**UNIVERSIDADE FEDERAL DE SÃO CARLOS**
**CENTRO DE CIÊNCIAS EXATAS E TECNOLOGIA**
**DEPARTAMENTO DE PÓS-GRADUAÇÃO EM ENGENHARIA DE PRODUÇÃO**

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# THE ROLE OF PROCUREMENT IN CREATING SUPPLY CHAIN RESILIENCE

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Tese apresentada ao Programa de Pós-Graduação em Engenharia de Produção como requisito para obtenção do título de Doutor em Engenharia de Produção.

Orientadora: Prof[a] Dr[a] Andrea Lago da Silva

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> "Abençoemos aqueles que se preocupam conosco, que nos amam, que nos atendem as necessidades... Valorizemos o amigo que nos socorre, que se interessa por nós, que nos escreve, que nos telefona para saber como estamos indo... A amizade é uma dádiva de Deus ... Mais tarde, haveremos de sentir falta daqueles que não nos deixam experimentar solidão." (Chico Xavier).

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# ABSTRACT

Achieving resilience along the supply chain in today's turbulent business environment requires efforts from both internal and external elements of the company. Because Procurement is currently considered a boundary spanning function, it has become a primary facilitator in helping to create supply chain resilience. The purpose of this study is therefore to understand the role of Procurement in managing the intra- and inter-organisational issues needed to create supply chain resilience. To do so, a literature review was developed by following the systematic literature review method in which intra- and inter-organisational issues that could impact supply chain resilience were identified. These issues were grouped into eight general topics: knowledge acquired, inventory, product and technology for intra-organisational issues; and strategic sourcing, supply chain design, transportation and risk for inter-organisational issues. Dynamic capability (DC) view was also reviewed to offer a deeper analysis and fresh perspective on the empirical results. A multiple case study was conducted in four focal companies from different sectors, including two key suppliers from each one. After all interviews were transcribed, the data was added to the QDA Miner software in order to conduct a content analysis of within-cases and, subsequently, cross-case analysis. Following the theory elaboration defined by Ketokivi and Choi (2014), propositions were developed based on the empirical and theoretical findings through the rationale of the dynamic capability view. As a result, procurement structure and external inventory were found as additional organisational issues, and a new rationale is proposed to explain how Procurement can create supply chain resilience through dynamically managing and controlling the identified organisational issues. The primary theoretical contribution of this research is applying a new perspective to the issue of resilience. The development of these capabilities may help Procurement managers to better cope with current critical supply disruptions and hence help to achieve company survival and competitiveness.

**Keywords:** supply chain resilience, procurement, supply chain disruption, intra- and inter-organisational issues, systematic literature review, dynamic capability.

# RESUMO

A busca pela resiliência nas cadeias de suprimentos, hoje inseridas em ambientes cada vez mais dinâmicos, requer esforços tanto internos quanto externos às empresas. Como grande parte do risco de ruptura da cadeia de suprimentos se encontra à montante da empresa focal, Compras tem se tornado uma função crítica; principalmente por ser responsável pela solução de conflitos e problemas entre clientes internos e fornecedores. No entanto, pouco se sabe sobre como Compras gerencia esses recursos de forma a lidar com rupturas de suprimentos. O objetivo deste estudo é compreender o papel de Compras na gestão de fatores (internos e externos), de modo a criar resiliência da cadeia de suprimentos. Para tanto, uma revisão teórica foi desenvolvida por meio do método de revisão sistemática da literatura. Neste, fatores internos e externos que podem impactar a resiliência na cadeia de suprimentos foram identificados e agrupados em oito pontos gerais: conhecimento adquirido, estoque interno, produto e tecnologia para pontos internos; e estratégia de suprimentos, configuração da cadeia, transporte e risco para pontos externos. Uma revisão sobre a teoria das capacidades dinâmicas foi também realizada, com intuito de oferecer uma análise mais aprofundada dos resultados obtidos na pesquisa empírica. De forma a completar a compreensão destes pontos, um estudo multicaso foi realizado em quatro empresas de diferentes setores, além de incluir dois fornecedores de cada empresa. Após a transcrição de todas as entrevistas, estas foram inseridas no software QDA Miner para a realização da análise de conteúdo caso a caso e intercasos. Seguindo a orientação de Ketokivi e Choi (2014), foram desenvolvidas proposições a partir da revisão bibliográfica e da análise dos dados empíricos dentro do contexto da teoria de capacidades dinâmicas. Observou-se que a estrutura de Compras e a presença de estoque externo foram apontadas como fatores adicionais. É apresentada também uma nova lógica para explicar como Compras pode criar resiliência na cadeia de suprimentos por meio de uma gestão dinâmica dos pontos-chave identificados sob a lente teórica. Tal resultado é caracterizado como principal contribuição teórica deste estudo. Em termos gerenciais, o desenvolvimento destas capacidades podem ajudar gerentes de Compras a reagirem às rupturas críticas de suprimentos, garantindo a competitividade e a sobrevivência da empresa.

**Palavras-chave:** cadeia de suprimentos resiliente, compras, fatores organizacionais internos e external, revisão sistematica de literatura, capacidades dinâmicas.

# FIGURES

# TABLES

# LIST OF ABREVIATIONS

Aadm2s1 - Admin assistant from Case 2 (KAPPL -S1)

AGRO -FC -Focal company from Case 4

AGRO-S1 - First supplier from Case 4

AGRO-S2 - Second supplier from Case 4

Amat4 - Materials Analyst from Case 4 (AGRO-FC)

Bcof3 - Coffee Commodity Buyer from Case 3 (FOOD -FC)

BEV-FC - Focal company from Case 1

BEV-S1 - First supplier from Case 1

BEV-S2 - Second supplier from Case 2

Blog3 - Logistics Buyer from Case 3 (FOOD -FC)

Bmet3 - Metal Commodity Buyer from Case 3 (FOOD -FC)

Bnut3 - Nuts Commodity Buyer from Case 3 (FOOD -FC)

DC - Dynamic Capability

FOOD-FC - Focal company from Case 3

FOOD-S1 - First supplier from Case 3

FOOD-S2 - Second supplier from Case 3

Hcomp2s1 - Head of the company from Case 2 (KAPPL -S1)

KAPPL-FC - Focal company from Case 2

KAPPL-S1 - First supplier from Case 2

KAPPL-S2 - Second supplier from Case 2

Mcom1 - Commodity Manager from Case 1 (BEV-FC)

Mcom4 - Commodity Manager from Case 4 (AGRO-FC)

Minlog2 - Inbound Logistics Manager from Case 2 (KAPPL-FC)

Mkeya4s2 - Key account Manager from Case 4 (AGRO-S2)

Mmint1s1 - Market Intelligence from Case 1 (BEV-S1)

Mplan1 - Plant Manager from Case 1 (BEV-FC)

Mpmp1 - Production and Material Planning Manager from Case 1 (BEV-FC)

Mppc2 - Production and Planning Control Manager from Case 2 (KAPPL -FC)

Mproc1 - Strategic Procurement Manager from Case 1 (BEV-FC)

Mproc3 - Regional Head of Procurement - South America from Case 3 (FOOD -FC)

Mproc3s2 - Procurement Manager from Case 3 (FOOD -S2)

# LIST OF ABREVIATIONS (continue)

Mproc4 - Procurement Manager from Case 4 (AGRO-FC)

Mpurc1 - Purchasing Manager from Case 1 (BEV-FC)

Mpurc2 - Purchasing Manager from Case 2 (KAPPL -FC)

MRP - Material Resource Planning

Msac1s2 - SAC Manager from Case 1 (BEV-S2)

Msale1s1 - Sales Manager from Case 1 (BEV-S1)

Msales3s1 - Sales Manager from Case 3 (FOOD -S1)

Msales3s2 - Sales Manager from Case 3 (FOOD -S2)

Mscm4s1 - Supply Chain Manager - Latin America from Case 4 (AGRO-S1)

Mtransp2 - Transport Manager from Case 2 (KAPPL -FC)

Psale1s2 - Sales Person from Case 1 (BEV-S2)

Psale2s2 - Sales Person from Case 2 (KAPPL -S2)

Psale4s1 - Sales Person from Case 4 (AGRO-S1)

PSM - Purchasing & Supply Management

SCM - Supply Chain Management

SCRes - Supply Chain Resilience

SLR - Systematic Literature Review

WEF - World Economic Forum

# TABLE OF CONTENT

# 1. INTRODUCTION

The growing interconnection among companies has been the main cause of network complexity in the current global sourcing scenario. Although global sourcing has been highlighted as a good option to improve product quality and reduce cost (Wagner and Bode, 2006; Stecke and Kumar, 2009), any type of disruption may eventually break the seamless flows of goods and impact all interconnected entities in the network (Blackhurst et al., 2005; Christopher et al., 2011). Jüttner et al. (2003), in support of other authors, affirm that the domino effect has been aggravated during the last decade owing to the increasing number of supply chain disruptions. As a result, global sourcing can create positive effects from a competitive point of view; however it might also expose networks to a number of risks (Christopher and Lee, 2004).

In addition to this concern, the trend to high demand variability due to the short life of products and the different expectations and requirements of customers have impacted the supply chain's operations causing them to become more unstable and unpredictable. Thus, the operations of companies and their supply chains are no longer as stable as they were. This scenario has changed and is currently subjected to a multitude of events from a variety of sources, such as natural disasters, social conflicts, economic crises and even production planning failures.

Unfortunately, the occurrences of these kinds of unexpected and critical events have risen globally in the last decade. Extensive examples are easily found in the literature along with historical cases of tsunamis, epidemics, and terrorist attacks. In this regard, The World Economic Forum (2014) released a new report about Global Risk in which the top 5 global risks between 2007 and 2014 are depicted (Figure 1). As can be seen in Figure 1, climate change is considered the second highest global risk followed closely by critical information infrastructure breakdown. As a matter of consequence, these kinds of risks are very connected among each other, so that they are likely to cause great impacts for small to large businesses along the complex global network. Figure 2 represents political and social instability as high societal risk. In this regard, Brazil has been highlighted in this report due to many protests against corruption and inhumane treatment.

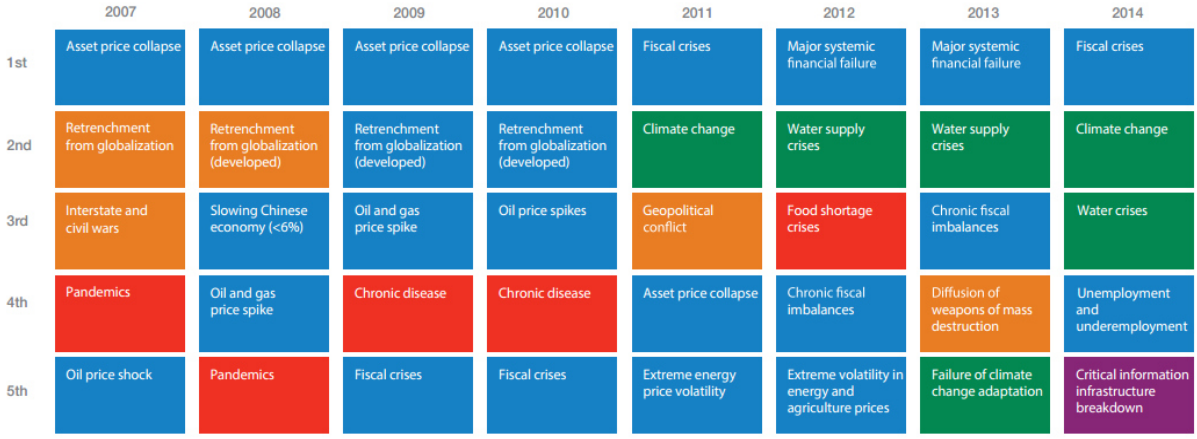


**Figure 1.** The evolving global risk landscape in terms of impact (2007-2014)
Source: Global Risks 2014, Ninth Edition is published by the World Economic Forum. Note: These risks are still classified into Economic risk (blue square), Environmental risk (green square), Geopolitical risk (orange square), Societal risk (red square) and Technological risk (purple square).

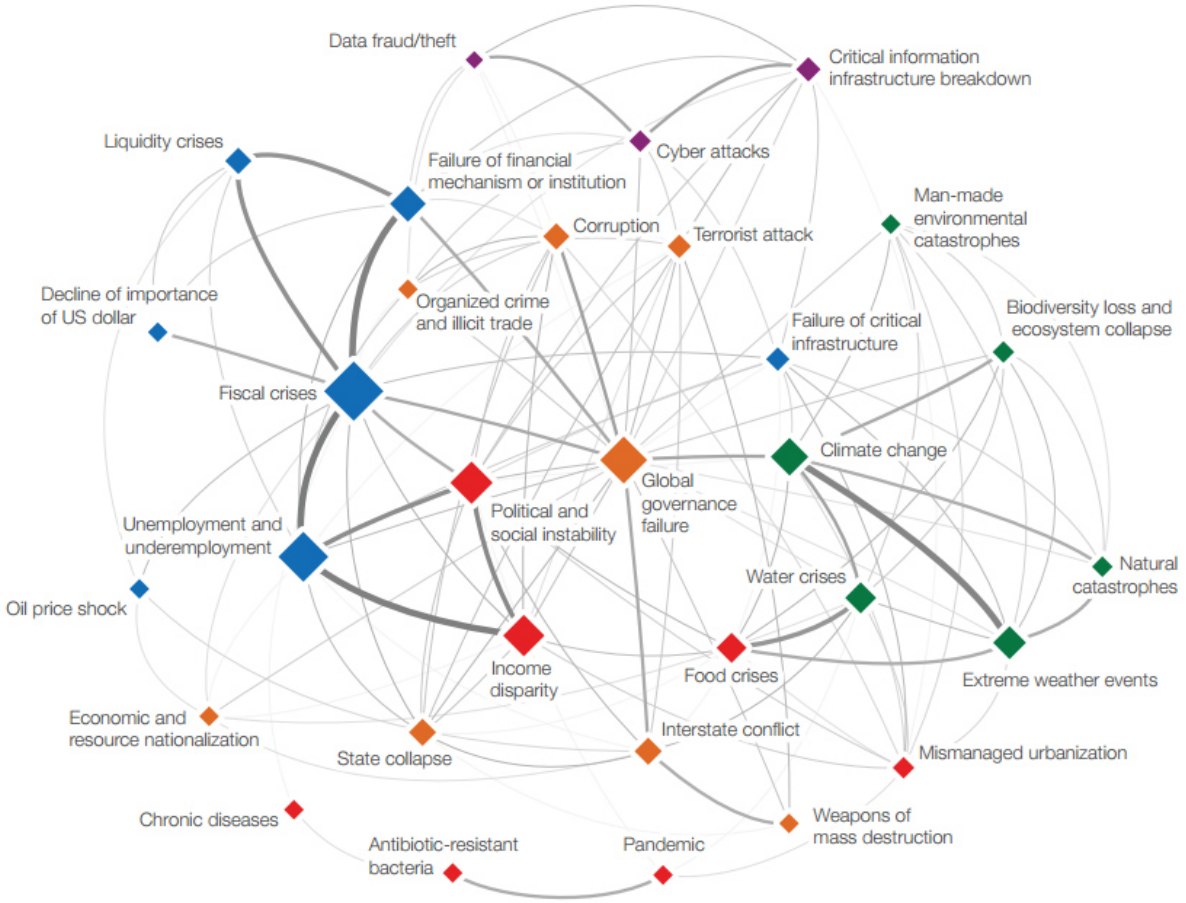


**Figure 2.** The global risk interconnections map
Source: Global Risks 2014, Ninth Edition is published by the World Economic Forum. Note: These risk are still classified into Economic risk (blue square), Environmental risk (green square), Geopolitical risk (orange square), Societal risk (red square) and Technological risk (purple square). The size of the squares represents the degree (number and strength) of connections.

In line with the last statement, there are many causes of supply chain disruptions for Brazilian companies, such as bad infrastructure, social protests, and global risk (climate changes) which generates natural disasters. Transportation problems are often related to bad conditions of the public roads and to the floods occurring in different parts across this country, especially in Rio de Janeiro and Sao Paulo. Rainstorms which leads to floods and mudslides is another critical event that directly affected the regional economy. A significant mudslide incident occurred in Rio de Janeiro in April 2010 and is an example of this type of problem (ILOS, 2013).

Furthermore, the recent critical Brazilian protest against the government in June 2013 has already shown its impact on international companies placed in Brazil, such as Fiat and Volkswagen, besides harming the local fuel distribution. According to the Brazilian Institute of Logistics and Supply Chain (ILOS, 2013) - one of the largest companies in Brazil in the planning, structuring and deployment of complex logistics and supply chain operations -, the protests blocked hundreds of roads across the entire country, hampering logistics companies'ability to deliver their loads on time.. On the other hand, agencies from the national post office (Correios) adopted an alternative way to deliver its parcels on time; they made use of airplanes instead (ILOS, 2013).

Although much attention has been paid to these kinds of extreme and natural disasters due to their notable environmental, social and managerial consequences, day to day problems can cause great damages to the entire supply chain if no action is readily taken. Thus, there are numerous sources of risk to be considered within organisations and along their supply chains. Table 1 shows the root of the risks and the most common causes for those. From these causes, Stecke and Kumar (2009) affirm in their study about disruptions, vulnerability and strategies that the average of critical events and their losses in business have constantly increased since the 90's.

As manufacturers depend on timely delivery of materials, these new obstacles have caused decision-makers to question the way supply chains are managed. Thus, recognising this current global scenario of risk and disruptions, the trend of the growing number of critical incidents, and its undeniable impact on business, a new thought in supply chain management has arisen in the literature that focuses on preparation, response and recovery actions. This approach has been named as supply chain resilience. According to Ponomarov and Holcomb (2009, p.131), supply chain resilience is defined as "the adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and

control over structure and function". For this reason, resilience has become one of the top researched topics in supply chain management due to its capability to promote sustainable futures business.

**Table 1.** Sources of risk and its common causes

| Sources of risk | Causes | Rationale |
|---|---|---|
| **Organisations** | Plant | Problems in the manufacturing process which may cause hardships in the internal production flow. |
| | Internal comunication | Problems regarding information sharing which may cause disruptions in the production flows or failures in the production. |
| **Supply chain** | Suppliers | Delay or unavailability of raw materials from suppliers which may cause stoppage of production activities, and consequently delay in deliveries for customers. |
| | External comunication | Communication problems among members of the supply chain due to the lack of trust and information sharing which may cause problems regarding visibility and control. |
| | Transportation | Problems regarding transportation or loss of products due to accidents or theft, for example. |
| | Products changing | Violation of the integrity of the products such as tampering of the packaging or contents. |
| | Demand | Dynamic changes in demand which may cause upstream disruption due to the lack of capacity and flexibility of suppliers. |
| **Environment** | Natural disasters | Unpredictable events arise from the environment, such as floods, hurricanes, tsunamis and tornados. |
| | Natural accidents | Unpredictable or man-made events. |

Source: Rice (2003), Christopher and Peck (2004), Sheffi (2005), Blackhurst et al. (2005), Stecke and Kumar (2009) and Simangunsong et al. (2012)

Christopher and Peck (2004) state that sudden and unforeseen events may arise from internal, external or environmental sources. Thus, achieving resilience along the supply chain requires effort both from internal actions within the company as well as from the wider network. Because much of the negative effects on the supply chain emerge from disruptions that occur upstream of the supply chain, Procurement is a critical business function capable of solving conflicts and issues among internal customers and suppliers (Ellram and Birou, 1995).

Currently considered an evolution of the term Purchasing, Procurement has now been defined by The Charity Institute of Purchasing & Supply (2014) as “the business management function that ensures identification, sourcing, access and management of the external resources that an organisation needs or may need to fulfil its strategic objectives”. Therefore, it became more strategic instead of operational function in nature, by being responsible for sourcing raw materials from suppliers worldwide and bringing them into the

organisation to enable the production of goods for customers. Furthermore, Procurement is also very important to help reduce up to 80% of the product's cost.

Supply networks are vulnerable on many fronts, including political upheavals, increasing economic uncertainty, rapid changes in technology, higher customer expectations, capacity constraints, globalized market forces and natural disasters. A recent study by Aon Risk Solutions found that, on average, the percentage of global companies reporting a loss of income due to a supply chain disruption increased from 28% in 2011 to 42% in 2013 (Sáenz and Revilla, 2014). Regarding this, Wright (2013) reported that companies are currently shifting their focus from being reactive to proactive; for this reason, more than 80% of companies in his study are now concerned about supply chain resilience. In order to effectively manage and control company's resources, Procurement is considered a boundary spanning function by bridging the gap between internal and external enterprise. Thus, taking into consideration this context and the increasing scope of Procurement, there are capabilities available to function with a variety of problems from the upside of the supply chain, and consequently aiding to create supply chain resilience.

