cohesive among all activities since they grow together in levels of maturity (Sogaard et al., 2019). This result is complementary to the contingency association model. On the one hand, the contingency model shows the mechanisms of association among supplier relationship management and purchasing operations, being purchasing operations a mediator between supplier relationship and performance. On the other hand, the patterns identified in the cluster analysis show that although these mechanisms of association and support are present, the implementation of all the considered activities work as an integrative system in which they grow together in a balanced approach. Thus, this consolidates the view of purchasing operations of a process that should be deployed in three main activities (Monczka et al., 2016; Perner et al., 2014), but it also adds the relevance of connecting them with supplier relationship management (the strategic and external side of the process) (Lerman et al., 2022) and with knowledge management activities to deal with the dynamism of the process (Yang et al., 2021).

### **2.6.1 Theoretical contribution**

Our study contributes to the use of the contingency-configurational view in supply and purchasing management, extending it from supply management (Flynn et al., 2010; Huo et al., 2015) to purchasing operations. Using, first, the contingency view, we showed the mediating role of purchasing operations between the contingency role of suppliers' relationship and firm performance. The low effect sometimes observed of supply management on firm performance can be explained when the purchasing operations are not considered. Therefore, our findings suggest that scholars must consider both external and internal activities as a contingency perspective, hand by hand when studying supply management activities with firm performance. Furthermore, purchasing operations usually consider only transactional processes. In this sense, another theoretical contribution of this study is that we show the role of knowledge management routines as a part of the configurational perspective of purchasing operations. We showed that knowledge management has a moderating role

between purchasing assessment and customer performance, helping to deepen reflection on the causes and consequences of the decision-making process in supply management. Moreover, we showed that knowledge management is part of the maturity patterns of purchasing operations, which demonstrates its role in the configuration of purchasing operations. Therefore, scholars should reconsider the way purchasing is analyzed in supply management and use the contingency-configurational view to broaden their analysis of what purchasing represents in the studies.

### **2.6.2 Managerial and practical implications**

Managers and practitioners can obtain several takeaways from our study. First, our study shed light on the importance of the tactical side of purchasing department in a firm to achieve performance. Because many previous studies (e.g., Brandon-jones & Knoppen, 2018; Carr & Pearson, 2002; Chen et al., 2004; Paulraj et al., 2006) suggested that purchasing is a strategic aspect of the firm, the problems faced in reality by them persist in purchasing departments. In other words, many managers still associate the purchasing process only with the strategical planning of the firm, neglecting its “ongoing operation” alongside the supply chain. To some extent, firms may achieve performance. However, this performance can be affected if managers neglect the operational side of purchasing. Our study showed the necessity of identifying vendors, communicating with them, pricing and requirement negotiations, and assessing the processes are paramount to achieving different performance levels (i.e., financial, customer, and delivery). Therefore, managers and practitioners should be more attentive in their purchasing department by seeking more external and internal interconnected activities (e.g., supplier selection and transaction evaluation). Our main point is that managers should understand that purchasing is not isolated from strategical planning. Purchasing is a process with a broader impact on supply (e.g., manufacturing, distribution, selling), which needs a holistic view of how its operations impact the entire supply chain.

Second, from a practical point of view, managers should use lessons learned, best practices review, and the reuse of several sources of knowledge to ask themselves this question: To what extent does buying from Supplier A or B help us meet our customer’s requirements? For instance, a building company may establish a very good relationship with a materials supplier, and purchasing operations may work efficiently, but purchasing knowledge management will lead the company to consider whether the quality of the final build, which largely derives from the materials acquired, will meet customers’ expectations. If the answer is no, the purchasing assessment process will have to be reviewed. We also show the importance of knowledge management for purchasing departments. At least, practitioners should use all accumulated knowledge in purchasing operations to avoid keeping the same errors with suppliers. Logically, the ideal and recommendation to managers is a complete

configured process in their purchasing department and not only to support the assessment activities as it is shown it happens today in the investigated companies. Knowledge management can help them better decide the transaction activities, increase learning curves in transaction operations, and assess whether the relationship with suppliers and purchasing operations meets customer needs and requirements. In this sense, practitioners are first challenged to formally consider knowledge management in purchasing operations to obtain the empirically demonstrated benefit. Then, practitioners are challenged to go a step further and elevate the contribution of knowledge management to the other purchasing dimensions not yet evidenced in this study. Empirical evidence from other fields has shown the relevance of knowledge management in a complete organizational process, which we expect might also be important here for purchasing activities.