### 1.1 Research Problem and Questions

According to the general knowledge applied to the management area, companies in support of their supply chains deliver the right product, in the right quantity, in the right condition, to the right place, at the right time and for the right cost. However, satisfying all these “rights” has never been an easy task for supply managers. Lately, these objectives have been a challenge to those who want to enhance the value of the products/service as well as satisfying customers, especially under the current unstable environment and volatile market.

Several cases are reported in the literature about companies’ problems due to supply chain disruptions that arise from a host of causes. The consequences that arise from these disruptions impact the economy and the image of hundreds of organisations. The challenge is to help organisations to develop efficient capabilities by means of their own resources to cope with rapid-onset events. Based on that, agility in threat detection and response, collaboration and information sharing among supply chain members, besides assertive decision making to overcome different kinds of disruptions are critical to enabling to companies continue their business without significant impacts. How to better prepare for an efficient responce to and recovery from such unforeseen disruptions is considered an important capability. Organisations around the world are trying to develop this capability. The capability is called resilience and has been associated by many scholars (e.g. Blackhurst et al., 2011; Jüttner and

Maklan, 2011; Johnson et al., 2013) as a source of competitive advantage for companies.This research makes use of the dynamic capabilities (more details in chapter 2) as a lens to view and support the findings from this research.

Tipping points for the acceptance of the resilience concept were remarkable events such as UK fuel protest in September 2000, the foot and mouth disease in February 2001 in the UK, and the USA terrorist attack in September 2001 (Christopher and Peck, 2004). After that, studies (*e.g.* Sheffi, 2001; Rice and Caniato, 2003; Christopher and Peck, 2004; Ponomarov and Holcomb, 2009; Colicchia et al., 2010; Pettit et al., 2010; Zsidisin and Wagner, 2010; Blackhurst et al., 2011; Jüttner and Maklan, 2011; Carvalho et al., 2012a,b; Ponis and Koronis, 2012; Spiegler et al., 2012; Pettit et al., 2013; Johnson et al., 2013; Scholten et al., 2014; Brandon-Jones et al., 2014) tended to approach this topic within the supply chain context, however only a small part of this topic has been researched to date. Some have focused on developing and testing different frameworks (Pettit et al., 2010; Blackhurst et al., 2011; Scholten et al., 2014), others have studied relationship of resilience to other concepts such as green, lean, agile and risk (Carvalho et al., 2012a; Jüttner and Maklan, 2011; Ponis and Koronis, 2012; Azevedo et al., 2013) or even using modelling and simulation to assess resilience in the supply chain (Carvalho et al., 2012b; Spiegler et al., 2012).

Among these studies, Zsidisin and Wagner (2010) and Blackhurst et al. (2011) are the most similar studies to the present one. Zsidisin and Wagner (2010) sought to understand the supply disruptions from a supply management (purchasing) perspective, whilst Blackhurst et al. (2011) explored the enhancers and inhibiters to achieve firm's resiliency. The first aims at investigating the perceptions of supply management professionals to different sources of risk, and hence testing the extent resilient practices that moderate disruption frequency. The second provides an in-depth empirical investigation of supply disruptions in multiple industries and, consequently highlightes the supply chain design characteristics that enhance supply resiliency. Although the goals of this previous research start to delineate the resilience problem, there is still a gap regarding particular issues in which Procurement should address to help generate resilience by effectively managing resources in order to better prepare, respond and recover from supply disruptions. Considering that Procurement has the ability to quickly transfer information between internal and external company, the lack of specific knowledge from Procurement in making assertive decisions to overcome unexpected and critical situations of failures can be assumed as point for companies that intend to become (and remain) competitive in the current market.

Despite resilience has been considered a relevant capability to achieve effective response in supply disruptions, it is still unclear how to create resilient capabilities in companies, especially from a Procurement perspective. Additionally, the complexity of the global supply chains, the different and traditional cultures, the current uncertain demand, and the unexpected events reveal considerable barriers to the development of supply chain resilience.

The overarching purpose of this research is to understand the relationship between procurement and supply chain resilience. Therefore, the specific questions addressed to guide this study are:

*RQ1) What are the intra-organisational issues that must be addressed to Procurement in dealing with unexpected supply chain disruptions?*

*RQ2) What are the inter-organisational issues that must be addressed to Procurement in dealing with unexpected supply chain disruptions?*

*RQ3) How can Procurement manage and control these intra- and inter-organisational issues in order to help create supply chain resilience, through the lens of dynamic capability view?*

### 1.2 Objective

The aim of this study is to *understand the role of Procurement in managing and controlling the intra- and inter-organisational issues that helps create supply chain resilience.*

This research explores the barriers and enablers in creating supply chain resilience and looks that the activities and responsibilities of Procurement in helping to generate and facilitate recilience. To goal this:

- to detect a set of enablers and barriers that impact supply chain resilience;
- to identify the importance of Procurement function in dealing with supply disruptions;
- to identify the existing Procurement actions/solutions to cope with disruptions and how they can improve supply chain resilience;
- to compare theoretical and empirical findings in order to verify how they answer the research questions proposed to collaborate with the body of literature in this specific topic.

### 1.3 Research Justification

Awareness of the current environmental and market instability and its impact on business, makes it so that traditional strategies are no longer applicable. Practitioners and scholars have been encouraged to adopt different and more adaptable strategies to deal with the problem of disruption. Ates and Bititci (2011, p.5602) affirm that "change management process capability is fundamental to organisational resilience". Hence, many strategies and programs have been approached to better understand and deal with these threats. Risk management is one helps to forecast, monitor and mitigate risks; however that there are many risks which cannot be forecasted and/or avoided (Zsidisin et al., 2000). In these types of cases where there is an inability to predict the impact, resilience has been proven to be a valuable capability for companies. Developing resilience makes companies more prepared for effectively overcoming unexpected and unavoidable incidents.

Furthermore, studies (Christopher and Holweg, 2011; Jüttner and Maklan, 2011; Carvalho et al. 2012a; Wright, 2013; Maslaric et al., 2013) have recently emphasized the need for coping with current risks in the network. However, Blackhurst et al. (2005) point out the sparse information about the ways to deal with these risks. These scholars also highlight the scarcity of studies related to practical findings and applications. In this sense, this research aims to explore, theoretically and empirically, issues that must be addressed to respond and recover after large or small-scale disruptions and how Procurement is able to manage and control them in a most effective way.

To effectively manage the flow of resources and information, and orchestrate supply and demand the Procurement activities should be alert on the happenings inside and outside the companies. Thus Procurement function is considered strategic due to its responsibility to manage upstream and downstream flows of information and resource (Ellram and Birou, 1995). The importance of this strategic function is not something new but has been recognised by Kraljic (1983, p.110) through his statement, "the greater the uncertainty of supplier relationships, technological developments, and/or physical availability of those items, the more important supply management becomes". For these reasons, Procurement is seen to be a powerful function within the company by being responsible to manage essential flows at upstream side of the companies (particular side by which this research is focused on). Additionally, by defining and managing resources effectively along the supply chain, Procurement has the ability to prepare companies to respond positively to disruptions and recover from them in a most effective way. Moreover, if Procurement chooses the right resources and makes assertive decisions, the organisation will perform better. Thus,

organisations might take advantage of the unpreparedness of competitors to achieve a good position in the competitive market.

Following the rationale about the Procurement's capability to manage and control resources, Johnson et al. (2013) has made a note in their study affirming that although Jüttner and Maklan (2011) has associated the adaptive resilience capability with resource based view in their paper, they could use dynamic capability theory. It is because this theory helps explain how competences and resources can be combined, cultivated, organised and protected (Teece et al., 1997; Lockett et al., 2009; Teece, 2007). In addition to it, Pettit et al. (2010) and Johnson et al. (2013) also outline future research that could explore other resources or capabilities - such as intra-organisational management capabilities - which might enhance resilience. Furthermore, Treiblmainer (2014, p.8) states that "publications are needed which conceptually merge supply chain resilience and existing theories".

To sum up, despite the increasing number of annual studies in this field, supply chain resilience still remains in its infancy. The number of non-explored topics within this research area (Christopher and Peck, 2004; Ponomarov and Holcomb, 2009; Carvalho et al., 2012a) is very large. Therefore, many gaps and opportunities for future research still exist in this topic; to deepen the knowledge in some studies already developed, or explore new perspectives from different problems in order to find out innovative strategies, or enlarge the study so as to cover many areas of interest. For this reason, the present study is going to focus on a small piece of the wide area of supply chain resilience; focusing on Procurement to explore and contribute to the available knowledge in this area.

## 1.4 Thesis Structure

Figure 3 illustrates the rational of this research and its final structure according to the content.

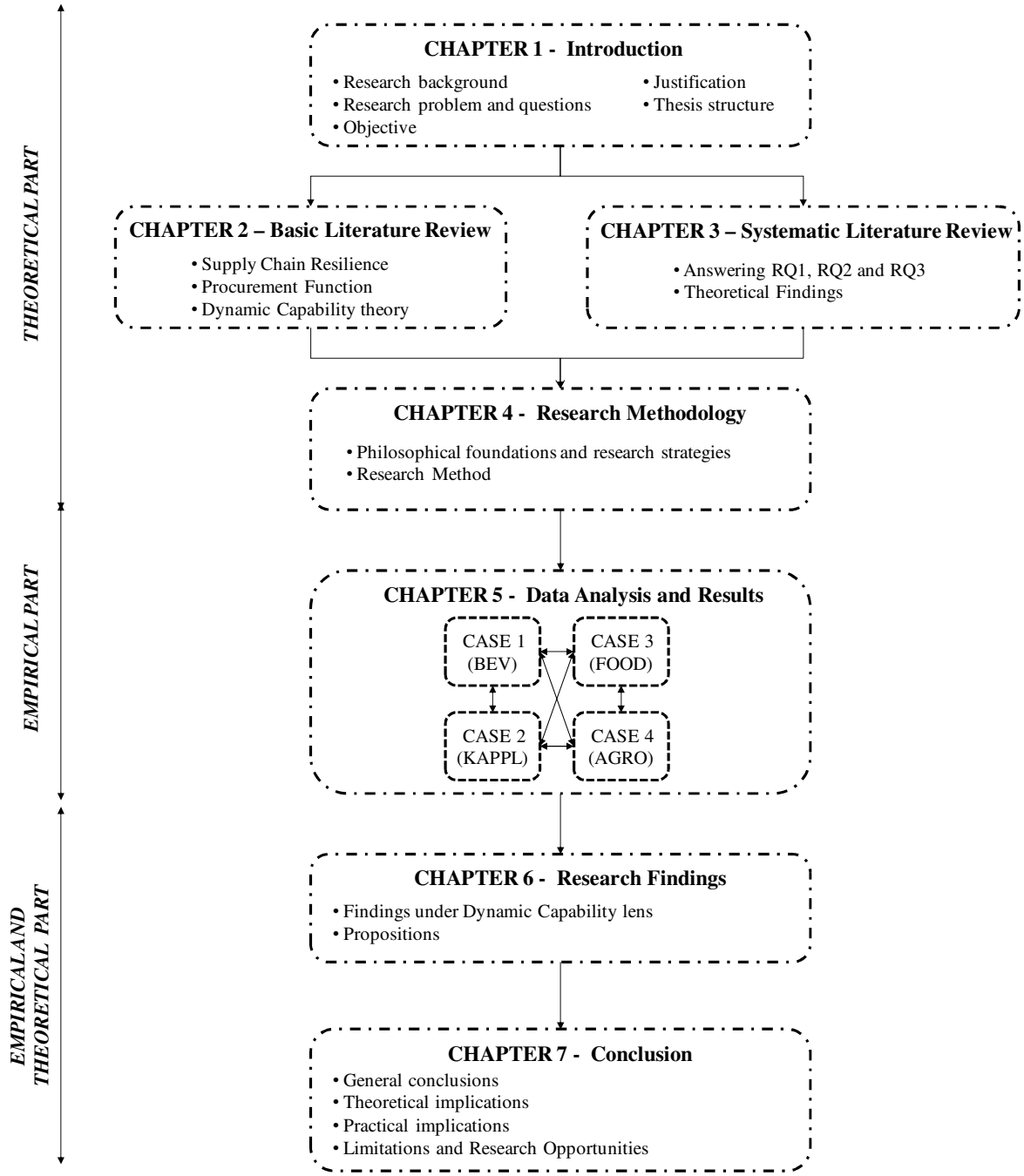


**Figure 3.** Thesis structure
Source: created by the author

# 2. BASIC LITERATURE REVIEW

Aiming to explore the problem highlighted in Chapter 1, a literature review was developed in order to delimit the scope of the research by presenting the state-of-the-art on providing a theoretical background, besides being a way for researchers to get to grips with the knowledge in the topic of interest. Considering the current criticism of the traditional method of randomly selecting studies and quality of papers to support the research, a systematic method of developing a literature review was carried out - Systematic Literature Review (SLR). However, before exploring and answering the proposed questions through the SLR (Chapter 3), a basic literature review was presented to ground fundamental concepts and knowledge about Supply Chain Resilience, Procurement business function and Dynamic Capability Theory. Figure 4 illustrates the structure and content of this chapter.

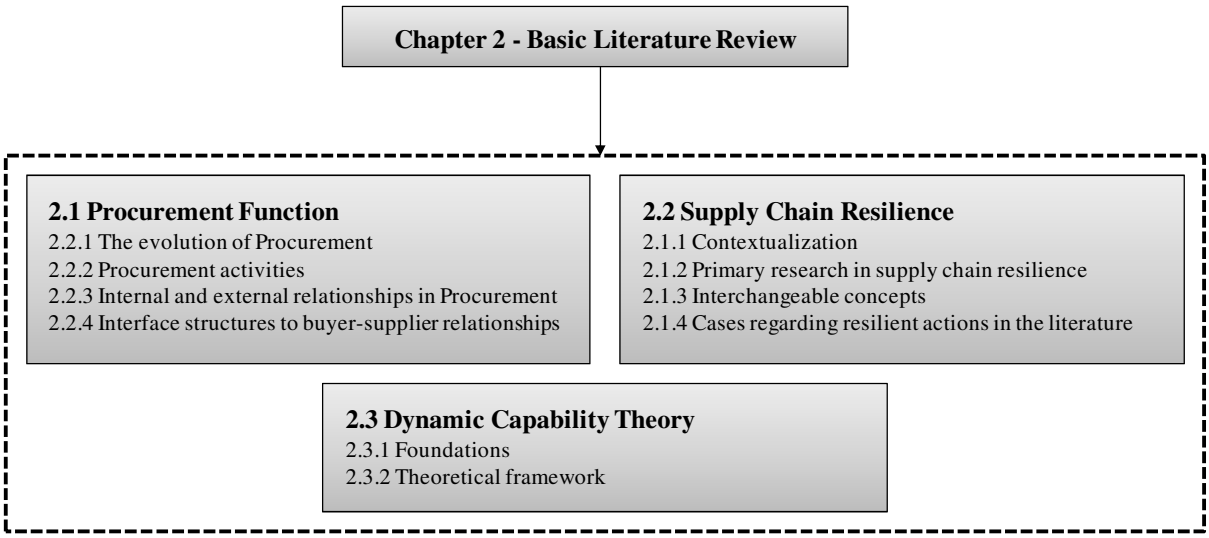


**Figure 4.** Structure of the basic literature review
Source: created by the author

## 2.1 Procurement Function

Widely recognised as a business function, Procurement currently plays a fundamental role in companies all over the world. In the literature, Procurement and Purchasing are sometimes used interchangeably. However, many authors (*e.g.* Ellram and Carr, 1994; Monczka et al., 1998; Foerstl et al., 2013; Lysons and Farrington, 2006; Miemczyk et al., 2012; Sobhani et al., 2014) distinguish them affirming that Procurement is an evolution of Purchasing, and is now considered a wider concept including purchasing processes and even supply management.

Procurement, which was previously fundamentally focused on cost reduction, is therefore no longer considered just a resource management function (Ellram and Carr, 1994; Lindgreen et al., 2013). According to Nix (2001), this function has evolved through four stages:

- *traditional*: focused on selecting and negotiating with suppliers in order to achieve the lowest price of goods;
- *partnership/relational*: focused on building a strong buyer-supplier relationship in order to manage the flow of goods along the supply channel;
- *operational supply chain approach of material logistics management*: focused on managing flow of goods and information internally and externally;
- *strategic supply chain approach of managing for integrated value added*: focused on redesigning business processes in order to optimize the performance of the organization and, therefore, its competitive advantage.

Gadde and Hakansson (2001), Trent and Monczka (2002) and Sobhani et al. (2014) present an overview about the evolution of the Procurement business function. Following their statements, in the past Procurement did not have the importance that it has in today's business; it exclusively focused on purchasing and accounting, which was only about 20% of the corporate expenditures. Ergo, it had a passive role in the business organisation and it was included in day-to-day operational activities. Mid 1920, Procurement managers began to be involved in other activities, such as inventory management, transportation, supplier's selection and make-or-buy decisions. Thus, the importance of this function has increased in 1930 due to its influence in the product cost which Procurement managers aimed to reduce. For this reason, it has got great importance in the business, even today. By the end of 1940, the product development activity was included in this function in order to analyse the trade-off between cost and product's functionality. In 1950, the development of system contracts has emerged in this function which was a way of reinforcing the cost reduction among its suppliers, and therefore guaranty particular services level (for a specific period of time) with little day-to-day involvement in transactions (Gadde and Hakansson, 2001; Trent and Monczka, 2004; Sobhani et al., 2014).

Between 1960 and 1970, the material management was introduced into this function to improve the cross-functional integration among production scheduling, purchasing, transportation and distribution. At that time, the internal and external integration became a

concern for managers, especially because purchases took about 35% to 65% of companies' expenditures. Nonetheless, the same authors state that, in some cases, MRP (Material Resource Planning) has failed to drive integration in the right way, which ended up creating more functional silos due to the inability of the people to work with a complex computerized systems. Afterwards, Procurement has continually evolved and was recognized as an important function which could make considerable contributions to solve companies' problem, such as manufacturing cost, quality of the products and redundant inventories. But because of these problems, other functions/departments started working in a more collaborative way, and hence creating cross-functional teams. During the next decades (1980-1990), Procurement has gradually reinforced its position in the companies' hierarchy, and many tasks were incorporated from 90's, such as outsourcing, supply chain management and global sourcing (Gadde and Hakansson, 2001; Trent and Monczka, 2004; Sobhani et al., 2014).

Based on the above discussion as well as a strong consensus in the literature about the evolution of Procurement, Figure 5 portrays the remarkable points of this business function. Therefore, since the end of 70's, this function has become increasingly more strategic, ceasing to be a lowly and secondary business activity (purchasing only) (Svahn and Westerlund, 2009; Chicksand et al., 2012; Lindgreen et al., 2013). All in all, strategic management of procurement is a topic which is often discussed nowadays and has had more attention during the last twenty years, in which has been responsible for playing a strategic role in a company's profitability and being one of the major drivers in the extended supply chain (Foerstl et al., 2010; Sobhani et al., 2014).

On balance, Procurement has now been defined by The Charity Institute of Purchasing & Supply (2014) as "the business management function that ensures identification, sourcing, access and management of the external resources that an organisation needs or may need to fulfil its strategic objectives". Accordingly, by being responsible to connect requirements between internal and external part of the company, it has now been involved in environmental and market risk, which additionally changes its traditional strategies to a more dynamic ones (Foerstl et al., 2013). Therefore, totally aware of its importance as a business function, there is still a need to better understand how its activities and practices can become more effective in helping organisations as well as the extended supply chains to creating resilience to wisely react after unforeseen events.

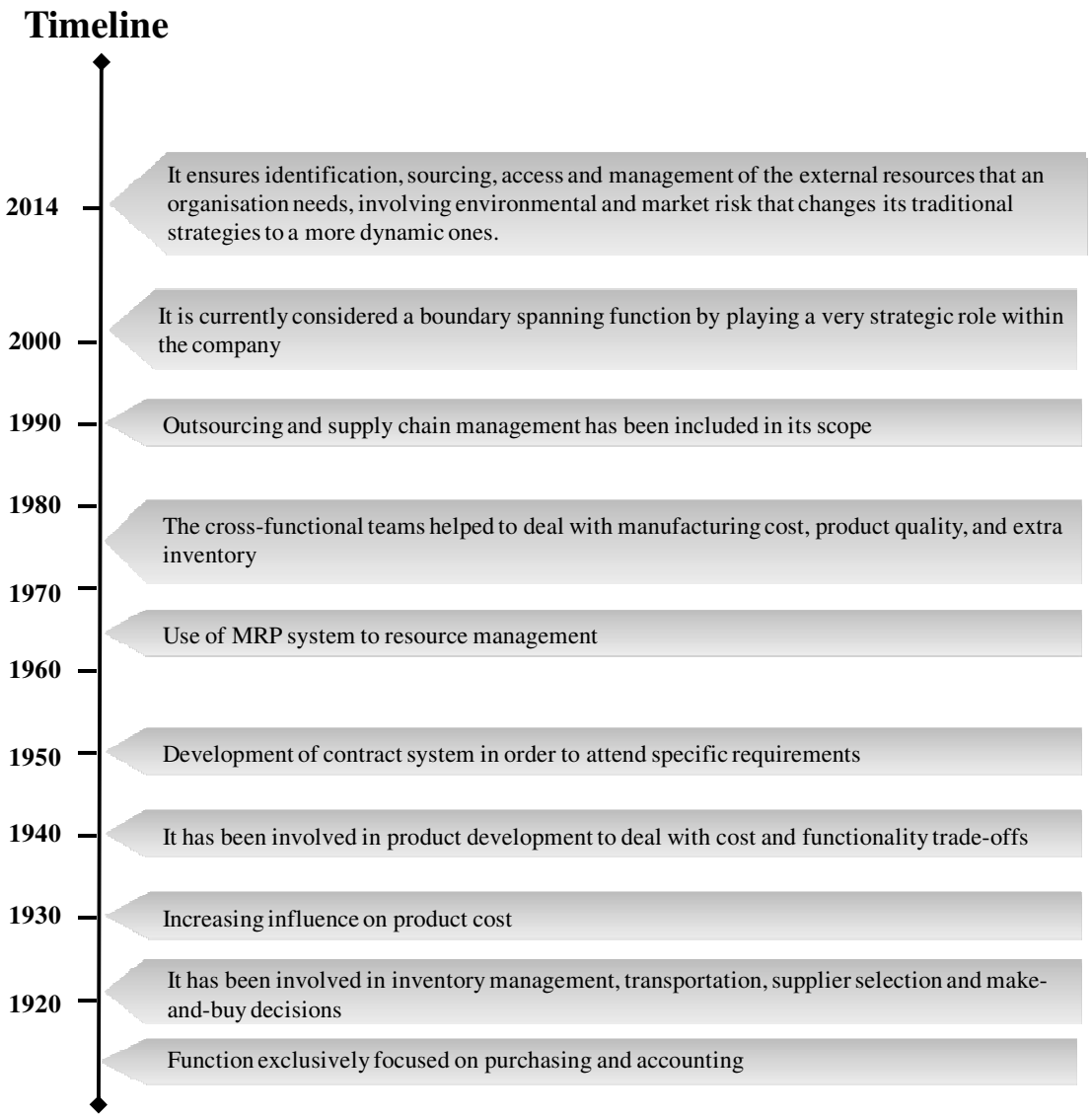


**Figure 5.** The historical evolution of the Procurement function
Source: Created by the author through Gadde and Hakansson (2001), Trent and Monczka (2004), Foerstl et al. (2013) and Sobhani et al. (2014)'s statements.

### 2.1.1 Procurement activities

As previously reported, Procurement responsibilities have increasingly become more complex as a result of continuous business changes and its involvement with a considerable amount of activities across the company. It has encompassed suppliers, transportation, incoming inspection, quality control and assurance (Monczka et al., 1998; Nix, 2001; Foerstl et al., 2013) through the process of planning, evaluating, implementing, and controlling highly important and routine sourcing decisions (Carr and Smeltzer, 1997; Sobhani et al., 2014). Additionally, it involves the determination of resource needs, supplier selection, price negotiation, contracts specifications, and delivery verification. Thus, Procurement has the

task to get resources, suppliers and services of the right quality, in the right quantity, at the right price and from the right source (Weele, 2005; Schoenherr et al., 2012). To sum up, Table 2 illustrates Procurement activities identified in the literature.

**Table 2.** General procurement activities

| Activities | Characteristics | References |
|---|---|---|
| **Analyse of the supply market** | Analyse supply market, resources, cost analysis, supply sources and ways to develop alternative resources. | Ellram and Carr (1994); Monczka et al. (1998); Ellegaard and Koch (2012); Sobhani et al. (2014) |
| **Supplier selection** | Identify the available suppliers, select them according to location, cost, quality and other feasible points for the company and supervise the source. | Monczka et al. (1998); Zeng (2000); Zdisisin et al (2000); Dubois (2003); Smeltzer et al. (2003); Zdisisin (2003); Muffatto and Payaro (2004); Trim (2005); Weele (2005); Agndal and Nilsson (2007); Johnston and Kristal (2008); Terpend et al, (2008); Svahn and Westerlund (2009); Primo et al (2010); Ellegaard and Koch (2012); Chicksand et al. (2012); Lindgreen et al. (2013); Sobhani et al. (2014) |
| **Supplier relationship** | Negotiate contracts, conditions and legal mutual agreement. | Ellram and Carr (1994); Dubois (2003); Zsidisin (2003); Muffatto and Payaro (2004); Trim (2005); Weele (2005); Johnston and Kristal (2008); Terpend et al, (2008); Svahn and Westerlund (2009); Andrea et al (2011); Chiang et al (2012); Ellegaard and Koch (2012) |
| **Supplier development** | Assist suppliers to develop their processes, activities and services and evaluate its performance. | Monczka et al. (1998); Dubois (2003); Zdisisin (2003); Muffatto and Payaro (2004); Agndal and Nilsson (2007); Johnston and Kristal (2008); Terpend et al. (2008); Svahn and Westerlund (2009); Andrea et al (2011); Ellegaard and Koch (2012); Sobhani et al. (2014) |
| **Global sourcing development and management** | Manager all the suppliers from different locations all over the whole. | Zeng (2000); Smeltzer et al. (2003); Trim (2005); Primo et al (2010); Lindgreen et al. (2013); Sobhani et al. (2014) |
| **Risk management and control** | Manager the existent risks from suppliers in order to prevent disruptions. | Weele (2005); Svahn and Westerlund (2009); Primo et al (2010); Foerstl et al. (2010) |
| **Evaluate the internal requirements** | Identify internal needs in order to make new orders. | Monczka et al. (1998); Muffatto and Payaro (2004); Zdisisin (2003); Svahn and Westerlund (2009); Andrea et al (2011) |
| **Stock management** | Management of the stock (raw materials) by paying attention to minimum stock, inventory turnover, transfer of raw materials to avoid excess inventory and obsolescence. | Monczka et al. (1998); Agndal and Nilsson (2007); Andrea et al (2011); Sobhani et al. (2014) |
| **Inbound/outbound transportation management** | Check raw materials shipment through invoices and direct observation in order to ensure the right delivery. | Monczka et al. (1998); Nix (2001); Andrea et al (2011); Foerstl et al. (2010); Sobhani et al. (2014) |

More pointedly, Sobhani et al. (2014, p.252), in support with Carter and Narasimhan (1996), has stated five fundamental principles that Procurement should make use in order to achieve successful development of strategies: 1) aligning firm-level strategies with goals of purchasing management, 2) managing human resource effectively, 3) closely linking with key suppliers, 4) integrating with other manufacturing functions, 5) generating suitable environment within the Procurement function.

Procurement has therefore been significant by managing critical issues regarding unstable environment (Lawson et al., 2009), organisation's profitability (Alinaghian et al., 2011; Sobhani et al., 2014), and contributing as much as other functions to business continuity (Andrea et al., 2011; Ellegaard and Koch, 2012). Furthermore, as it has been touted to play a major role like a boundary spanning function (Monczka et al., 1998; Castaldi et al., 2011), it can be fundamentally appraised to achieve agility in the supply chain (Chiang et al., 2012), and expected to contribute to supply chain resilience.

### 2.1.2 Internal and external relationships in Procurement activities

Processes of planning, implementing, evaluating and controlling purchase decisions for all direct activities, such as acquiring goods, carrying out buyer-supplier interface and managing internal and external flows of goods and/or services comes under the scope of Procurement (Szwejczewski et al., 2005; Paulraj and Chen, 2007; Sobhani et al., 2014). Bearing this in mind, the relationship between buyer and supplier involves much more than the Sales function from the seller and Procurement function from the buyer. It also involves Manufacturing, Logistics, Finance and other business functions from both sides of the extended enterprise (Agndal and Nilsson, 2007; Castaldi et al., 2011).

Szwejczewski et al. (2005) state that Procurement managers are responsible for providing other functions with important information, such as suppliers' capacity, logistics data, pricing and discounts, and new products information. Therefore, there is a need to develop the internal integration between Procurement and other functions for an effective decision-making in the end (Chiang et al., 2012; Foerstl et al., 2013). In their study, Agndal and Nisson (2007) related Procurement to different functions. Regarding Production/Manufacturing, Procurement is responsible for sharing information of resources responsible for the production planning. In the Quality Control, Procurement needs to check if the quality required from their purchases is exactly how they ordered. In R&D (Research and Development) or Engineering, Procurement decides the requirements to select suppliers for new products. In Accounting and Finance, It determines the amount of orders to make the payment. To conclude, the same authors point out that a great number of employees from different hierarchy levels within the organisation are involved in most stages of the Procurement activities. In line with this, Szwejczewski et al. (2005) summarize all these information flows in Figure 6, in which illustrates the connection of Procurement to the internal customer and suppliers.

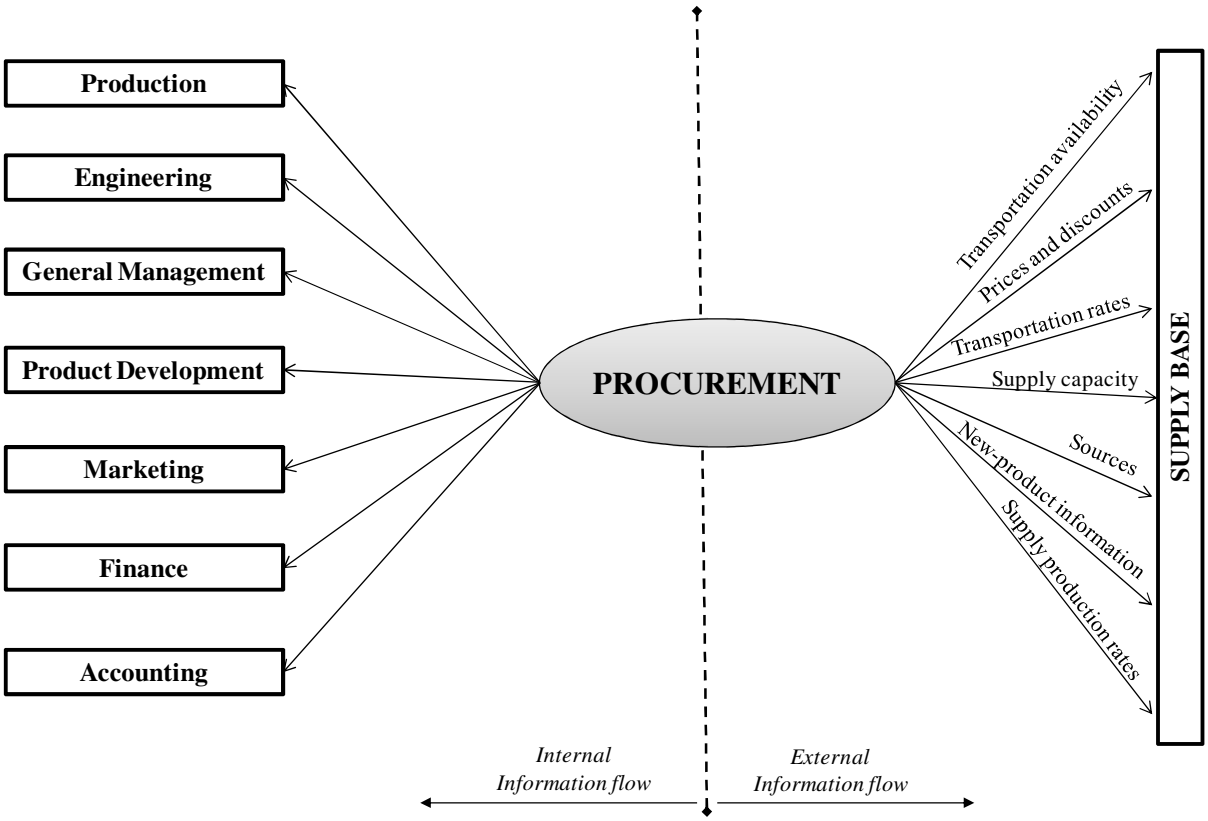


**Figure 6.** Procurement as a boundary spanning
Source: Adapted from Ellram and Birou (1995) and Szwejczewski et al. (2005)

Likewise the internal relationship, Procurement is strongly involved in the upstream of the supply chain, that makes the processes more effective, efficient and sustainable (Schoenherr et al., 2012). As mentioned before, Procurement is responsible for the selection and relationship of suppliers, product or service cost, the delivery deadlines and the product quality, for instance. Thus, different impacts on business performance are a result of the functions' decision making (Nix, 2001; Szwejczewsky et al., 2005; Castaldi et al., 2011; Lindgreen et al., 2013).

Due to the direct relationship with the external part of the enterprise, Procurement has the responsibility to mitigate risks and overcome problems that might arise from the environment or from the supply side (Chicksand et al., 2012). For this reason, this function should develop good relationship with its suppliers so as to increase trust, collaboration, information sharing (Ellram and Birou, 1995; Lee et al., 2009; Chiang et al., 2012), and therefore level of satisfaction from both sides (Humphreys et al., 2009; Chicksand et al., 2012).

In this context, Ellram and Birou (1995) have exposed some issues regarding supplier relationships, such as the evaluation of how to establish good relationships; the organization's involvement in supplier education, training, improvement, and development; and the reciprocity regarding supplier partnership or strategic alliances. Figure 6 also highlights some external activities where Procurement should be involved.

To conclude this rationale, Procurement definitely plays a key interchange role between external suppliers and internal organisational customers in creating and delivering value to external customers (Sobhani et al., 2014), and paying heed at both sides of the enterprise so as to find proper and reasonable solutions to them (Ellram and Birou, 1995; Lindgreen et al., 2013). Therefore, it is "very important for companies especially manufacturing organisations because purchasing materials and services cover the highest proportion of the cost of goods sold" (Sobhani et al., 2014, p.251). Furthermore, by synchronising the flow of goods and information between buyer and supplier, Procurement communicates to suppliers about the market demand changes, and hence enabling the company and its supply chain to be responsive (Chiang et al., 2012).

### 2.1.3 Interface structure between buyer-supplier relationships

As the Procurement function has evolved throughout the decades, the structure of the company and the internal processes have also changed in order to support the additional supply activities (Nix, 2001; Foerstl et al., 2013). Therefore, how the internal and external part of the company work together is a matter of interface structure. In this regard, McDonald and Woodburn (2007) have proposed four main types of buyer-supplier relationships:

a) basic relationships: the Procurement and Key Account managers will be in a regular contact; the organisations are just aligned behind of these functions and not along them, and it is still the only channel to exchange information (Figure 7a);

b) cooperative relationships: this is similar to a network; here, Procurement and Key Account managers work together and interact with a wide range of people. So, people have more understanding about their business but many mistakes might occur due to the number of people involved. This is considered a challenge interface structure to managers (Figure 7b);

c) interdependent relationships: in this interface, functions directly contact each other and collaborate intensively among them; the interactions are still orchestrated and managed by Procurement managers and Key Account managers, however now they just oversee the interfaces and ensure that nothing is going wrong. In this case, companies are very integrated and it helps in terms of working practices and sharing of information. On the other hand, if

something happen and these companies need to separate, it may be a difficult situation (Figure 7c);

d) integrated relationships: in this structure, the two companies operate as a single one, however they keep distinct identities in order to create value. The boundaries between buyer and supplier become blurred, and the team created internally will make the decision. Like an interdependent relationship, any failure in one company may have high impact on the other (Figure 7d).

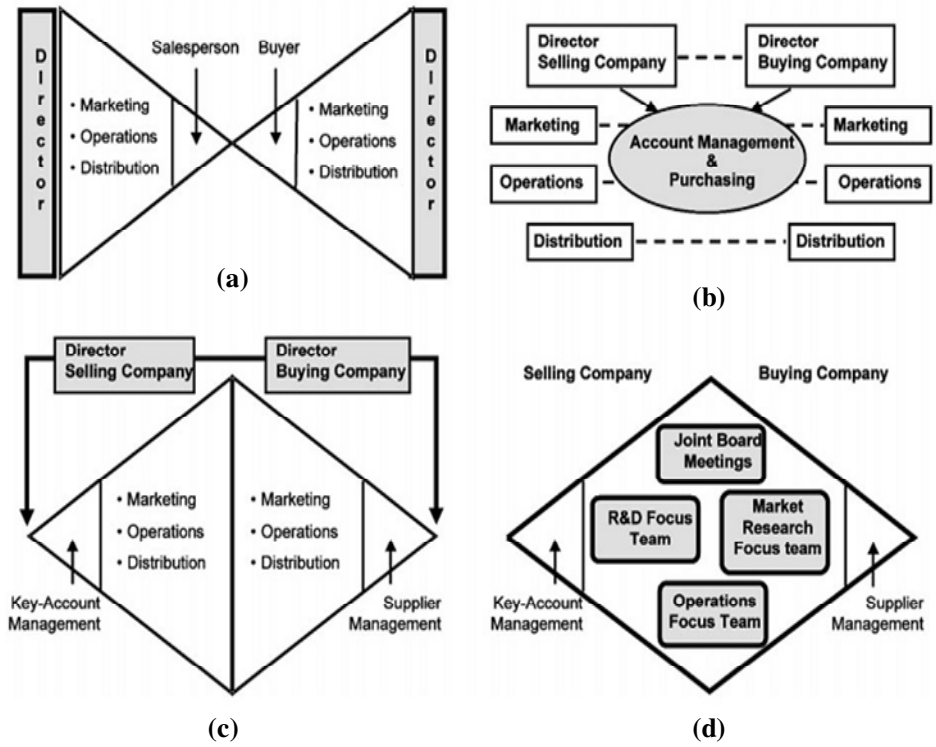


**Figure 7.** Interface structure between buyer-supplier relationships
Source: Christopher and Jüttner (2000)

Table 3 illustrates some characteristics of those interface structure as listed by McDonald and Woodburn (2007). It is noticed that for the first (basic) and second (cooperative) interface structure, developing visibility is something easier due to those functions are well-integrated; and therefore no evidence of functional silos seems to impede the communication. This is however the opposite situation of third structure. This one (interdependent relationships) does not seem to be a good structure to build resilience, knowing that a multi-disciplinary or cross-functional team is required (Christopher and Peck, 2004) and it is very focused on price and margin (Christopher and Jüttner, 2000).

**Table 3.** Buyer-supplier organisational structure

| Basic relationships | Cooperative relationships |
|---|---|
| Transactional, emphasis on efficiency | Selling company adds value to relationship |
| Driven by price, success measured by price | May be preferred supplier |
| Probably one of several suppliers | Exit not particularly difficult |
| Seen as easy to exit | Multifunciton contacts |
| Single channel of communication | Relationship still maily with buyer |
| Business relationship only | Organization mainly standard |
| Very little information sharing | Limited visits to customer |
| Reactive rather than proactive | Limited information sharing |
| Driven by personal reward structures | Forecasting, not joint strategic planning |
| Standard organization | Not really trusted by customer |
| **Interdependent relationship** | **Integrated relationships** |
| Both acknowledge importance to each other | Real partnership: complementary, multually dependent |
| Principal or sole supplier | Few in number |
| Exit more difficult | Sole supplier, possibly handling secondary suppliers |
| Larger number of multifunctional contacts | High exit barriers, exit is traumatic |
| Developing social relationships | Individual organizations subsidiary to team socially |
| Deep understanding of customer | Dedicated, cross-boundary functional/project teams |
| High volume of dialogue | Open inforamtion sharing on sensitive subjects |
| Streamlined processes | Transparent costing systems |
| Exchanged of sensiteve information | Assumption of mutual trustworthiness, at all levels |
| Proactive rather than reactive | Abstention from oppportunistic behaviour |
| Both sides prepared to invest in relationship | Lowered protection against opportunism |
| Wider range of joint and innovative activity | Joint long-term strategic planning |
| Joint strategic planning, focus on the future | Better profits for both |
| Development of trust | |

Source: Adapted from McDonald and Woodburn (2007)

Also, the cooperative relationships seems to be dangerous due to the limited level of information sharing (Blackhurst et al., 2005) and the challenge interface structure, while the integrated relationships keeps a sole supplier and is very dependent from each other (Sheffi, 2001). Therefore, the basic relationship presents feasible characteristics to creating resilience which emphases multiple suppliers for instance (e.g. Blackhurst et al., 2011; Christopher et al., 2011; Stecke and Kumar, 2009 and Carvalho et al., 2012a), however managers still have to pay attention to the limited amount of information sharing.