Finally, practitioners should consider our purchasing maturity results from a configurational perspective. The results show a pattern of maturity levels in purchasing operations, and they suggest that all purchasing activities, including knowledge management, should be implemented and further developed in a cohesive approach. This means that the purchasing operations activities explored in this study represent a system that should be implemented jointly to work well and increase performance. Therefore, practitioners should take care of the different details of the operational activities in purchasing and create a growth path for these activities together. They can also focus on building roadmaps to describe how to transition from one level to the other in a coherent manner between the different dimensions.

### **2.6.3 Limitations and future research**

One limitation of our study is that we did not consider dynamic effects in the SCM that can affect the purchasing operation. One of these aspects is price variation in the supply chain. This may affect both the relationship with suppliers and how purchasing operations behave. For instance, the supply disruptions resulting from the COVID-19 pandemic have harmed the SCM activities. Purchasing operations have had to ensure the provision of materials, often by overspending due to a lack of supply. Such dynamic factors may open an important stream of research in the future, focused on investigating the relationship between SCM and purchasing operations.

A second aspect that deserves further investigation in the future is the role of digital technologies for smart supply chains in the suppliers-purchasing relationship. The smart supply chain has been one of the growing fields in the literature, considering how the Internet of Things, cloud computing, big data, and artificial intelligence may enhance performance (Frank et al., 2019; Meindl et al., 2021; Lerman et al., 2022). Real-time integration between suppliers and purchasing may change

how purchasing operations are executed and how they moderate and reinforce the relationship between the relationship with suppliers and firm performance. The smart supply chain also allows us to foresee pricing variations and better prepare the purchasing operations' transactional process or follow the suppliers and purchasing execution in real-time to assess their impact on deliveries, customers, and financial performance (Zekhnini et al., 2021). We did not consider such technological aspects that could support the investigated variables. They may be very relevant for future expansion of this topic's practical and theoretical understanding.

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## Appendix A: Questionnaire

**Questionnaire items to assess Relationship with Suppliers (SUPPLIERS)** (Adapted from Amoako-gyampah et al., 2020; Ayala et al., 2018; Ayala et al., 2020; Koufteros et al., 2012; Liu et al., 2009; Revilla & Knoppen, 2015; Yang et al., 2021). *Concordance Likert scale: 1 - strongly disagree to 10 - strongly agree. Cronbach = 0.90; CR = 0.99; AVE = 0.70. Factor loadings are shown in parentheses.*

- a) Our firm has been building a long-term relationship with its suppliers (0.82)
- b) Our relationship with supply chain partners is cooperative (0.93)
- c) Our company trusts the products/services provided by the suppliers (0.80)
- d) Our company values the exchange of information and the sharing of knowledge with strategic suppliers (0.80)

**Questionnaire items to assess Purchasing Transaction Management (TRANSACTION)** (Adapted from Dobler & Burt, 1996; Monczka et al., 2016; Weele, 2009). *Concordance Likert scale: 1 - strongly disagree to 10 - strongly agree. Cronbach = 0.87; CR = 0.99; AVE = 0.54. Factor loadings are shown in parentheses.*

- a) Changes in purchasing operations are made after detailed analysis (0.78)
- b) Our company has control over purchasing operations processes and resources (0.77)
- c) Few errors are observed in the purchasing process (0.65)
- d) Our company has the purchasing process under control (0.76)
- e) Purchasing transaction errors are resolved quickly (0.70)
- f) Purchasing operations are aligned with the company's strategic planning (0.76)

**Questionnaire items to assess Purchasing Document Management (DOCUMENT)** (Adapted from Perner et al., 2014). *Concordance Likert scale: 1 - strongly disagree to 10 - strongly agree. Cronbach = 0.89; CR = 0.98; AVE = 0.66. Factor loadings are shown in parentheses.*

- a) In our firm, purchasing operations are documented (0.70)
- b) In our firm, purchasing operations are reviewed (0.82)
- c) In our firm, the successes of purchasing operations are documented (0.87)
- d) In our firm, the alternative solutions adopted in purchasing operations are documented (0.86)