## 2.2 Supply Chain Resilience

The term ‘Resilience’ was not well-known in the business' world in the past and, to some extent, its meaning is still limited to a minority of researchers within the supply chain management field nowadays. It originated from a Latin word, "*resilire*", which means *to leap back or to rebound*. Thus the term Resilience can be explained as “the ability of an entity or a system to ‘recover form and position elastically’ following a disturbance or disruption of some kind" (Simmie and Martin, 2010, p.28). This concept has emerged from a medley of disciplinary concepts and ideas (Mitchell and Harris, 2012) which began in material science

to describe the capacity of a material to bounce back to its original shape after any deformation (Sheffi, 2005). Springs are therefore good examples of resilient materials due to its capability of being flexible and adaptable.

Thereupon, the resilience concept has additionally been applied to different subjects such as ecology, psychology, economy, social, and organisational approaches to exemplify the capacity of any system to return to its equilibrium state after a temporary disturbance. Because of this overarching view, resilience has become a multidimensional and multidisciplinary phenomenon in the last forty years (Ponomarov and Holcomb, 2009; Ponis and Koronis, 2012). Figure 8 shows difference of the amount of studies published among those areas regarding resilience, and it is noteworthy that resilience in management area has the lowest number of publications hitherto. It therefore leads to conclude that it might be considered the most recent and immature area regarding resilience.

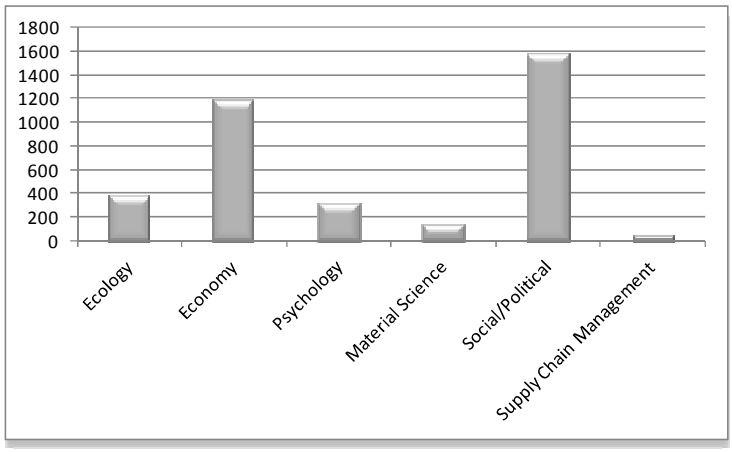


**Figure 8.** Different amount of studies about resilience in six distinct research areas[1]
Source: created by the author

In accordance with the above discussion, Figure 9 illustrates the definitions of the resilience concept in different research areas with noticed similarities and therefore the collaboration of them gives a general meaning of supply chain resilience (further presented). Resilience, as a research area in its infancy in supply chain management (Christopher and Peck, 2004; Ponomarov and Holcomb, 2009; Ponis and Koronis, 2012), has had some different definitions in the past.

[1] This graph is composed by the results from the searching on the ABI database which included ABI/Inform Global, Periodical Archive Online and ProQuest Business Collection. Although the same search has been done in more two databases (EBSCO and SCIELO), the result of only one database was chosen to represent this figure in order to avoid duplicates. However, it is important to highlight that the result of resilience in distinct areas was different for each of the databases but it was always the lowest in the supply chain management area. The reason for this is that each database has different journals indexed that focus on different areas.

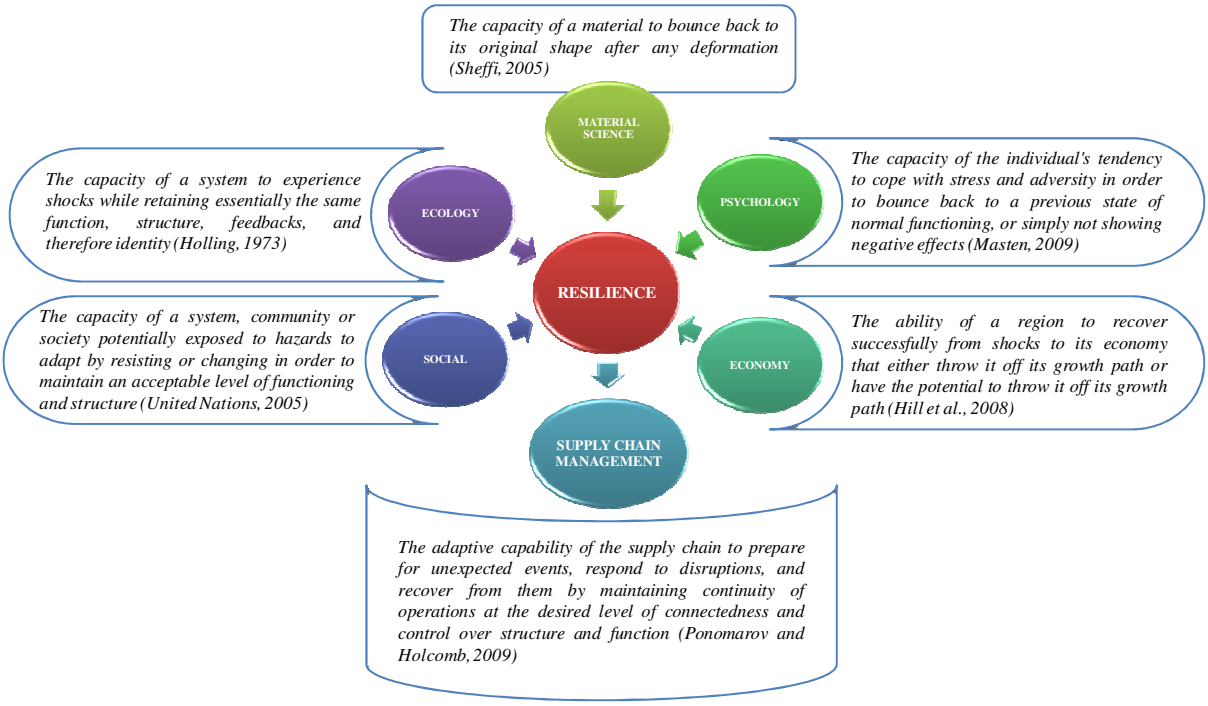


**Figure 9.** Definitions of resilience in different areas
Source: created by the author

Table 4 exhibits the definitions of supply chain resilience proposed by different authors in the area. Although these authors have defined resilience in different words, the general idea is consistent. Recognizing this, supply chain resilience is defined in this study as the capability of supply chains to prepare for unexpected events, and if it happens, they are able to respond to disruptions and recover from them so as to restore operations to the previous performance level or even to a new and better one.

In the business environment, the tipping points for acceptance of the resilience concept were the tragic events such as the UK fuel protest in September 2000, the foot and mouth disease in February 2001 in the UK, and the USA terrorist attack in September 2001 (Christopher and Peck, 2004). As well as the terrible loss of lives, the impact of these critical events on many companies all over the world was significant due to the increased inter-dependence in the network caused by global sourcing. Unfortunately, that was just the beginning of the turbulent era.

**Table 4.** Definitions of supply chain resilience

| Authors | Definitions |
|---|---|
| **Christopher and Peck (2004)** | "It is the ability of a system to return to its original state or move to a new, more desirable state after being disturbed." |
| **Sheffi and Rice (2005)** | "It is the firm's ability to absorb disruptions or enables the supply chain network to return to state conditions faster and thus has a positive impact on firm performance." |
| **Carvalho and Cruz Machado (2007)** | "Supply chain resilience is concerned with the system´s ability to return to its original state or, a new more desirable one, after experiencing a disturbance, and avoiding the occurrence of failure modes". |
| **Ponomarov and Holcomb (2009)** | "The adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function." |
| **Ates and Bititci (2011)** | "The capacity of an organisation to survive, adapt and sustain the business in the face of turbulent change." |
| **Jüttner and Maklan (2011)** | "The apparent ability of some supply chains to recover from inevitable risk events more effectively than others." |
| **Alberts (2011)** | "Resilience provide an entity with the ability to repair, replace, patch, or otherwise reconstitite lost capability or performance (and hence effectiveness), at least in part and over time, from misfortune, damage or a destabilizing pertubation in the environment." |
| **Carvalho et al. (2012a)** | "Resilience is referred to as the ability of supply chains to cope with unexpected disturbances." |
| **Urciuoli et al. (2014)** | "The capability of companies to anticipate, identify, react and learn from incidents". |

Years later, the earthquake and tsunami that took place in Japan in March 2011 resulted in one of the largest disruptions to global supply chains in modern history, according to Sáenz and Revilla (2014). In line with this, the same authors have stated that the percentage of global companies reporting a loss of income due to a supply chain disruption increased from 28% in 2011 to 42% in 2013. Therefore, under such circumstances, managers concerned about further threats are forced to change their traditional business activities and hence think of alternative ways to develop strategies for preventing and coping with different types of disruptions. In this regard, scholars and researchers have seen this topic as a great opportunity to be explored and thus helping practitioners in business continuity and competitive advantage.

To achieve resilience, authors (Ponomarov and Holcomb, 2009; Jüttner and Maklan, 2011; Spiegler et al., 2012; Wright, 2013) have pointed out three phases: readiness or preparedness, response and recovery. Going further, Sheffi and Rice (2005) have described them in eight stages (steps) that were represented in a performance versus time graph (Figure 10). Companies might get back to their normal performance easier if they were prepared and have made assertive decisions to overcome disruptions. On the other hand, its recovery is

going to take long. According to Pettit et al. (2010), resilience is not a static goal but requires continued attention. Furthermore, it is worth to highlight that creating resilience in the supply chain is costly, however the investment in resilience can be ultimate to business continuity in today's market and environment. In this sense, managing existing trade-offs to create or improve supply chain resilience has been a challenging and interesting subject to be explored by researchers and practitioners. Chopra and Sodhi (2014) has recently released a study discussing the trade-off of cost vs. resilience; however many perspectives and lenses can be applied to explore other aspects of the problem.

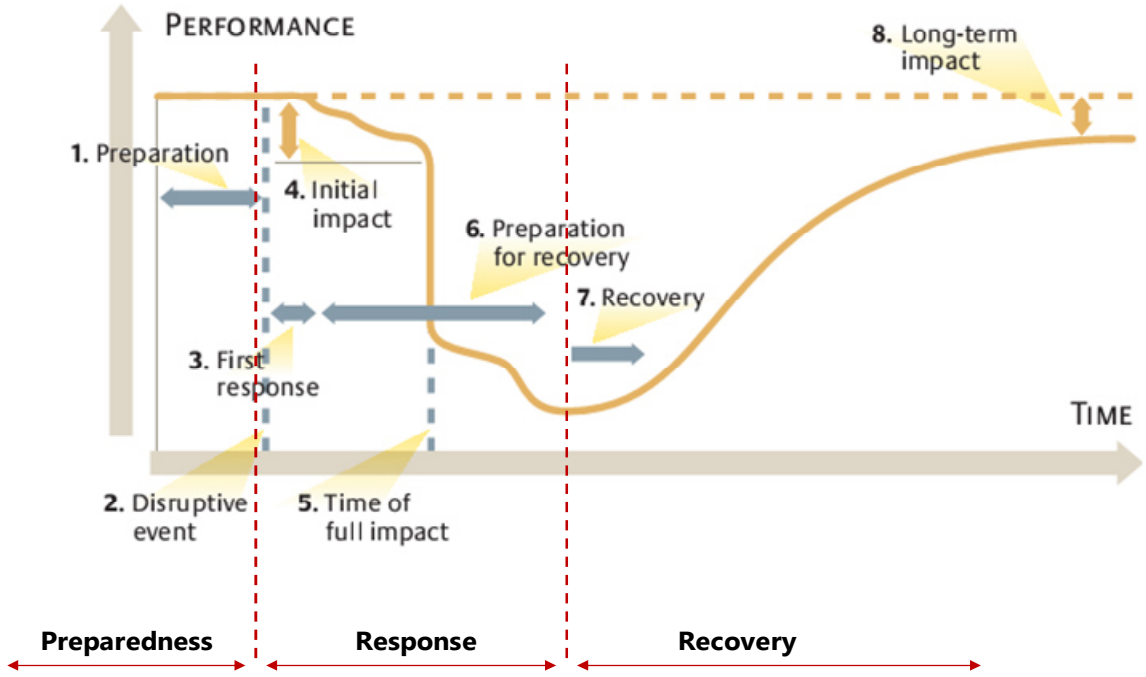


**Figure 10.** Stages of disruptions in a resilient supply chain
Source: Adapted from Sheffi and Rice, 2005, p.42

Admitting that almost every supply chain faces disruptions of varying severity and types (Blackhurst et al., 2005; Wieland, 2013; Golgeci and Ponomarov, 2013, Treiblmainer, 2014), Christopher and Peck (2004) have classified those into: internal, external and environmental. So that, being prepared to any future disruptive event enable companies to take efficient and effective response and therefore being less vulnerable to disturbances (Ponomarov and Holcomb, 2009; Pettit et al., 2010; Azevedo et al, 2013b; Scholten et al., 2014). Thus, "resilience within organisation studies recognises both the ability to absorb shocks in the form of extreme events and an adaptive capability to adjust to new circumstances" (Johnson et al., 2013, p.325). So that it is recognised as a responsive

capability for firm performance as well as key dimension of a firm's survival (Golgeci and Ponomarov, 2013).

### 2.2.1 Primary research in supply chain resilience

There is a remarkable increase in number of studies in the last years (Figure 11). However, this amount is still very small compared to the wide body of studies in risk supply chain management.

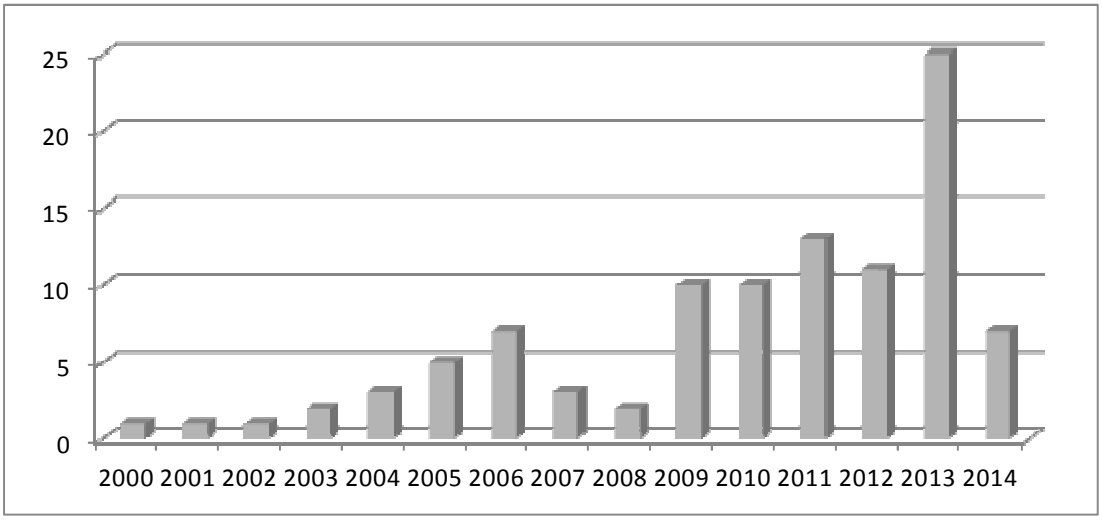


**Figure 11.** Number of studies in supply chain resilience throughout 14 years
Source: created by the author

Because of the emergency situation faced by many interconnected companies in mid-2000, Sheffi (2001) carried out a study looking at the corporate challenges for preparation against terrorist attack and, therefore, operating under heightened security. In this study, the author pointed out security measures and cooperation with government in order to prevent new attacks, besides highlighting the need for redundancy strategy and restructuration of business processes to deal with heightened security. Although it was a study released after the 9/11 terrorist attack (which was one of the tipping events of the resilience concept in supply chain management), it did not mention the term resilience as a key concept. On the contrary, it strongly pointed out the development of a security system for terrorist attacks.

In the same vein as Sheffi (2001), high emphasis on security, Rice and Caniato (2003, p.25) additionally highlight resilience in stating that "companies will need to design both security and resilience, as a secure supply network does not guarantee a resilient supply network". Thus, they also call the attention to two main enablers (redundancy and flexibility) to creating resilience, and classify the responses to disruption in four levels (basic, reactive,

proactive and advanced initiatives). Differently from Sheffi (2001), these authors draw the attention about the weakness in focusing on internal operation by considering only high impact events and low probability, such as terrorist attack, and leaving the rest of the risks and threats as a matter of companies' luck.

From different categorisation of risk sources (internal, external and environmental), Christopher and Peck (2004) set out a managerial agenda for identification and management of risk in the supply chain so that to improve resilience. As a result, they present a conceptual model composed of four principles to build a resilient supply chain, highlight the importance of flexibility and agility to create resilience and, the re-structuring, collaboration and transparency along the supply chain. In this study, which was based on empirical data from companies in different sectors, the authors suggest for future research on short and long-term costs associated with measures and the study of trade-offs between different risks associated with make or buy decision.

Ponomarov and Holcomb (2009) have also proposed a conceptual framework but they have narrowed it to the relationship between logistic capabilities and supply chain resilience. To do so, they first tried to better understand the origin of the term resilience and expose a historical evolution of this term in different fields such as ecology, psychology, economic and lastly organisation. Year later, Graeml and Peinado (2010) replicated this study with Brazilian companies. Likewise Christopher and Peck (2004), Ponomarov and Holcomb (2009) have asserted that resilience is one important construct to supply chain risk management. Additionally, these authors stated that their framework is limited due to a poor understanding about the relationships among the variables, the links between risk and implications for supply chain management, and the methodologies for managing these key issues. For these reasons, they have affirmed that further research opportunities are abundant in this topic, and have suggested studies about knowledge-based theory, ground theory and resilient metrics.

After 2009, many other studies (e.g. Colicchia et al., 2010; Pettit et al., 2010; Zsidisin and Wagner, 2010; Blackhurst et al., 2011; Jüttner and Maklan, 2011; Carvalho et al., 2012a,b; Ponis and Koronis, 2012; Spiegler et al., 2012; Azevedo et al., 2013; Bhattacharya et al., 2013; Wieland, 2013; Golgeci and Ponomarov, 2013; Braziotis et al., 2013; Sawik, 2013; Urciuoli et al., 2014; Kumar and Vlajic, 2014; Treiblmainer, 2014; Brandon-Jones et al., 2014) were published, and the number has increased every year. Each of them have approached a small part of the wider unexplored resilience from a supply chain perspective.

In this regard, some have focused on developing and testing different frameworks (Pettit et al., 2010; Blackhurst et al., 2011; Bhattacharya et al., 2013; Wieland, 2013), others have related resilience to other concepts such as green, lean, agile and risk (Carvalho *et al.*, 2012a; Jüttner and Maklan, 2011; Ponis and Koronis, 2012; Azevedo et al., 2013; Lotfit et al., 2013; Maslaric et al., 2013; Kumar and Vlajic, 2014) or even developing propositions through the theoretical lenses (Jüttner and Maklan, 2011; Brandon-Jones et al., 2014; Treiblmainer, 2014) and using modelling and simulation to assess resilience (Carvalho et al., 2012b; Spiegler et al., 2012). The number of published papers on this topic has risen (as can be seen in Figure 11), and it seems that it is a continuing trend, taking into account the unstable environment and volatile market in which global companies are embedded nowadays.

### 2.2.2 Interchangeable concepts

Due to various changes and hardships that supply chains have currently faced, several strategies have been created to prevent or to cope with the consequences. In this regard, many approaches have been discussed in the literature, such as vulnerability, risk, robustness and resilience. However, because of the many interpretations regarding these concepts, in particular, they can be found in the literature as interchangeable which sometimes making them confusing and difficult to understand the real meaning.

Numerous factors are capable of creating vulnerability to companies and its supply chains, such as complex networks, long lead-times and plant locations. Thus, Jüttner and Maklan (2011) define vulnerability as the susceptibility of the supply chains to likely disruptions. However, the term "likelihood" is more closely linked to the risk concept (Maslaric et al., 2013). Christopher and Peck (2004) define it as the probability of a given event versus its negative business impact, which can be arisen from internal, external and environment risk. These two variables are illustrated in Figure 12, where it is noticed that the highest vulnerability is achieved when the disruption probability (likelihood) and impact (consequences) are both high. On the other hand, low vulnerability is achieved by low disruption probability and light consequence combination, which normally corresponds to daily activities (Sheffi and Rice, 2005). Therefore, risk and vulnerability are concepts which can be addressed together but not with the same meaning.