**Questionnaire items to assess Purchasing Assessment Management (ASSESSMENT)** (Adapted from Monczka et al., 2016; Pohl & Kai, 2011). *Concordance Likert scale: 1 - strongly disagree to 10 - strongly agree. Cronbach = 0.93; CR = 0.99; AVE = 0.78. Factor loadings are shown in parentheses.*

- a) Our firm has performance targets for purchasing operations (0.87)
- b) In our firm, the performance of purchasing operations is measured (0.93)
- c) Performance indicators are defined for our company's purchasing operations (0.91)
- d) The performance assessment of purchasing operations is aligned with the interests of all parts of the company (0.81)

**Questionnaire items to assess Purchasing Knowledge Management (KNOWLEDGE)** (Adapted from Abbas, 2020; Flöthmann et al., 2018; Frank et al., 2015; Frank & Ribeiro, 2012). *Concordance Likert scale: 1 - strongly disagree to 10 - strongly agree. Cronbach = 0.90; CR = 0.99; AVE = 0.61. Factor loadings are shown in parentheses.*

- a) In our company, employees document knowledge about the purchasing process (0.66)
- b) Our company uses documented knowledge for new purchasing operations (0.80)
- c) Our company reuses purchasing process solutions (0.85)
- d) Our company reuses lessons learned (0.85)
- e) Our company uses documented best practices (0.80)

f) In our company, a comparison is made between current and previous purchasing problems (0.71)

**Questionnaire items to assess Performance (including financial performance, customer performance, and delivery)** Concordance Likert scale: 1 - strongly disagree to 10 - strongly agree. Cronbach = 0.82; CR = 0.99.

**Financial Performance (FINANCIAL)** (Adapted from Asare et al., 2013; Jayaraman et al., 2013).

*Factor loadings are shown in parentheses.*

- a) In the last two years, our company has had a growth in profit (0.80)
- b) In the last two years, our company has had a cost reduction (0.79)

**Customer Performance (CUSTOMER)** (Adapted from Asare et al., 2013; Ayala et al., 2018).

*Factor loadings are shown in parentheses.*

- a) Our company has the loyalty of most customers (0.70)
- b) Our company is able to attract new customers (0.76)
- c) Our company is able to maintain customer satisfaction levels in the various markets in which it operates (0.63)

**Delivery (DELIVERY)** (Adapted from Fynes & Búrca, 2005; Marodin et al., 2016). *Factor loadings*

*are shown in parentheses.*

- a) Our company is effective in on-time delivery (0.92)
- b) Our company has been successful in reducing lead-time (0.82)

**Questionnaire items for control variables**

- a) Please identify the industry segment of your company (based in Chudnovsky et al., 2006)
- b) Please inform the size of your company in number of employees (based in IBGE, 2015)
- c) Please inform how many employees work in the purchasing department
- d) Please inform the revenue of your company

### Appendix B: Rotated matrix of the Exploratory Factor Analysis (Varimax Rotation)

Questionnaire items		Factors and factor loadings				
		1	2	3	4	5
DOCUMENTS	Item_a	.311	.330	.095	.148	<b>.630</b>
	Item_b	.261	.224	.178	.169	<b>.785</b>
	Item_c	.453	.163	.088	.178	<b>.702</b>
	Item_d	.520	.092	.092	.100	<b>.706</b>
KNOWLEDGE	Item_a	<b>.632</b>	.059	.121	.212	.308
	Item_b	<b>.658</b>	.140	.070	.171	.468
	Item_c	<b>.636</b>	.253	.132	.345	.370
	Item_d	<b>.775</b>	.173	.148	.294	.139
	Item_e	<b>.739</b>	.142	.221	.205	.245
	Item_f	<b>.702</b>	.260	.224	.095	.161
SUPPLIERS	Item_a	.311	.141	.202	<b>.786</b>	-.030
	Item_b	.298	.146	.164	<b>.837</b>	.115
	Item_c	.189	.092	.192	<b>.789</b>	.205
	Item_d	.122	.248	.125	<b>.782</b>	.266
ASSESSMENT	Item_a	.171	<b>.848</b>	.127	.154	.189
	Item_b	.168	<b>.850</b>	.195	.152	.236
	Item_c	.230	<b>.849</b>	.173	.205	.160
	Item_d	.157	<b>.784</b>	.351	.123	.063
TRANSACTION	Item_a	.278	.452	<b>.665</b>	.002	.139
	Item_b	.215	.215	<b>.738</b>	.162	.033
	Item_c	-.058	.401	<b>.568</b>	.192	.299
	Item_d	.152	.140	<b>.798</b>	.151	-.015
	Item_e	.022	.146	<b>.672</b>	.324	.281
	Item_f	.176	.040	<b>.821</b>	.074	.047
% of variance explained (cumulative)		16.958	32.551	47.613	61.261	73.761