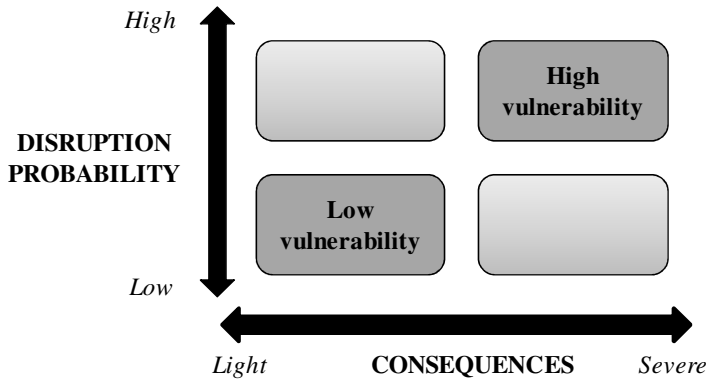


**Figure 12.** The relationship between likelihood and vulnerability
Source: Sheffi and Rice (2005)

Generally robust means something strong and sturdy. Hence, robust supply chain seeks to be strong enough to support impacts arising from different disruptions or maintain continuity of the process (Brandon-Jones et al., 2014). In support to it, Zsidisin et al. (2005, p.3404) affirm that "robustness is the ability of the system to resist a disruption". Moreover, Spiegler et al. (2012) assert that a robust system should keep the company's performance even after disturbances, model inaccuracies and changes. In this context, the Six Sigma methodology is an example of robust process by requiring high reduction of process variability in order to achieve continuous quality (Christopher and Rutherford, 2004). On the other hand, resilience, as previously defined, is the capability of the supply chains to respond quickly to unexpected events so as to restore operations to the previous performance level or even to a new and better one (Christopher and Peck, 2004; Ponomarov and Holcomb, 2009). Therefore, it has the characteristic to be flexible, adaptable and capable of taking advantage even in sticky situations.

Regarding robustness and resilience, studies were found which reported these two concepts in an interchangeable or even contradictory way. Tang (2006b, p.38) asserts that "having a robust supply chain strategy could make a firm become more resilient". In fact, robustness can help to reduce the impact caused by disruptions but cannot improve resilience, since the latter is a concept related to flexibility and not sturdiness. In the same vein, Hansson and Helgesson (2003, p.219) state that "robustness is a limited case of resilience". This therefore means that process with limited variability cannot be considered enough robust to absorb disturbances without the ability to be flexible (Christopher and Rutherford, 2004). By forcing a system to a minimum variation, it creates resistance but not flexibility. Alternatively, robustness can be achieved by means of resilience rather than resistance (Pettit et al., 2010).

Moreover, statements regarding vulnerability and risk are also confusing. Sheffi and Rice (2005, p.41) state that "reducing vulnerability means reducing the likelihood of a disruption and increasing resilience". However, this is not always the right way, knowing that the likelihood is a characteristic of risks, and sometimes they cannot be avoided or forecasted. Thus, it is not possible to guarantee that reducing risk makes the supply chain less vulnerable or more resilient. What might make a supply chain less vulnerable would be to make it different or adaptable. In this case, Ponomarov and Holcomb (2009, p.129) clear up this idea saying that "the vulnerability of infrastructure could be decreased during the recovery stage (*e.g.* a bridge destroyed by an earthquake could be replaced by a new one with a better and more robust design)". Because of that, the need for network re-design is pointed out which is one of the resilient strategies proposed by Christopher and Peck (2004) and Carvalho et al. (2012a), for example.

Zsidisin et al. (2000) argue that any business environment has certain degree of risk, and even if they are reduced by internal actions, organizations should develop further actions against unpredictable incidents. Therefore, although the traditional risk assessment approach is very important, it cannot cope with unpredictable events. Hence, it is believed that supply chain resilience may be able to complement the existing risk management programs. In support to that, Pettit et al. (2010, p.4) state that "resilience is an evolving concept and differs from traditional risk management".

Most successful companies are involved in a global network, which results in complex networks prone to risk arising from internal, external or environmental sources. Companies embedded in a vulnerable and risky environment can be victims of unexpected events in different levels (high to low impacts). If the disruption is not major, the robustness is a good option to build security to small impacts in order to guarantee the business continuity. However if the disruption is major, companies should develop resilient practices to rapidly bounce back to its original performance, in case they do not want to suffer great economic losses. Although reaching the survival and continuity of the business, companies are invariably embedded in a turbulent environment, which should be useful for them to back up the knowledge built from past experiences (lessons learnt) in order to further improve their resilient practices.

It is noteworthy that the decision making between resilience and robustness can be supported by Spiegler et al. (2012, p.6169) when they affirm that a "robust system is able to respond to reasonable variations, and a resilient system responds to major changes in input; a resilient supply chain will be robust while the reverse is not always true". Therefore, although

the robust strategies can protect companies from small impacts and risk management can reduce the supply chain vulnerability, resilience is able to take advantage in drastic situations from major disruptions by mitigating impacts and becoming competitive.

Finally, although building resilience in supply chain is not a low cost strategy, it is a strategy that will determine the success of companies in the turbulent environment and volatile market (Christopher and Holweg, 2011). The trend to minimal cost has changed and companies are more aware of the current challenges, which make them invest more in their business in order to be safe and competitive. Therefore, considering the relevance of resilience for company's future business, successful and unsuccessful cases are illustrated as follow.

### 2.2.3 Cases regarding resilient actions in the literature

In recent years, hurricanes, tsunamis, droughts, political upheavals and economic uncertainty have impacted manufacturing supply chains around the world. According to Sheffi and Rice (2005), many successful and unsuccessful examples from companies after any disturbance can be fully found in the literature. Table 5 exposes some of the main cases disclosed on media about the impacts and consequences of remarkable natural disasters. Although the examples portray successful actions by some companies, there are also many other examples of not being prepared or having other possible alternative to bounce back from unforeseen disasters.

In addition to those examples caused by natural disasters, the literature is also full of examples about disruptions caused by failures in business planning. One of the most common unsuccessful case focuses on problems with sourcing flexibility. In this context, Sheffi and Rice (2005) exemplify this point reporting the shipping delay from UPF to Land Rover. As Land Rover relied on a single supplier (UPF), this company ended up with no alternatives when UPF went into liquidation threatening to cut the supply of a vital component unless Land Rover paid a huge amount of money as a "goodwill" payment. The consequences of this could have been worse if Land Rover had denied the payment, harming nearly 1,500 jobs of their own plant and 10,000 jobs among suppliers (Christopher and Peck, 2004; Sheffi and Rice, 2005; Stecke and Kumar, 2009). In the same situation, Colicchia et al. (2010) also reported the problem faced by Ford Motor Company due to contract competition with an exclusive diesel engine supplier - Navistar International Corporation. In this case, the supplier suddenly cut off the deliveries of engines, which caused huge breaks in manufacturing of about 4000 units of the highly profitable F-series pickup truck.

**Table 5.** A few cases from natural disaster results

| Natural disaster | Companies involved | Consequences | Sucessful company's actions | Unsuccessful company's actions |
|---|---|---|---|---|
| Earthquake in Taiwan (September, 1999) | Dell and Apple (computer companies) | Power outages and damaged equipment halted supply of components to high tech manufacturers. | This company had a perfect lean and build-to-order system which makes it capable of changing standardized components in the last minute. Because of that, Dell could influence demand toward products with available components through direct sales model on the website. | After a recent launch of the new iBook and G4 Power Macintosh followed a characteristic pattern, which allowed customer to preorder with determined data for delivery, Apple faced customer's complains and consequently lost its market share for not delivery in time and with the expected configuration. |
| Fire plant in one of the Philips Electronics plant (March, 2000) | Nokia and Erikson (mobile companies) | The whole production of Philips were damage which 40% corresponded to supply these two big companies. This company ended up with lost sales of the high-margin, besides US$40 milion. | As soon as Nokia knew about the disaster and its severity, it immediately shifted their chips orders to other Philips plant, as well as to other Japonese and American suppliers. Although the major disruption, Nokia and Philips worked together to figure this problem out. | Errikson did not pay a careful attention to the severity of the incident. Because of that, it delayed its response and lost opportunity to get other source of microchips suppliers. This lack of responsiveness caused approximatly US$2.34 billion of losses for this company. |
| 9/11 terrorist attack in U.S.A (September, 2001) | Ford and Chrysler (automotive companies) | U.S.A govenment tightened security at country borders and shut down all flights in and around the United States. It caused shipment delays from Canadian and Mexican suppliers to these two leader companies. | Quickly answering the disruption caused by U.S.A government, Chrysler swifted its transportation mode to road transportation, and implemented contingency plans. | Ford did not have an efficiency response which resulted in five plants closures for many days. For this reason, its production was cut in 13 percent the week following the attacks, and ended up losing more than 16,000 units of production by the end of that same week. |
| Hurricane Katrina (August, 2005) | Wallmart (retailer company) | It caused a massive devastation towards the Louisiana and Mississippi coasts with the catastrophic flooding. | Before the hurricane, Wallmart had launched a comprehensive emergency response. It included: stocking stores in the storm zone with special merchandise; stationing teams to evaluate stores as soon as the hurricane passed; and gathering representatives of all major functional areas in a centralized emergency operations center in order to find displaced employees, re-open stores, and help stricken communities. | Other small companies and mainly the public sector were devasted after the incendent, because they had no previous plan to deal with critical events. |

**Table 5.** A few cases from natural disaster results (continue)

| Natural disaster | Companies involved | Consequences | Sucessful company's actions | Unsuccessful company's actions |
|---|---|---|---|---|
| Hurricane Sandy (November, 2012) | Legrand (electrical equipment manufacturer) and JP Morgan Chase (American multinational banking corporation of securities, investments and retail) | It caused extreme impacts, such as major flooding with closure of port and airports in U.S.A North-eastern, fuel shortages, and evacuations of facilities. | JPMorgan Chase's headquarters could reopen on the day after incident due to they held at least 100 hub bank branches in New York, New Jersey and Connecticut. Because of this event, they were stocked with extra cash in order to overcome the consequences of the storm. | Among the companies most impacted by the hurricane, Legrand could not return to its normal production until early next week. |

Source: This table was build based on many source of information - Sheffi (2001); Sheffi (2005), Sheffi and Rice (2005), Lee and Hancock (2005), Tang (2006a,b); Horwitz (2009); Stecke and Kumar (2009), World Economic Forum (2013).

On the other hand, successful cases have also been highlighted in the literature. Dell is one of the well-published cases regarding resilience because of their strategies to deal with critical events. By using a well-conducted make-to-order system and also by postponing their product assembly, which allows for the adjustment in configuration and consequently prices of the final product, Dell has kept up its performance and hence being competitive (Christopher and Holweg, 2011). With different strategies that gave good results, Volkswagen has settled cars manufactures in different locations, such as United States of America, Brazil, Mexico and Germany. Hence, local disruptions can be compensated for increasing production in other plants, however it requires extra capacity to be flexible in times of needs. Likewise, Toyota and Sears keep certain inventories of cars and appliances at certain locations, so that all retailers nearby the region can share their inventories. In doing so, they can achieve a higher customer service level without incurring high inventory cost when dealing with regular demand fluctuations (Tang, 2006b).

All these cases show strategies by which companies were capable of coping with those drawbacks. Nonetheless, it is important to clear up that different companies have different needs. So that, which makes one company vulnerable, may not make other. To exemplify this, Sheffi and Rice (2005) portray an interesting view of McDonald's stores, by stating that they are not so vulnerable to local terrorist attack considering that they hold hundreds of other stores nearby (redundancy), however they are extremely vulnerable to any outbreak of mad cow disease or other problems which may undermine the consumer's confidence.

After the understanding of the two main subjects of this study (Supply Chain Resilience and Procurement function), the next step is to get grips with the organisational theory that will support the results of this study - Dynamic Capability Theory.

### 2.3 Dynamic Capability View (DC)

According to Corley and Gioia (2011, p.12), "theory is a statement of concepts and their interrelationships that shows how and/or why a phenomenon occurs". It helps researchers to comprehend the complex environment in which the object of study is embedded (Chicksand et al., 2012). Thus, looking at management context and assuming that companies have goals, hierarchies, rules, career plans and many other foundations to be considered, the general organizational theory seeks to understand how an organization works to motivate its participants to achieve consistent results under a variety of internal and external factors. In

other words, organisational theory observes how internal and external actions can affect the organisations' survival (Fligstein, 2001).

Through this general concept of organization theory, many specific theories and views have emerged to support and explore phenomena in operational management studies, such as agency theory, resource-based view, and strategic contingency theory. This research seeks to understand the organizational capabilities and resources required to create and maintain a resilient supply chain. Considering that these capabilities and resources are continuously changing in response to variations in the external environment (Helfat et al., 2007), a particular view that takes into consideration internal, external, and environmental changes through resources and processes adaptation would be useful to analyse factors within the context of this study. It is therefore named as Dynamic Capabilities.

> *"Strategy matters most during times of change. Businesses and people find it far easier to do more of the same than to do something different. But the world does not stand still. As markets become more globally integrated and new forms of technology and competition arise, companies cannot rest on their laurels. Firms must adapt to and exploit changes in their business environment, while seeking opportunities to create change through technological, organizational, or strategic innovation. [...] To survive and prosper under conditions of change, firms must develop the "dynamic capabilities" to create, extend, and modify the ways in which they make their living" (Helfat et al., 2007, p.1).*

Although dynamic capabilities are rooted in the economics-based strategy literature and the evolutionary approaches to organisation, such as Schumpeter (1934), Penrose (1959), Williamson (1975, 1985), Nelson and Winter (1982) and Teece (1982, 1984) (Augier and Teece, 2009), this concept has gained attention since it was first introduced by Teece and Pisano (1994) and Teece (1997)'s studies (Easterby-Smith and Prieto, 2008). Additionally, after the study of Eisenhardt and Martin (2000), dynamic capabilities have become recognised as an extension of the Resource-Based View (RBV). These authors have argued that "RBV has not adequately explained how and why certain firms have competitive advantage in situations of rapid and unpredictable change" (Eisenhardt and Martin, 2000, p.1106).

In this regard, Easterby-Smith and Prieto (2008) disclosed many arguments which prove that dynamic capabilities (DC) go beyond the RBV explanation. Priem and Butler (2001), for instance, state that RBV is essentially a static theory and has difficulty to incorporate the evolution of the resources and capabilities over time to achieve competitive

advantage. Moreover, Cavusgil et al. (2007) states that despite RBV encourages managers to focus on strategies for exploiting firm-specific assets, it does not adequately address several aspects of how firms should create sustainable competitive advantage.

Therefore, RBV is normally used to understand how competitive advantage within firms is achieved and how that advantage might be sustained over time. Furthermore, it is based on the VRIN (Valuable, Rare, Inimitable and Non-substitutable) attributes; which means that organisational resources are valuable, rare, inimitable and non-substitutable (Eisenhardt and Martin 2000). However, in a changing environment, accumulating only resources is insufficient for maintaining competitive advantage. Organisation needs to reconfigure its resources into dynamic capabilities so as to achieve competitive advantage (Chien and Tsai, 2012). In this sense, the view of RBV has evolved to dynamic capabilities view (Teece 2007; Blome et al., 2013).

Slightly different from RBV assumptions, dynamic capabilities are typically valuable and rare considering that competitors do not have the same resources and capabilities, however other conditions (inimitable and non-substitutable) do not always hold (Ponomarov, 2012). The reason is that in a rapid changing environment, the capabilities of reconfiguring and orchestrating the existing resources may create valuable assets that are somewhat rare, but not perfectly imitable, and some resource can be substitutable (Lacerda et al., 2014). Moreover, considering the characteristic of not perfectly imitable, dynamic capabilities are developed through multiple learning paths, so that have commonalities across organisations (Wheeler, 2002). In this context, Cavusgil et al. (2007) presents the main differences between RBV and Dynamic Capability (Table 6). The other characteristics are discussed as follows along the dynamic capabilities content.

**Table 6.** Comparing and contrasting the views of RBV and DC

| Key concepts | Resource-Based View (RBV) | Dynamic Capabilities (DC) |
|---|---|---|
| **Conceptualization** | Bundle of heterogeneous resources | Specific organisational processes by which managers alter their resources based |
| **Resources/Capabilities** | Idiosyncratic | Commonalities with some idiosyncratic details |
| **Environment** | Does not differentiate | Moderately dynamic versus high-velocity market |
| **Competitive Advantage** | From VRIN attributes | From valuable, somewhat rare, substitutable DCs, lies in resouce configurations built from DCs |

Source: Adapted from Cavusgil et al (2007)

Dynamic capabilities are therefore considered a potential view/lens to guide managerial studies in understanding of the newer sources of organisational competitive advantage amid the recent unstable environment and volatile market. The original definition of this approach was given by Teece et al. (1997, p.516) who stated that dynamic capability is "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments". Years later, Eisenhardt and Martin (2000, p.1107) refined and expanded this definition to "the firm's processes that use resources - specifically the processes to integrate, reconfigure, gain and release resources - to match and even create market change".

Following this train of thought, dynamic capability is defined in this study as "the capacity of an organization to purposefully create, extend, or modify its resource base" (Helfat et al., 2007, p.4) by "adapting, integrating, and reconfiguring internal and external organizational [processes], resources, and functional competencies" (Teece et al., 1997, p.515) so as to become a source of sustained competitive advantage (Eisenhardt and Martin, 2000). Assuming that dynamic capabilities reside in the potential of resources, routines and competences changes (Easterby-Smith and Prieto, 2008), managers have to manipulate the internal and external organisational resources as well as the organisational routines and competences in order to develop new value-creating strategies (Kuuluvainen, 2012).

According to many authors (*e.g.* Teece et al., 1997; Cavusgil et al., 2007; Chien and Tsai, 2012), the term "dynamic" refers to the capability to regenerate competences that correspond to the changing environment, whereas the term "capability" emphasizes the key role of strategic management in appropriately adapting, integrating, and reconfiguring both internal and external organizational processes, resources and competences in response to the changing environment. Therefore, the concept of dynamic capability includes the capacity to identify the need or opportunity for changing, formulate a response to such a need or opportunity, and implement a course of action. Although not all dynamic capabilities serve all these three functions, different dynamic capabilities serve different purposes (Helfat et al., 2007).

By and large, the core idea of the DC is that when the competitive landscape evolves rapidly and unpredictably, an organization can achieve and sustain advantage by appropriately extending, modifying and/or creating resources (Teece et al., 1997) and routines (Eisenhardt and Martin, 2000; Zollo and Winter, 2002). This potential depends therefore on complex organisational processes (also known as routines or practices), shaped by the firm's specific resource positions, and the evolution paths it has adopted (Prieto and

Easterby-Smith, 2006). In this sense, the three main elements of the dynamic capability view are further presented.

Overall, although DC is a recent theoretical view (since about 1997) in comparison with several matured organisational theories/views (e.g. cost transaction and resources based view), the number of papers that have been using it to explain the phenomenon in study is ever-growing. Furthermore, many of them are in the operations management area (Browman and Ambrosini, 2003; Bititci et al., 2011; Kuuluvainen, 2012; Chang and Wang, 2013) and in the context of supply chain (Beske, 2012; Blome, 2013; Treiblmainer, 2014). In this regard, Golgeci and Ponomarov (2013) asserted that DC should be useful to predict supply chain performance outcomes.

### 2.3.1 Processes, Positions and Paths: the fundamental elements of dynamic capability view

Through adapting, integrating, and reconfiguring internal and external organizational resources, dynamic capability has the ability to renew capabilities to achieve strategic management in the current changing environment. In this context, three key elements of strategic structures with dynamic capabilities are organizational processes, assets positions, and path dependence (Chang and Wang, 2013). This was previously affirmed by Teece et al. (1997, p.509), who state that competitive advantage through dynamic capabilities is seen "as resting on distinctive ***processes*** (ways of coordinating and combining), shaped by the firm's specific asset ***positions*** (such as knowledge assets and complementary assets), and the evolution ***path***(s) it has adopted or inherited". The following sub-sections aim to clarify each one of these elements separately.

#### Assets Positions

According to Helfat et al. (2007), the resource base of an organisation includes tangible, intangible, and human assets as well as capabilities which organizations own, control, and use to implement strategies. Recognising that knowledge and skills come from human assets that create competences and capabilities (Teece et al., 1997; Augier and Teece, 2009), the resource base in this study is simply divided into tangible and intangible. Thus, intangible resources include skills, information and knowledge for instance, whereas tangible resources include products, inventory and suppliers, for example. According to Cavusgil et al. (2007), developing dynamic capabilities is not only based on identifying the assets (or resources) positions, but especially on how they are structured within the company or along

the supply chain. In doing so, reconfiguration of strategic resources can result in value-creating strategies (Prieto and Easterby-Smith, 2006), and consequently competitive advantage over the competitors.

**Organisational and Managerial Processes**

The dynamic capabilities are not only determined by an organisation's tangible and intangible resource base at a given point in time, but are acquired over time through various management decisions (Eisenhardt and Martin 2000; Blome et al., 2013). Therefore it is relevant to know what organisations do and how they do (Helfat et al., 2007). As such, dynamic capabilities can be perceived as the routines in an organisation to identify threats and opportunities (Teece, 2007) and to guide and facilitate the development of the capabilities by changing the resource base (Eisenhardt and Martin, 2000; Nielsen, 2006; Beske, 2012).