### Appendix C: Bivariate correlation matrix

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Industry_scale	-														
2 Industry_labor	-.628**	-													
3 Industry_R&D	-.275**	-.388**	-												
4 Ln_employees_purch	.162*	-.136*	-.123	-											
5 Industry_sales_low	-.137*	.074	.147*	-.535**	-										
6 Industry_sales_medium	.010	.044	-.036	-.186**	-.333**	-									
7 Industry_size	.115	-.086	-.092	.633**	-.652**	-.144*	-								
8 SUPPLIERS	.071	-.045	-.018	.124	-.049	-.010	.093	-							
9 KNOWLEDGE	-.0178	-.061	.0582	.119	-.089	-.040	.145*	.585**	-						
10 OPERATIONS	-.018	.043	-.059	.190**	-.199**	.109	.150*	.472**	.488**	-					
11 DOCUMENTS	.060	-.175**	.117	.272**	-.219**	-.016	.269**	.480**	.757**	.428**	-				
12 ASSESSMENT	.040	-.058	-.031	.338**	-.287**	.031	.299**	.449**	.505**	.577**	.506**	-			
13 FINANCIAL_PERF	.045	.050	-.145*	.054	.024	-.070	.097	.237**	.256**	.377**	.155*	.427**	-		
14 CUSTOM_PERF	.017	-.002	-.094	.174**	-.092	-.038	.146*	.459**	.462**	.543**	.401**	.587**	.655**	-	
15 DELIVERY	-.030	-.105	.086	.248**	-.163*	.015	.128	.511**	.481**	.544**	.454**	.552**	.207**	.505**	-
Mean	.308	.470	.145	2.515	.256	.244	.581	7.605	7.347	6.561	7.590	7.586	7.664	7.269	7.295
S.D.	.462	.500	.353	1.405	.438	.430	.494	1.702	1.537	1.619	1.884	1.979	1.268	1.227	1.752
Skewness	.839	.121	2.026	.732	1.123	1.202	-.331	-1.257	-.623	-1.013	-0.983	-1.435	-1.057	-.956	-.913
Kurtosis	-1.308	-2.003	2.123	.190	-.745	-.559	-1.907	1.665	.203	1.362	1.034	2.049	2.895	2.380	.945

\*\*p<0.01; \*p<0.05

**3 PAPER 2 – MANAGING PARADOXES FOR DIGITAL  
TRANSFORMATION IN SUPPLY CHAIN INTEGRATION**

**4. PAPER 3 – WHEN SUPPLY CHAINS ARE DIGITALIZED: EXAMINING THE SOCIAL EXCHANGE STRUCTURE BEHIND THE INTER-ORGANIZATIONAL INTEGRATION THROUGH DIGITAL TRANSFORMATION**

## 5. FINALS CONSIDERATIONS

This work presented three articles, each corresponding to a specific objective of this dissertation. Figure 5.1 illustrates the relationship between the three articles of the dissertation. First, Article 1 addresses how the configuration of purchasing operations, an interface area between the external and internal SC activities, affects the firm performance when companies manage their relationship with suppliers. Second, Article 2 demonstrates how companies must manage digital resources to achieve higher operational performance by integrating SC through the DT. Finally, Article 3 shows how social exchange occurs when digital integration is implemented along the supply chain. The three articles were developed sequentially to form a whole perspective that explains how SC can be integrated through DT, considering processes, resources, and relationships. The results of each of these articles that make up this thesis form a set of descriptive models that clarify the integration of supply chain management and the digital transformation of supply chains.

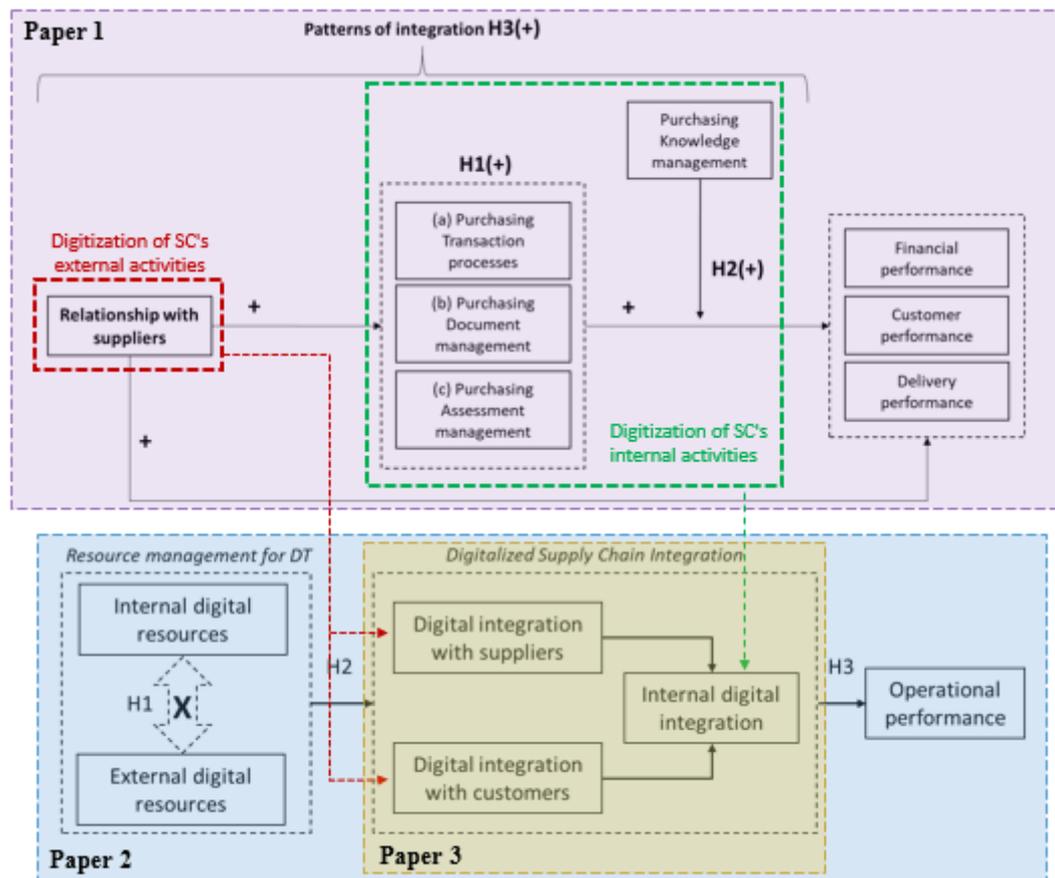


Figure 5.1- Relationship among the three articles of the thesis

### **5.1. Theoretical contributions**

This thesis investigates the integration of the SC through the DT within the lenses of processes, resources, and relationships among the actors to ascertain essential requirements for successful DT implementation. Regarding processes, this study contributes to the supply and purchasing management field by expanding the application of the contingency-configurational view. Previous research has predominantly focused on supply management processes. Still, this study incorporates purchasing operations into the analysis since it is the interface area between SC's external and internal activities. By adopting the contingency view, the study examines the mediating role of purchasing operations in the relationship between suppliers' contingency role and firm performance. The findings suggest that the limited impact of supply management on firm performance can be attributed to the neglect of purchasing operations. Therefore, scholars should consider external and internal activities from a contingency perspective to enhance their understanding of the relationship between supply management and firm performance. Furthermore, the study highlights that purchasing operations often prioritize transactional processes while overlooking knowledge management routines. By demonstrating the moderating role of knowledge management in the relationship between purchasing assessment and customer performance, the study contributes to the theoretical understanding of decision-making processes in supply management. The research also reveals knowledge management's significance in shaping purchasing operations' configuration. It suggests that scholars should adopt the contingency-configurational view better to understand the multifaceted nature of purchasing within supply management.