Ponomarov (2012), in accordance with Barney (1996), has stated that organisations that do not exploit their own internal resources can only expect to obtain "normal" returns from their strategic efforts. If the situation is extreme, they will not achieve efficient strategies. Although most underlying routines tend towards stability/inertia, they should be adaptable under conditions of moderate turbulence in the environment (Teece, 2012). Thus, Easterby-Smith and Prieto (2008) have affirmed that changes in routines or practices should be implemented by appropriately altering resources so as to achieve value-creating strategies.

Integration and coordination of the organisation processes is demanding to achieve dynamic capabilities. Eisenhardt and Martin (2000) exemplified this point by citing new product development in which managers from multifunctional teams with combination of various skills, expertise and assets to create new products. Bowman and Ambrosini (2003) also complement by affirming that integration can also be related to external (suppliers or customers) and internal (human assets) resources.

According to Eisenhardt and Martin (2000), dynamic capabilities exhibit commonalities across organisations and these features can be classified as "best practice", as it can be transferred from one organisation to another. However, the idiosyncrasy within organizational routines differentiates organisations from its major competitors in terms of productivity and survival, if it is an extreme case (Prieto and Easterby-Smith, 2006). These affirmations are therefore supported by Table 6.

**Path dependence**

According to Cavusgil et al. (2007, p.162), "the concept of path dependency recognises that "history matters". The firm's past investment and routines constrain its future behaviour". Taking this affirmation into account, past experiences and learning are two main factors which help generate competences. This rationale is supported by Augier and Teece (2009, p.418) who affirm that "competences reflect both individual skills and experiences as well as distinctive ways of doing things inside firms", and Prahalad and Hamel (1990) who complements this idea by defining competences as the collective learning that gives organisations the ability to deploy their resources productively. In these sense, Teece (2012, p.1396) has said that "capabilities are built not just on individual skills but also on the collective learning derived from how employees have worked together, as well as on special equipment or facilities to which the firm has access".

Equally to dynamic organizational capabilities, dynamic managerial capabilities arise from prior learning and experience (Helfat, 2007). Learning is defined as "a process by which repetition and experimentation enable tasks to be performed better and quicker" (Teece et al., 1997, p. 520). So, this may occur through imitation of others or through collective contributions to the pointed problem (Jarratt, 2008). Overall, many studies link knowledge management and learning to dynamic capabilities. Examples of them are Bowman and Ambrosini (2003), Easterby-Smith and Prieto (2008), Jarratt (2008) and Chien and Tsai (2012).

The alternative view is that dynamic capabilities can be embodied in functional capabilities (Easterby-Smith and Prieto, 2008). Managers are decision makers, and they must collect information, analyze it, synthesize it, and act upon it inside the organisation. If this path is chosen, then rules may become codified and routinely applied whenever certain changes are detected (Augier and Teece, 2009). Thus, the dynamic capabilities framework is presented to summarise the three fundamental elements (3P's) of the dynamic capability theory and their corresponding factors and characteristics. Figure 13 illustrates such rationale which follows the affirmation of Teece et al. (1997).

Considering that organisations are embedded into today's uncertain and volatile environments, each organisation holds tangible and intangible resources (assets positions). Over time, managers increase their competences through lessons learned and past experiences (path dependence) from daily routines and practices (organisational processes). Good practices or routines (product development and alliances, for example in Eisenhardt and Martin, 2000) might become best practices which might help different organisations.

However, if any turbulence or extreme situations happens in the business environment, organisations are able to integrate, adapt and reconfigure internal and external resources by changing ordinary routines through managers competences. As a result, value-creating strategies are built to achieve dynamic capability, which normally leads to competitive advantage. Nevertheless, Eisenhardt and Martin (2000, p.1117) have also affirmed those capabilities should be applied "sooner, more astutely, or more fortuitously" than organisation's competitors.

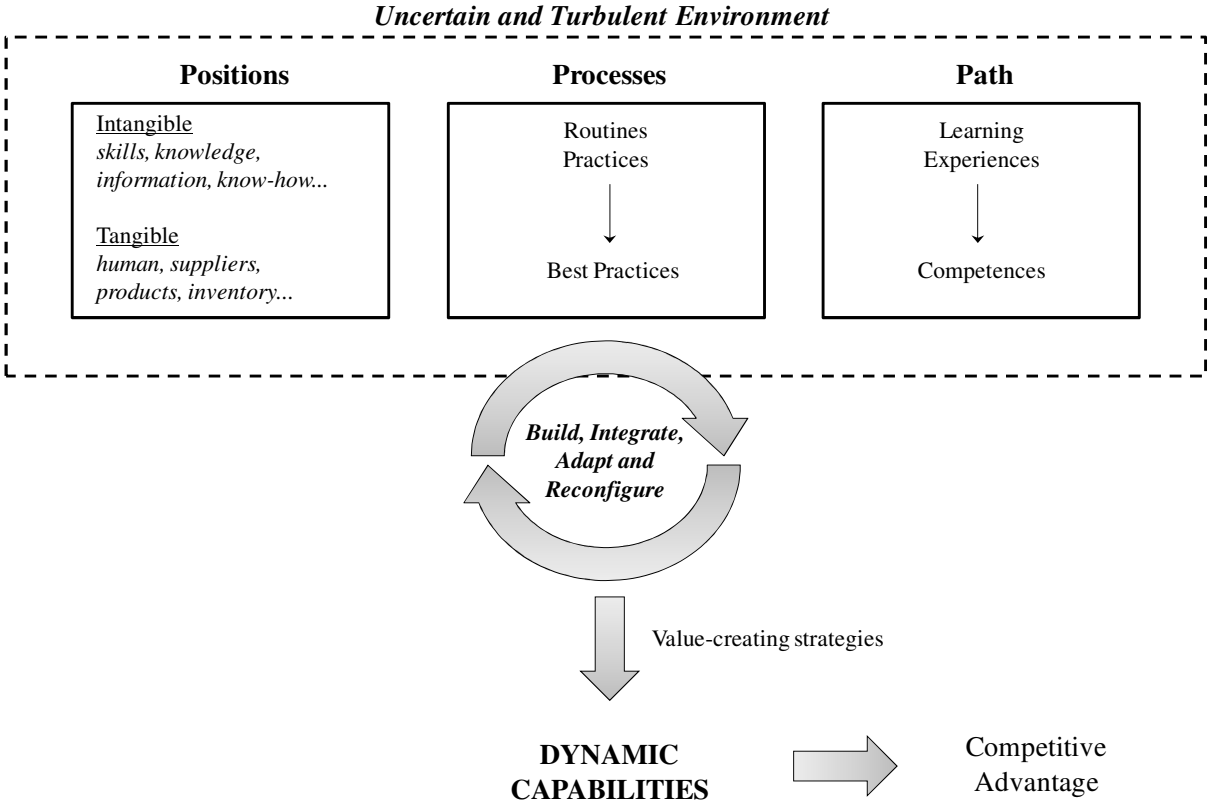


**Figure 13.** Framework of the dynamic capability theory applied to this study
Source: created by the author

The next chapter presents the process of systematic literature review and its results based on the proposed review questions.

## 3. SYSTEMATIC LITERATURE REVIEW

Due to the amount of information that has been arisen from scientific studies in the past 20 years (Badger et al., 2000; Petticrew and Roberts, 2006), is a challenge for researcher to not overlook relevant research. Thus, to avoid bias and to guarantee rigorous, replicability and consequently relevant results, the systematic literature review is applied to this study. This chapter is therefore composed by the process of the systematic literature review which aims to answer three review questions (further presented). As a result, theoretical findings as well as research frameworks are exposed based on what it is known in the literature so far. They findings were further explored through the empirical data. Figure 14 represents this rationale.

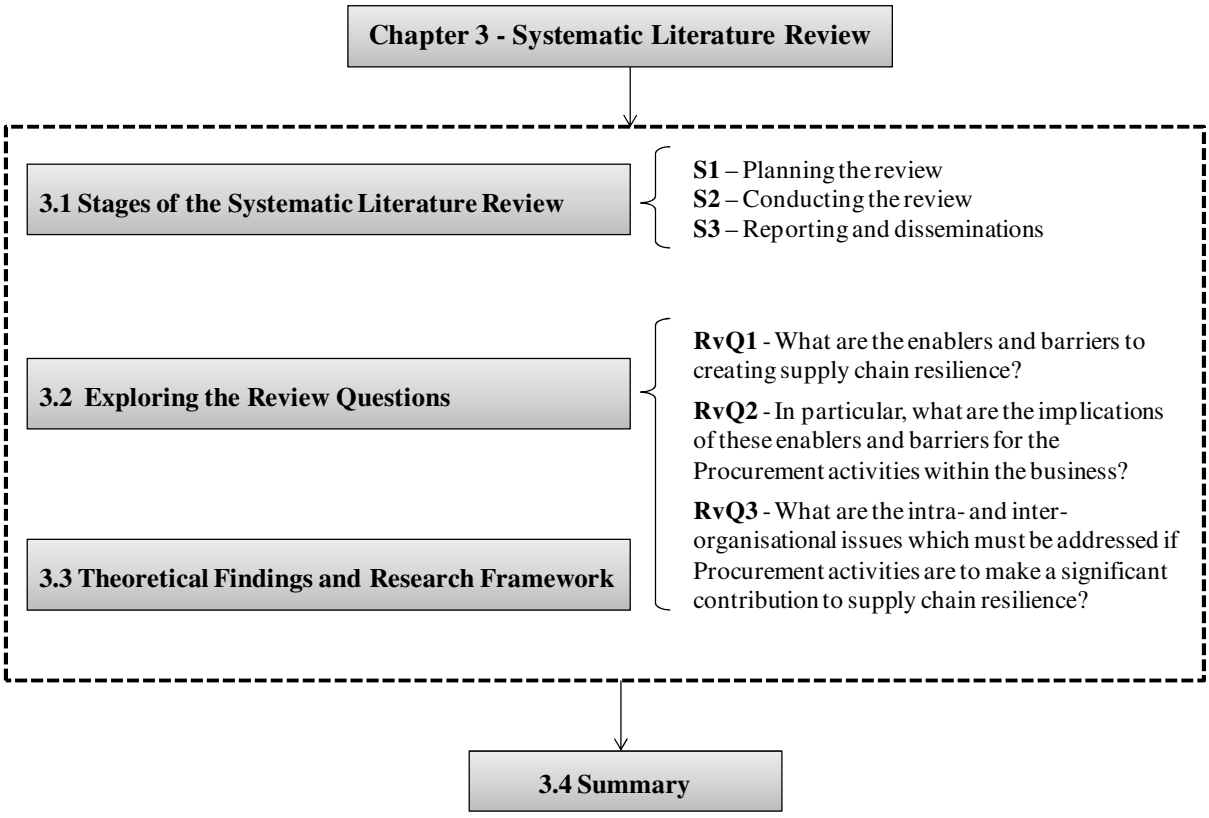


**Figure 14.** Structure of the systematic literature review
Source: created by the author

### 3.1 Stages of the Systematic Literature Review

> *"Systematic Literature Review is a specific methodology that locates existing studies, selects and evaluates contributions, analyses and synthesizes data, and reports the evidence in such a way that allows reasonably clear conclusions to be reached about what we do and do not know. […] In terms of outcome, where studies provide consistent results, systematic reviews might be expected to provide solid and dependable evidence that is robust and potentially transferable across different contexts"(Deyner and Tranfield, 2009, p.672).*

Therefore, three stages developed by Tranfield et al. (2003) and Tranfield et al. (2004) were followed to conduct this review. All the stages and steps are illustrated in Figure 15.

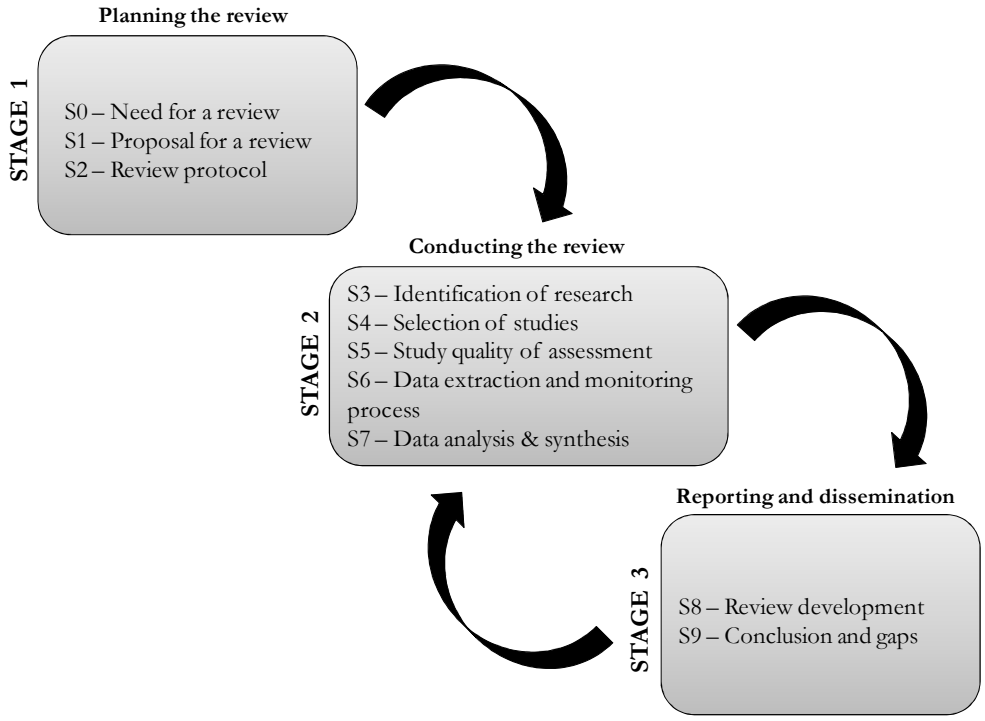


**Figure 15.** Stages for conducting a systematic literature review
Source: Adapted from Tranfield et al. (2003) and Tranfield et al. (2004)

#### Stage 1 - Planning the Review

The systematic review process was carried out to determine what is known and what is not known about the role of Procurement in creating supply chain resilience with a focus on the upstream of the enterprise. Figure 16 illustrates the intersection among the main research areas of this study. To achieve this aim, three review questions (RvQ's) were addressed:

*RvQ1) What are the barriers and enablers to improving supply chain resilience?*

*RvQ2) In particular, what are the implications of these enablers and barriers for the Procurement activities within the business?*

*RvQ3) What are the intra-organisational and inter-organisational issues which must be addressed if Procurement activities are to make a significant contribution to supply chain resilience?*

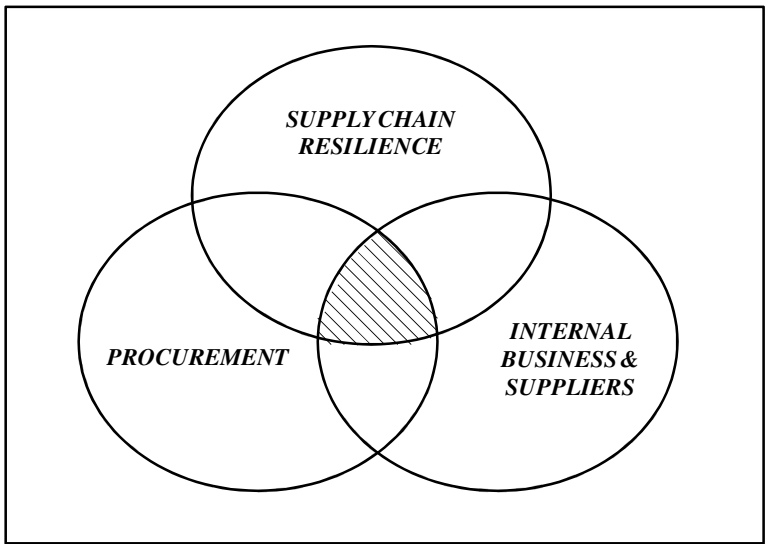


**Figure 16.** The focus of the systematic literature review
Source: created by the author

Seeking to provide robust and reliable results, a protocol was developed by setting out details from all the steps of the systematic review process (Table 7).

**Table 7.** Protocol to support the systematic literature review

| Stage 2 | Details |
|---|---|
| **Strategy to identify studies** | - identify constructs (Table 8);<br>- define keywords (Table 8);<br>- develop search strings (Table 8);<br>- search on ABI/Inform, EBSCO and SCIELO databases;<br>- search on 14 years-period (2000 - 2014). |
| **Selection of the studies** | - 1° selection: titles and abstracts screening;<br>- 2° selection: introduction, conclusion and looking over the paper's content;<br>- 3° selection: assessment about four main points: quality of journal, accessibility, theoretical and empirical content, and unit of analysis (Table 12);<br>- 4° selection: quality appraisal of papers (Table 13); |
| **Data extraction & monitoring process** | - full paper's reading;<br>- use of the QDA Miner (qualitative software) to code the content based on what is intended to extract. In other words, codes were created which aims to answer the question proposed; for instance, possible barriers and enablers to supply chain resilience, and implications of those on the Procurement activities. |
| **Data synthesis** | - content analysis based on literature review by crossing data from different concepts, discussion and authors;<br>- answer the review question from what is known in the literature;<br>- highlight the relevant points and gaps by the time. |

### Stage 2 - Conducting the Review

For each construct, a number of keywords were listed to cover points of interest. The keywords and codes were extracted from constructs involved in this research. Tests were made with possible strings before defining the final ones. All this information is available in Table 8 below.

**Table 8.** Keywords and codes for the search

| Constructs | Keywords | Codes | Strings |
|---|---|---|---|
| **Supply chain resilience** | - supply chain resilience<br>- resilient supply chain<br>- resilience / resilient<br>- supply chain vulnerability<br>- vulnerability<br>- risk in supply chain<br>- risk | (supply chain* AND resilien* OR risk OR vulnerab*) | "supply chain*" w/5 (resilien* OR risk OR vulnerab*) |
| **Procurement** | - purchasing<br>- procurement | (purchasing OR procurement) | ("supply chain*" w/5 (resilien* OR risk OR vulnerab*) AND (purchasing OR procurement)) |
| **Buyer-supplier relationship** | - external integration<br>- inter-firm integration<br>- buyer-supplier relationship<br>- sourcing strategy<br>- partnership | ("external integrat*" OR "inter-firm integrat*" OR "buyer-supplier relationship*" OR "sourcing strateg*" OR partnership*) | (purchasing OR procurement) AND ("external integrat*" OR "inter-firm integrat*" OR "buyer-supplier relationship*" OR "sourcing strateg*" OR partnership*) |
| **Intra-organisation** | - internal integration<br>-cross-functional integration<br>- cross-functional relationship | ("cross-functional integrat*" OR "cross-functional relationship*" OR "internal integrat*") | (purchasing OR procurement) AND ("functional integrat*" OR "functional relationship*" OR "internal integrat*") |

* A boolean operator was used to delimit the first search string. So that, w5 (for ABI/Inform) or w/5 (for EBSCO and SCIELO) was used for a '5 word' proximity of the term supply chain.

To do so, papers were selected from ABI/Inform and EBSCO which are considered two of the most extensive databases in management (Khan et al., 2012; Thomé et al., 2012), in addition to SCIELO which can cover the searching of national studies. The results of the first search are shown in Table 9 in which a total of 3034 hits were found.

**Table 9.** Result of the database searching

| Strings | ABI | EBSCO | SCIELO |
|---|---|---|---|
| **Search string 1** | 530 | 347 | 14 |
| **Search string 2** | 80 | 73 | 5 |
| **Search string 3** | 877 | 985 | 12 |
| **Search string 4** | 64 | 44 | 3 |
| **Total =** 3034 | 1551 | 1449 | 34 |

Taking one search string at a time, the next step was to undertake a broad review of all 3034 hits by reading the titles and abstracts. From this first screening for general relevance, the total of 290 journal articles came out. These were transferred into the Refworks database (https://www.refworks.com), and eliminated the duplicates. Thus, the total number of journal articles was reduced to 214 (Table 10).

**Table 10.** Result of the first selection

| Strings | ABI | EBSCO | SCIELO |
|---|---|---|---|
| **Search string 1** | 34 | 49 | 3 |
| **Search string 2** | 3 | 1 | 0 |
| **Search string 3** | 26 | 62 | 4 |
| **Search string 4** | 24 | 8 | 0 |
| **Total** = 214 | 87 | 120 | 7 |

Although extremely reduced compared to the result from the first search, 214 papers were still considered a big number to conduct the full reading. For this reason, the second selection was conducted by reading the introductions and conclusions, and also looking over the content of these articles. By this process, 133 papers were selected (Table 11).

**Table 11.** Result of the second selection

| Strings | ABI | EBSCO | SCIELO |
|---|---|---|---|
| **Search string 1** | 24 | 40 | 0 |
| **Search string 2** | 2 | 1 | 0 |
| **Search string 3** | 18 | 29 | 0 |
| **Search string 4** | 14 | 8 | 0 |
| **Total** = 133 | 56 | 77 | 0 |

At this point, all 133 papers were read in detail and assessed through the general assessment criteria specified in Table 12. Subsequently, a total of 51 papers were selected.