Having defined the requirements referring to the processes of the interface between the external and internal activities of the SC for the successful implementation of the DT, the necessary resources for this digital integration were analysed. Consequently, the research adopted a quantitative approach to explore paradoxes in digital integration. The findings demonstrate the need to approach DT in SCI from a paradoxical perspective, particularly in acquiring external and developing internal digital resources. Therefore, based on the results, the study suggests that companies engaged in DT for SCI should embrace and manage contradictions by utilizing internal and external digital resources. This requires an ambidextrous digital capability and effectively manages paradoxes through acceptance, contextualization, and resolution cycles. The study reveals that the synergy between paradoxical tensions (digital resources) contributes to the external dimensions of SCI, specifically digital integration with suppliers and customers. However, no direct statistical evidence supports an association between this synergistic effect and the internal dimension of SCI. This suggests that an ambidextrous digital capability becomes necessary when the company focuses on external integration.

On the other hand, when a company focuses on internal processes, the digital transforming capability and the paradoxes associated with internal DT processes using a hybrid structure may suffice to explain DT. The study also highlights the importance of integrating various digital resources when dealing with the complexity of integrating with suppliers and customers. Furthermore, the study demonstrates that the internal dimension of SCI acts as a mediator between internal and external digital resources and performance, enhancing supply chain outputs.

Finally, looking at the requirements for successful DT implementation regarding relationships among the SC actors, the study investigates integrating supply chains digitally using the Social Exchange Theory and the TOE framework. The study adopts a qualitative approach, analysing a focal company's experience implementing digital integration within its supply chain structure (encompassing four suppliers and four customers). The findings show how stakeholders' pursuit of value creation and rewards can influence their willingness and ability to implement digital transformation to integrate the supply chain. Were proposed a final framework which shows actions to ensure rewards from the digital integration of the supply chain. Consequently, the study provides a comprehensive understanding of the theoretical foundations of digital integration in supply chains. It offers valuable guidance for researchers examining the SET elements through the TOE framework seeking effective integration of digital technologies into their operations.

## **5.2. Practical contributions**

This study provides valuable insights for managers and practitioners in the field, offering practical contributions to improve performance within SCI. Firstly, it highlights the significance of the operational aspects of the purchasing department. While existing research often focuses on the strategic nature of purchasing, our study emphasizes the importance of operational activities, such as vendor identification, communication, price negotiation, and process assessment. Neglecting these activities can have a detrimental impact on performance. Therefore, managers should adopt a holistic view of purchasing, recognizing its interconnectedness with strategic planning and its influence on the supply chain.

Secondly, managers should draw on lessons learned and leverage various sources of knowledge to evaluate the contribution of different suppliers in meeting customer requirements. Effective knowledge management within the purchasing department is crucial to ensure that the quality of the final product aligns with customer expectations. This study highlights the significance of knowledge management for purchasing departments and encourages practitioners to integrate it more

comprehensively into their operations. This integration can aid decision-making, enhance learning curves, and align the relationship with suppliers and purchasing operations with customer needs.

Thirdly, to effectively handle the paradox associated with internal and external digital resources, managers should prioritize the development of both types. Internally, they should focus on enhancing their teams and technologies for DT. Externally, they should establish a network of partners using an ecosystem approach, which can support their company and other stakeholders in the supply chain. It is essential for managers to consistently maintain both internal and external resources and effectively manage the tensions that arise from integrating these resources. Although this requires effort, this research demonstrates that adopting a two-fold approach can increase cost efficiency and improve supply chain integration, leading to enhanced outcomes such as improved delivery and reduced lead time.

Lastly, the findings contribute to understanding the relationships between the SC actors during the digital integration in supply chains and highlight the importance of a shared purpose. The study shows the social aspects that emerge from this integration. It emphasizes the significance of trust, reciprocity, and mutual benefits in successful digital integration and the factors influencing it in the SC. It provides a comprehensive understanding of the practical implications of digital integration in supply chains, offering valuable guidance for organizations seeking effective integration of digital technologies into their operations.

In conclusion, our study offers practical recommendations for managers and practitioners to recognize the operational aspects of purchasing, integrate knowledge management comprehensively, consider effectively managing the paradoxes associated with digital resources and evaluate the elements of social aspects necessary to integrate the SC digitally. Thus, practitioners can achieve better outcomes in integrating supply chain operations through the DT.