**Table 12.** General assessment criteria

| Criteria | Inclusion Criteria | Exclusion Criteria |
|---|---|---|
| **Journal of quality** | Scholarly journals | Academic journals out of management and business area, and from current magazines, trade publication, conference, book or sites |
| **Accessibility** | English and Portuguese language papers | Non-English or non-Portuguese language papers |
| **Theoretical part** | Concepts of supply chain resilience and Procurement within business context | Theoretical part about Material Science, Psychology, Healthy and Environmental issues |
| **Empirical part** | Qualitative, quantitative or mixed | None |
| **Unit of analysis** | Events, cases, individual, inter levels and organisations | Communities |

Source: created by the author

The last selection was regarding quality of the papers. The quality criteria assessment is employed with the intention to check the alignment of review questions, methods of

research, methodological rigour and contribution to knowledge of the chosen studies (Ramos, 2009). The purpose of this additional quality assessment is to attribute levels of quality to papers and therefore to decide what level of quality should be included in this review. The criteria described in Table 13 were used to select the final journal articles. Each of the 51 selected for this step was classified based on four criteria (contribution, strength of argument, theoretical bases and methodological rigor) and only articles that achieved equal or higher than two (medium level) were classified.

**Table 13.** Criteria for quality appraisal criteria

| Criteria | Level | | |
|---|---|---|---|
| | ***1 - Low*** | ***2 - Medium*** | ***3 - High*** |
| **Contribution** | Weak relation between conclusions and data presented; Ideas, models or theories are not new | Small contribution to the field. Builds on other's ideas or arguments; Findings support other studies | Clear contribution to the field. Presents new concepts, ideas or findings and connects them with existing knowledge |
| **Strength of argument** | Weak statements and claims; simple analysis of existing theories | Arguments are convincing and integrate relevant theories, concepts and constructs | Arguments are compelling and well-integrated with current literature. Conclusions are supported by findings or reasoning |
| **Theoretical bases** | Little information or superficial use about the relevant literature and/or theories | Awareness of major theories in the field; exhibits well-supported arguments | Excellent analysis and review of relevant theories; critical evaluation of the literature |
| **Methodological rigor** | Inadequate application of methods; lack of descriptions about data analysis or collection | Methodology used is justifiable to research question; limitations are not completely addressed | Methodology is appropriate for research question; limitations are addressed; excellent implementation |

Source: Adapted from Ramos (2009)

To assist in this process, a spread sheet was developed to record all required information from each paper. It helped to better analyse the papers for the final selection, besides being a useful database for future re-analysis and research. Additionally, this systematic literature review was updated to include papers from 2013-2014. As a result, 18 papers came out but after all the processes only three were therefore selected. At the end, a total of 36 journal articles were selected from this process to help answer the three review questions proposed. All of them are presented in Table 14.

**Table 14.** Papers selected from the systematic review process

| Authors | RvQ1 | RvQ2 | RvQ3 | Conceptual | Empirical | General Topic |
|---|---|---|---|---|---|---|
| Zsidisin et al. (2000) | | | X | | X | Purchasing organisations and risk |
| Sheffi (2001) | X | | | X | | Resilience in the supply chain and terrorist attack |
| Zsidisin (2003) | | | X | | X | Supply risk |
| Christopher and Lee (2004) | X | X | X | X | | Supply chain risk and confidence |
| Christopher and Peck (2004) | X | X | X | X | | Resilient supply chain |
| Zsidisin et al. (2004) | | | X | | X | Supply risk assessment and purchasing |
| Blackhurst et al. (2005) | X | X | X | | X | Supply chain disruption |
| Sheffi and Rice (2005) | X | X | X | | X | Resilient supply chain |
| Zsidisin et al. (2005) | | | X | | | Business continuity, procurement and supply chain |
| Faisal et al. (2006) | X | | | X | | Supply chain risk mitigation and enablers |
| Tang (2006a) | X | | X | X | | Supply chain risk management |
| Tang (2006b) | X | | X | X | | Robust strategies and disruptions |
| González-Benito (2007) | | X | X | | X | Purchasing and business performance |
| Paulraj and Chen (2007) | X | X | X | | X | Uncertainty and strategic supply chain |
| Lee et al (2009) | | X | X | | X | Supply alliance and enviroment uncertainty |
| Ponomarov and Holcomb (2009) | X | | | X | | Resilient supply chain |
| Stecke and Kumar (2009) | X | | | X | | Supply chain disruptions and strategies |
| Svahn and Westerlund (2009) | | | X | X | | Purchasing strategies and supply relationship |
| Pettit et al (2010) | X | | X | | X | Resilient supply chain |
| Colicchia et al (2010) | X | | X | | X | Resilient supply chain and global sourcing |
| Yang and Yang (2010) | X | | | X | | Postponement and supply chain risk |
| Tachizawa and Gimenez (2010) | X | X | | | X | Supply flexibility strategies |
| Zsidisin and Wagner (2010) | X | | X | | X | Supply chain resiliency and perceptions |
| Blackhurst et al. (2011) | X | | X | | X | Global supply resiliency |
| Christopher and Holweg (2011) | X | | X | | X | Supply chain in the turbulence era |
| Christopher et al. (2011) | X | X | X | | X | Global sourcing risk |
| Jüttner and Maklan (2011) | X | X | | | X | Supply chain resilience, risk and vulnerability |
| Yi et al. (2011) | X | X | | | X | Supply chain flexibility and uncertainty environment |
| Carvalho et al. (2012a) | X | X | X | X | | Agile and resilience |
| Carvalho et al. (2012b) | X | | | X | X | Resilient supply chain and simulation |
| Chiang et al. (2012) | X | X | | | X | Strategic sourcing, flexibility and supply chain agility |
| Simangunsong et al. (2012) | X | X | | X | | Supply chain uncertainty |
| Spiegler et al. (2012) | X | | | X | | Resilient supply chain and control engineering |
| Azevedo et al. (2013) | X | X | X | | X | Ecosilient index - green and resilient concepts |
| Johnson et al. (2013) | X | | | X | | Supply chain resilience and social capital |
| Scholten et al. (2014) | X | | X | | X | Mitigation processes to build supply chain resilience |

Note: RvQ1 = Review Question 1; RvQ2 = Review Question 2; RvQ3 = Review Question 3

A summary of all these steps and results are illustrated in Figure 17. According to Pilbeam et al. (2012), a number of alternative approaches can be used to systematically analyse and synthesise the literature review. The data is then analysed using the content analysis based literature review discussed by Seuring and Gold (2012). According to them, the reason for approaching this method of analysis is that the "content analysis offers one sound methodological frame for conducting rigorous, systematic and reproducible literature reviews" (p.545). Following this, the codes were created by reading and extracting possible enablers and barriers responsible for creating resilience capability from the literature, and also implications of those on the Procurement activities, which resulted in the intra- and inter-organisational issues in the end. A qualitative software (QDA Miner) was used to support the extraction, organisation and analyses of the data.

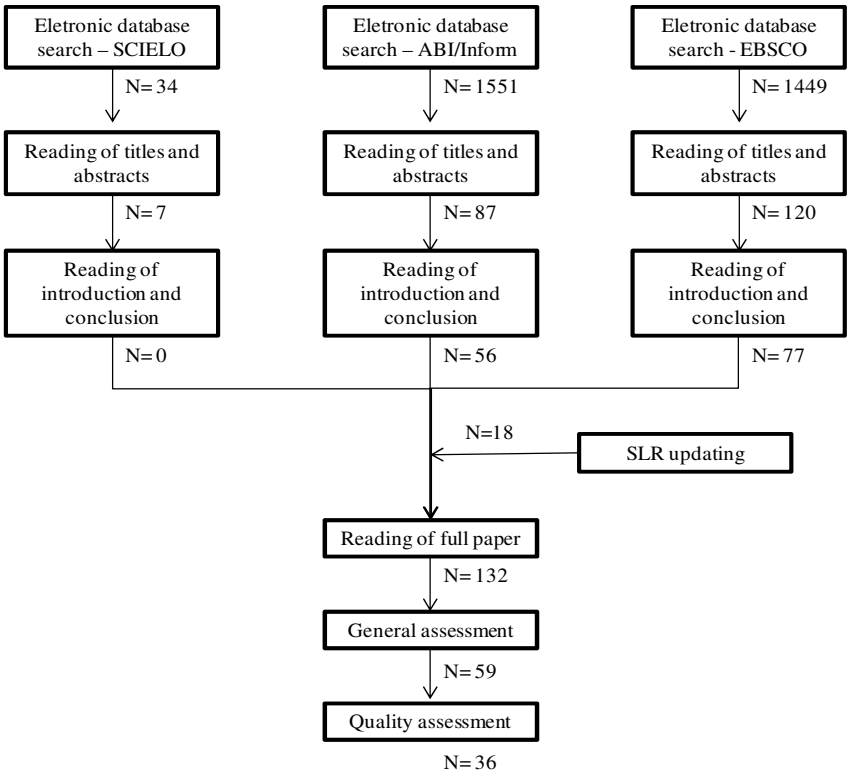


**Figure 17.** Summary of the systematic literature review process
Source: created by the author

**Stage 3 - Reporting and Dissemination**

The final stage is the presentation of the findings and subsequent analysis. Thus, the content correspond to the answers of the Review Questions (RvQ's) previously proposed, which covers the barriers and enablers to creating supply chain resilience, followed by a discussion regarding their implications on Procurement activities. Based on that, intra and inter-organisational issues are highlighted which will be validated in the future through empirical research. In the end, a summary will be drawn by showing some interesting points of the literature which are worth highlighting.

## 3.2 Exploring the Review Questions

***RvQ1: What are the barriers and enablers in creating supply chain resilience?***

According to the previous discussion, there are a number of disturbances which might influence specific nodes along the supply chains. Although there are risks that cannot be avoided or forecasted, there are also factors which may hamper the resilience building in the supply chain. In this study, these factors are named "barriers". Examples of these barriers are normally found in the literature related to unsuccessful cases. Table 15 shows the main possible barriers identified in the literature.

**Table 15.** Barriers identified in the literature

| Barriers | What are the barriers to supply chain resilience? | Authors |
|---|---|---|
| **Complexity** | The great numbers of interconnections in a supply chain, the great complex supply chains become. Thus, it can hamper to visualise critical nodes and consequently to make decisions and react quickly. | Stecke and Kumar (2009); Pettit et al. (2010); Zsidisin and Wagner (2010); Yang and Yang (2010); Christopher et al. (2011); Yin et al. (2011); Spiegler et al. (2012); Johnson et al. (2013) |
| **Financial weakness** | By choosing a supplier which is prone to financial instabilities or financial failures, it can become difficult to develop resilience considering that is a costly strategy. | Zsidisin et al. (2000); Pettit et al (2010); Christopher et al. (2011); Simangunsong et al. (2012). |
| **Lack of capacity** | This is also considered one of the main barriers due to the inability to create extra resources in order to cover periods of scarcity cause by unexpected disturbances. | Zsidisin et al. (2000); Stecke and Kumar (2009); Zsidisin and Wagner (2010); Simangunsong et al. (2012); Azevedo et al. (2013b); Johnson et al. (2013); Scholten et al. (2014) |
| **Lack of collaboration** | The lack of managers or employees' willingness to help each other to achieve a common aim (in this case, overcoming disruptions) can be considered a barrier to develop resilience. | Jüttner and Maklan (2011); Johnson et al. (2013); Scholten et al. (2014) |
| **Lack of coordination & control** | The inability of companies to coordinate and control their processes may be harmful to achieve alignment between supply and demand. | Blackhurst et al. (2005); Zsidisin et al. (2005); Colicchia et al. (2010); Tachizawa and Gimenez (2010); Yin et al. (2011); Simangunsong et al. (2012); Azevedo et al. (2013b) |
| **Lack of information sharing** | By no (or rare) information sharing among companies or among employees is quite difficult to achieve any agreement about effective actions to cope with disruptions. | Christopher and Peck (2004); Blackhurst et al. (2005); Zsidisin and Wagner (2010); Tachizawa and Gimenez (2010) |
| **Lack of integration** | Without a good team work, finding solutions to major or even simple impacts may take a long time. | Tang (2006a); Johnson et al. (2013) |
| **Lack of flexibility** | It is considered one of the main barriers due to the lack of companies' ability and/or capacity to manufacture in order to delivery on time. | Zsidisin et al. (2000); Christopher and Lee (2004); Christopher and Peck (2004); Stecke and Kumar (2009); Colicchia et al. (2010); Zsidisin and Wagner (2010); Christopher and Holweg (2011); Azevedo et al. (2013b); Johnson et al. (2013); Scholten et al. (2014) |
| **Lack of knowledge** | This barrier is characterized by the lack of manager's understanding about the entire supply chain and also the consequences of possible risks and impacts. | Chirstopher and Peck (2004); Rice and Sheffi (2005); Stecke and Kumar (2009); Yin et al. (2011); Simangunsong et al. (2012) |
| **Lack of visibility** | With a blurry sight of what is the right demand or right supply, it becomes difficult to make strategic decisions in case of disruption or even to manage the daily routine. | Christopher and Peck (2004), Christopher and Lee (2004), Zsidisin et al. (2005); Tachizawa and Gimenez (2010); Azevedo et al. (2013b); Johnson et al. (2013); Scholten et al. (2014) |
| **Lack of trust** | If there is no trust among members of the supply chain, it can hamper the information sharing and collaboration which may block to creating resilience. | Chirstopher and Lee (2004); Faisal et al (2006); Jüttner and Maklan (2011); Johnson et al. (2013) |
| **Long lead-times** | It is a barrier in terms of the company's inability to quickly react due to internal problems (e.g. complex process). | Christopher and Peck (2004); Tang (2006b); Azevedo et al. (2013b) |
| **Long distance** | It can be considered barriers owing to the inability to deliver promptly or to response quickly in case of emergency because of the long distance between companies. | Christopher and Peck (2004); Stecke and Kumar (2009); Zsidisin and Wagner (2010) |

It is noteworthy that these barriers are not referenced in the literature in a clear and separated way; on the contrary, they are very interrelated. These interconnections can be seen through Figure 18 which illustrates the connections among barriers identified in papers, in a 2D map created by QDA Miner software. This figure was developed by means of the cluster analyses followed by coding co-occurrences of the barriers highlighted in this study. All these tools are provided by the software.

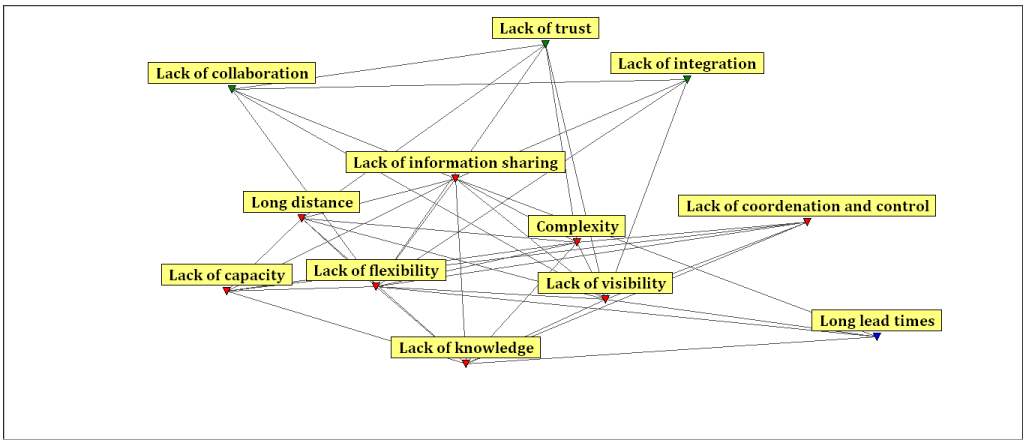


**Figure 18.** Interconnections among barriers to creating supply chain resilience
Source: created by the author by means of the contend analyses in QDA Miner

It is notable that how these barriers can impact the daily supply chain management. In case of disruption, these points might increasingly hamper the reaction and also effective decision making. In order to enable the development of resilience within the company and consequently along its supply chain, facilitators are listed in Table 16. These facilitators can help companies to be responsive and bounce back from any disturbance. In this study, these factors are named "enablers". As much as the barriers, enablers are discussed in the literature as complementary factors to achieve supply chain resilience. Similar to Figure 18, Figure 19 also represents the interconnections among those.

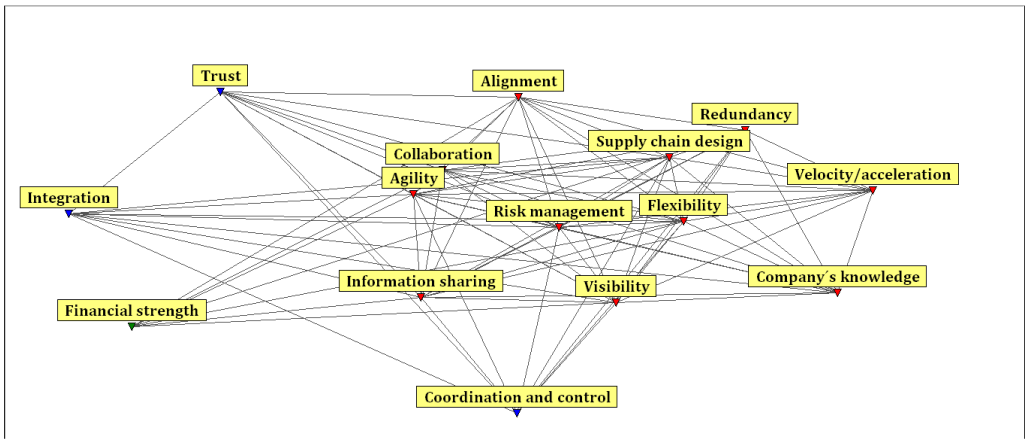


**Figure 19.** Interconnections among enablers to creating supply chain resilience
Source: created by the author by means of the contend analyses with QDA Miner

**Table 16.** Enablers identified in the literature

| Enablers | What are the enablers to supply chain resilience? | Authors |
|---|---|---|
| **Agility** | Agility allows companies to quickly react to unpredictable events, which is clearly considered a distinct advantage in a current uncertain environment. | Christopher and Peck (2004); Christopher and Lee (2004); Lee (2004); Ponomarov and Holcomb (2009); Christopher et al. (2011); Jüttner and Maklan (2011); Carvalho et al. (2012a); Chiang et al. (2012); Scholten et al. (2014) |
| **Alignment** | Synchronisation of the variables and incentive alignment as two of the architectural elements of supply chain collaboration are essential for effective system-level disruption responses. | Lee (2004); Faisal et al (2006); Jüttner and Maklan (2011) |
| **Collaboration** | Collaborative working among sourcing parties or among employees is an enabler due to its capability to exchange information and willingness to help each other. By developing it, the supply chains tend to be more responsive. | Sheffi (2001); Christopher and Lee (2004); Christopher and Peck (2004); Faisal et al (2006); Pettit et al (2010); Christopher et al. (2011); Jüttner and Maklan (2011); Carvalho et al. (2012a); Simangunsong et al. (2012); Spiegler et al. (2012); Azevedo et al. (2013b); Johnson et al. (2013); Scholten et al. (2014) |
| **Trust** | Reliability among companies along the supply chain is a key enabler to achieve collaboration, visibility, information sharing and risk mitigation, for example. | Christopher and Lee (2004); Christopher et al. (2011); Chiang et al. (2012); Johnson et al. (2013) |
| **Coordination & Control** | Companies need to be capable of coordinating and controlling their own processes and flows in order to better manage the resources along their supply chains, especially in case of disruptions. | Christopher and Lee (2004); Sheffi and Rice (2005); Ponomarov and Holcomb (2009); Stecke and Kumar (2009); Colicchia et al. (2010); Tachizawa and Gimenez (2010); Yang and Yang (2010); Blackhurst et al. (2011); Yin et al. (2011); Azevedo et al. (2013b) |
| **Company's Knowledge** | Companies which have a wide knowledge about the end-to-end flows of their products are able to make decisions in a more conscientious way, besides backing up knowledge from previous experiences. | Sheffi (2001); Christopher and Peck (2004); Zsidisin et al. (2005); Faisal et al (2006); Ponomarov and Holcomb (2009); Colicchia et al. (2010); Jüttner and Maklan (2011); Scholten et al. (2014) |
| **Flexibility** | Flexibility can also be considered a capability of companies to be responsive in this current volatile market. Flexible products, processes and transportation, for instance, provide a wider range of options for managers replace the interrupted flow, and consequently take a more responsive action. | Christopher and Peck (2004); Sheffi and Rice (2005); Tang (2006a); Tang (2006b); Ponomarov and Holcomb (2009); Stecke and Kumar (2009); Colicchia et al. (2010); Pettit et al (2010); Zsidisin and Wagner (2010); Tachizawa and Gimenez (2010); Yang and Yang (2010); Christopher and Holweg (2011); Christopher et al. (2011); Jüttner and Maklan (2011); Yin et al. (2011); Carvalho et al. (2012a); Carvalho et al. (2012b); Chiang et al. (2012); Simangunsong et al. (2012); Azevedo et al. (2013b); Johnson et al. (2013) |
| **Financial Strength** | Capacity to absorb fluctuations in cash flow and support the creation of resilience, which is known as a costly capability by creating redundancy and flexibility, for instance. | Zsidisin et al. (2000); Pettit et al (2010); Simangunsong et al. (2012) |

**Table 16.** Enablers identified in the literature (continuation)

| | | |
|---|---|---|
| **Information Sharing** | Information sharing is also one of the main enabler to achieve resilience due to ground the base for enhancing visibility, coordination and alignment. | Sheffi (2001); Christopher and Lee (2004); Christopher and Peck (2004); Blackhurst et al. (2005); Faisal et al (2006); Stecke and Kumar (2009); Blackhurst et al. (2011); Carvalho et al (2012b); Chiang et al. (2012); Simangunsong et al. (2012) |
| **Integration** | Integration seeks to develop a good relationship among business functions, as well as demand and supply side, which has the effect of increasing organisation performances by increasing information sharing. | Zsidisin et al. (2005); Ponomarov and Holcomb (2009); Tachizawa and Gimenez (2010); Chiang et al. (2012); Johnson et al. (2013) |
| **Redundancy** | Having extra capacity options, for example inventory or suppliers can make companies more resilient in terms of being able to change quickly the normal direction of the flows. | Christopher and Peck (2004); Sheffi and Rice (2005); Stecke and Kumar (2009); Pettit et al (2010); Yang and Yang (2010); Zsidisin and Wagner (2010); Jüttner and Maklan (2011); Carvalho et al (2012b); Simangunsong et al. (2012); Scholten et al. (2014) |
| **Risk Management** | Risk sharing enables loss dispersion, besides being a widespread approach for supply chain risk mitigation. | Sheffi (2001); Faisal et al (2006); Ponomarov and Holcomb (2009); Christopher et al. (2011); Jüttner and Maklan (2011); Azevedo et al. (2013b); Scholten et al. (2014) |
| **Supply Chain Design** | Re-design the supply chain is one of the enablers that make the supply chain more responsive by focusing on location strategies. It is said by authors that if this enabler is performed in a real time, it is possible to mitigate risks and consequences of supply chain disruptions or even to avoid looming disruptive events. | Christopher and Peck (2004); Blackhurst et al. (2005); Ponomarov and Holcomb (2009); Stecke and Kumar (2009); Jüttner and Maklan (2011); Christopher et al. (2011); Christopher and Holweg (2011); Carvalho et al. (2012b); Spiegler et al. (2012); Scholten et al. (2014) |
| **Velocity and Acceleration** | According to physical, velocity is defined as distance over time, and acceleration as velocity over time. These two factor are very important to create quick reactions in a disruptive supply chain and their closely linked to flexibility and agility. | Christopher and Peck (2004); Jüttner and Maklan (2011); Johnson et al. (2013); Scholten et al. (2014) |
| **Visibility** | Being able to visualize both demand and supply side is one of the main enabler that allow managers to make decision in a safe manner and also visualize possible risks and ways to cope with them. In addition, by achieving this enabler, it is easier to manage resources and change strategies in case of disruptions. | Sheffi (2001); Christopher and Peck (2004); Carvalho et al (2012a); Christopher and Lee (2004); Blackhurst et al. (2005); Ponomarov and Holcomb (2009); Stecke and Kumar (2009); Colicchia et al. (2010); Pettit et al (2010); Blackhurst et al. (2011); Jüttner and Maklan (2011); Azevedo et al. (2013); Johnson et al. (2013); Scholten et al. (2014) |

By and large, enablers and barriers are contradictory from each other. Thus, authors discuss them in several different ways and from different perspectives. Complexity, for instance is the most referenced and discussed barrier by authors, where it is characterized by short product cycles, good quality and cost reduction. In addition, product and process complexity are also mentioned. In this context, Stecke and Kumar (2009) affirm that product complexity increases process complexity, and both are able to make the supply chain more vulnerable. High degree of complexity can create risk and make the impact less predictable. Furthermore, as previously mentioned, there are critical events impossible to forecast, and in case of disturbance, this complexity can make the supply chain even less agile (Yang and Yang, 2010).

To deal with complexity in the network, Pettit et al. (2010) state that there is a need for collaboration among functions as well as inter-organisational alignment among members of the supply chain. On the other hand, only Yang and Yang (2010) highlight the opposite idea (complexity reduction) as an enabler. They affirm that by reducing complexity, companies are able to streamline their processes, eliminate waste and ultimately improve the overall performance; so that it can be considered a strategic goal for operations. Nevertheless, the current trend of the growing market has shown the inherent difficulty in reducing complexity. Recognising that, companies no longer invest all their resources in verticalization, which would make it difficult to satisfy customers by keeping high quality, low cost and short product life.

One of the options to deal with complexity is resilience. Thus, when the matter is resilience, the main common characteristics highlighted in the literature are redundancy and flexibility. Redundancy, second major capability cited by creating resilience, is defined by Sheffi and Rice (2005, p.44) as a "familiar concept of keeping some resources in reserve to be used in case of a disruption". Practical examples of this factor are referenced such as safety stock, multiple suppliers (regardless of the cost) and low capacity utilization. Although it can be considered a costly strategy, it does represent a safe way to cope with uncertainties and disruptions (Simangunsong et al., 2012). However, redundancy can also increase the supply chain complexity, which means in some cases holding more inventories along the nodes and, consequently, creating problems of visibility (Yang and Yang, 2010). Therefore, Zsidisin and Wagner (2010) affirm that redundancy is a less powerful practice to reduce risk of disruptions.

Flexibility, on the other hand, is defined by Peck (2005) as the ability to bend easily without breaking. In this sense, flexibility is considered to be a great strategy for companies

to deal with complexity by developing their supply chains in order to adapt effectively or rapidly respond to any unexpected environmental changes (Tachizawa and Gimenez, 2010; Yi et al., 2011; Jüttner and Maklan, 2011; Johnson et al., 2013). Authors discuss this capability in terms of product (Chiang et al., 2012; Khan et al., 2012; Simangunsong et al., 2012), processes (Rice and Caniato, 2003; Stecke and Kumar, 2009; Chiang et al., 2012), transportation (Tang, 2006a,b; Stecke and Kumar, 2009; Spiegler et al., 2012), sourcing (Pettit et al., 2010; Yi et al., 2011; Carvalho et al., 2012a, Chiang et al., 2012), volume (Chiang et al., 2012; Simangunsong et al., 2012) or, even in a general way (e.g. Sheffi and Rice, 2005; Ponomarov and Holcomb, 2009; Zsidisin and Wagner, 2010; Christopher and Holweg, 2011; Zhang et al., 2011; Azevedo et al., 2013b; Johnson et al., 2013). By effectively managing these different types of flexibilities, it is possible to reassure that being flexible also means the ability to recover quickly from disruptions (Carvalho et al., 2012a).

Due to these flexible characteristics, flexibility is a concept implicit in the resilience thinking which is also grouped with others factors. For instance, flexibility is stated by Chiang et al. (2012) as a significant factor to develop agility. Christopher and Peck (2004) also relate flexibility to agility,, while Yi *et al.* (2011) include collaboration and integration, and Colicchia et al. (2010) embrace risk management. Nonetheless, Jüttner and Maklan (2011) regard redundancy as a component of flexibility, considering that it might be a way of having extra options (for example, extra inventory or suppliers). Furthermore, they include collaboration and trust to improve flexibility. As a result, it is possible to conclude that building flexibility is one of the powerful enablers to create resilience in this turbulent era (Christopher and Holweg, 2011).

Therefore, although redundancy and flexibility are fundamental enablers in creating resilience to provide options for companies to quickly recover from disruptions, flexibility seems to be a more reasonable way to achieve competitive advantage in day-to-day operations, whilst redundancy requires investment in extra inventories (Sheffi and Rice, 2005; Stecke and Kumar, 2009; Scholten et al., 2014). Moreover, redundancy has been considered a flexible characteristic in some cases (Jüttner and Maklan, 2011). But it is vital to highlight that both strategies create cost, so that there is no need to create them in all cases (Yang and Yang, 2010). Being costly strategies, both enablers are underpinning in the financial strength of the company which will enable the development in a right manner (Zsidisin et al., 2000; Simangunsong et al., 2012).

Aiming to achieve well-managed flexibility and redundancy to deal with complexity, companies should create agility in their internal processes as well as in their supply chains.

Considered one of the formative elements of resilience by Ponomarov and Holcomb (2009), agility is characterized as the ability of companies to rapidly respond to unpredictable changes in demand or supply (Christopher and Peck, 2004; Christopher et al. 2011) and, hence, being able to reduce the lead-time (Lee, 2004). However, in order to obtain such condition, agility is supported by other enablers, such as velocity & acceleration (Christopher and Peck, 2004; Jüttner and Maklan, 2011; Carvalho et al., 2012; Scholten et al., 2014), information sharing (Christopher and Peck; Ponomarov and Holcomb, 2009; Chiang et al., 2012), coordination (Christopher and Lee, 2004; Azevedo et al., 2013b), visibility (Christopher and Peck, 2004; Jüttner and Maklan, 2011; Christopher et al., 2011; Johnson et al., 2013), alignment (Faisal et al., 2006; Chiang et al., 2012), collaboration (Pettit et al., 2010; Christopher et al., 2011) and integration (Tachizawa and Gimenez, 2010, Yi et al., 2011). All these enablers together are included in the agile supply chain approach, which is considered a big challenge for companies that pursue competitiveness and business continuity.

Other enabler implicit in the resilience approach is risk management. Ponomarov and Holcomb (2009) allege that risk assessment and risk sharing among supply chain nodes help to mitigate risk. In addition to this enabler, it is also relevant to create a body of knowledge which will support managers to deal with risk and possible incidents. In this regard, Zsidisin et al. (2005) states the importance of firms learning from their own experiences. Thus, companies can increase their understanding about specific sources of risk, and hence helping managers to develop skills in order to better design a resilient supply chain (Colicchia et al., 2010).

The last resilient enabler pointed out in the literature is called by supply chain design, supply chain (re)engineering or even supply chain structure. Christopher and Peck (2004, p.13) assert that "resilience should be designed in". However, to design it in is imperative to understand the structure of the wider supply chain. Thus it is possible to redesign it in order to build visibility and flexibility (Christopher et al., 2011) to balance multiple tiers at upstream (Carvalho et al., 2012b) and downstream, and also to reduce risk (Spiegler et al., 2012). Through this restructure, supply chain can be quickly reconfigured in a real time by aiming to mitigate effects from disruptions (Blackhurst et al., 2005; Scholten et al., 2014).

Recognizing therefore the possible enablers and barriers above discussed, authors explore and highlight their influences within the business or along the supply chain. Generally, all the enablers have the capability to make supply chains more responsive and, consequently, make the companies more competitive, while the barriers cause opposite effect.

Although enablers and barriers uses the same principle in opposite ways, they are also interconnected among their own group. Thus, once one enabler/barrier is strengthened or weakened, others will also be influenced by that. Figure 20 illustrates the interconnections among enablers (given that barriers represent the opposite idea). It is therefore observed that once the capability of each enabler at the left side of the figure is decreased, for instance financial strength and trust, the rest of the enablers will be influenced, and invariably become barriers. On the other hand, if they are increased, they become enablers and hence helping to create supply chain resilience.

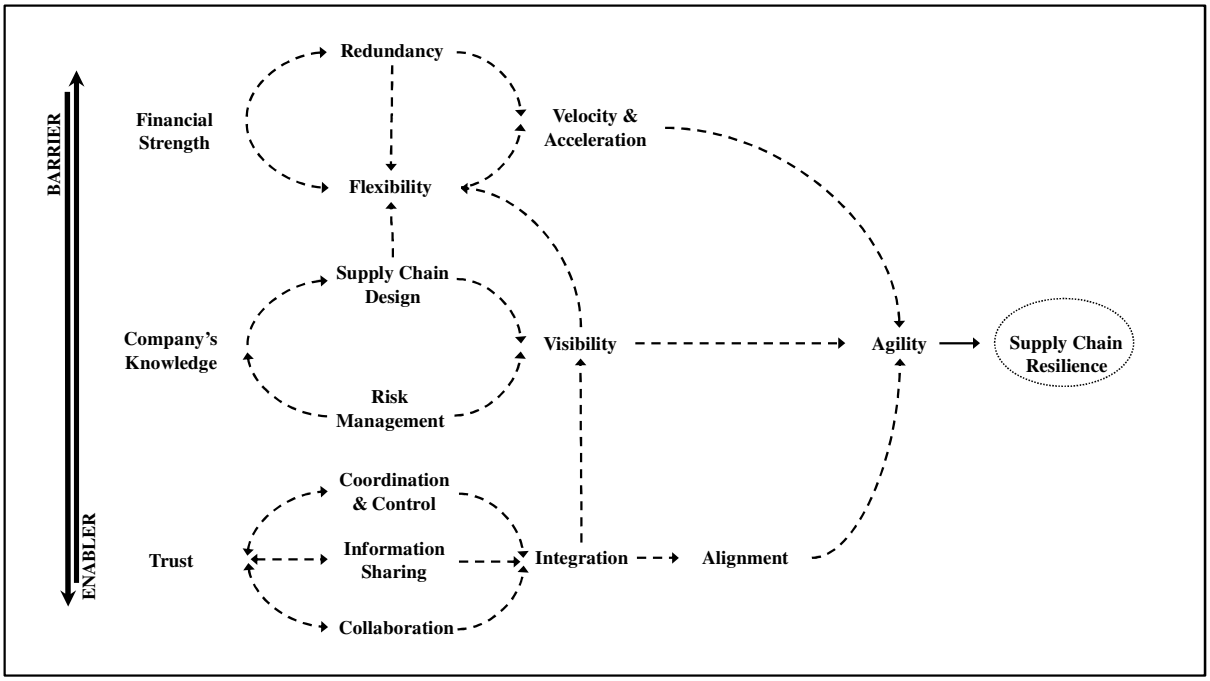


**Figure 20.** Interconnections among a set of enablers to creating supply chain resilience
Source: created by the author

The interconnections proposed here were developed based on the understanding of authors' discussion about these capabilities in the existent literature. However, these connections can be rearranged depending on the context (environmental, economic or social) or perspective that the study might be analysed. Further research could test these relationships by applying techniques to reassure the connections. In this sense, Faisal et al. (2006) applied the Interpretive Structural Modelling with the aim to justify the connections among enablers from supply chain risk management, whilst Yenradee and Dangton (2000) used FISM (Fuzzy Interpretative Structural Modelling).

Furthermore, the key enablers discussed here can be concentrated in three basic enablers as shown in Figure 20 - financial strength, company's knowledge, and trust. To some

extend it matches Christopher and Peck (2004)'s framework in which they established four key elements: company's knowledge, collaboration, risk management and supply chain design. All these elements are included in the present framework, however supply chain design and risk management were considered sub-elements of the company's knowledge while financial strength was added as an important element to support flexibility and redundancy, which normally make this strategy costly.

***RvQ2: In particular, what are the implications of these enablers and barriers on the Procurement activities within the business?***

According to the findings of the review questions 1 (RvQ 1), it is known that those enablers as well as barriers collaborate to facilitate or hamper the creation of supply chain resilience. However to what extent are they to make significant implications on Procurement activities? Regarding this question, implications of those identified barriers and enablers on Procurement activities are therefore discussed here.

Considering the enablers highlighted previously, flexibility is one of the most often discussed capabilities in the literature. Its development in a company's strategy provides a variety of options in decision making for Procurement managers. In this regard, authors point out many ways to develop flexibility in company's strategy, such as sourcing flexibility (*e.g.* Zeng, 2000; Tang, 2006a,b; Pettit et al., 2010; Chiang et al., 2012; Simangunsong et al., 2012; Azevedo et al., 2013b), product flexibility (*e.g.* Chiang et al., 2012; Simangunsong et al., 2012), process flexibility (*e.g.* Rice and Caniato, 2003; Chiang et al., 2012; Simangunsong et al., 2012), and transportation flexibility (*e.g.* Tang, 2006a,b; Spiegler et al., 2012).

Regarding sourcing flexibility, Yi et al. (2011) explain that Procurement normally employs this strategy to maintain supplier availability in order to support the company with good quality materials in case of needs. In this sense, Jüttner and Maklan (2011) assert that sourcing flexibility can be considered a key enabler to resilience owing to the ability to shift cost-effective supply sources by choosing the cheapest source or strengthening the companies' bargaining power in price negotiations with their suppliers. In addition, Carvalho et al. (2012b) highlight its benefits in terms of cost reduction, critical paths and lead-times. They propose that supplier flexibility implies in agility and resilience through a conceptual model, which increases the responsiveness of the company in critical times.

On the other hand, the lack of this capability can cause considerable adverse effects to companies. After clearly stating that flexibility impacts supply and Procurement, Sheffi and

Rice (2005) report the unsuccessful case of Land Rover to exemplify how flexibility in sourcing can be a powerful tool to avoid opportunism from suppliers. For this reason, these authors as well as others (*e.g.* Zsidisin et al., 2000; Christopher and Lee, 2004; Stecke and Kumar, 2009; Colicchia et al., 2010; Zsidisin and Wagner, 2010; Christopher and Holweg, 2011; Scholten et al., 2014) affirm that relying on a single supplier may be a risky option. Therefore, the lack of flexibility is considered one of the key barriers that hamper the normal flow of product manufacturing and delivery in some occasions. Nevertheless, Christopher and Peck (2004) and Sheffi and Rice (2005) also state that despite this risk, it may be a good option to improve quality and cost of the final products by investing in a few supplier relationships.

Regarding supplier relationship, Christopher (2000) and Christopher and Jüttner (2000) affirm that different structural interfaces between buyer and supplier may increase the level of connectivity between both parts. As a result, agility is enhanced by reducing the responsibility of Procurement to mediate the flow of information between buyer and supplier, and hence increase the information sharing among other functions. Because of that Christopher (2000) states that most of the agile companies normally have a small supplier base, prioritising strong relationships and more information sharing to increase the level of connectivity. Considering the trade-off of having a single or multiple sourcing and in support of Simangunsong et al. (2012), it is recognised here that employing a balance source of suppliers would be a reasonable choice to create resilience in the supply chain. This would allow companies to skip out the risk of relying on only one supplier in having other suppliers if the need arises. It also helps to keep reasonable material quality, product cost and reliable delivery.

Following this line of thought, one of the criteria to select suppliers is their financial situation. Thus, Zsidisin et al. (2000, p.188) state that "if a supplier is not profitable, it may not stay in business for very long", recognising that it can be a risk for the buyer company. For this reason, financial strength is highlighted here as a resilient enabler which impacts Procurement activities. Furthermore, collaboration is also found to be a good way to achieve effectiveness of the supplier's management team, while velocity and acceleration is normally related to suppliers' location (Tang, 2006a; Zsidisin and Wagner, 2010).

Flexibility is not the only capability that has an impact on the sourcing strategy. Internal integration and information sharing may also be expected to be positively linked to supplier responsiveness. Agility is critical regarding the global sourcing process because it is able to reduce response time to supply disruptions (Christopher et al., 2011; Scholten et al.,

2014), whereas redundancy can also enhance response time but may influence the inventory cost (Carvalho et al., 2012a). In addition, Christopher et al. (2011) say that enhancing collaboration between buyers and suppliers may significantly help mitigate risk, which is one of the Procurement activities, especially when dealing with global sourcing. Otherwise, the lack of confidence discussed by Christopher and Lee (2004) would result in poor collaboration and visibility at the upstream of the supply chain, which impacts on Procurement in terms of inaccurate forecasts, inventory cost and purchase cost. All these points are therefore relevant for supplier development.

In order to support sourcing strategies, companies should know how to manage their inventories wisely. Considering the uncertain environment in which companies are currently working in, authors and practitioners have emphasised the need to develop preventative actions. Thus, the manner of organising and managing inventory has been based on this concern. Sheffi (2001) proposes two ways of employing warehouse: centralised and dispersed. The first enables companies to be responsive by affording extra capacity in one strategic area which aims to supply the deficits in others. Although this author states that reducing the number of warehouses and inventories has been a trend in the current uncertain scenario, this decision may be a risky strategy; recognising that in case of local incidents no other option will be available to supply the emergency needs (*e.g.* Stecke and Kumar, 2009; Christopher and Holweg, 2011). Nonetheless, it is important to highlight that despite the inventory having a great strategy to improve agility and responsiveness; it gives time to companies to come up with solutions after disruptions. It does not reduce any chance of undesirable incidents (Zsidisin et al., 2000; Scholten et al., 2014).

In this case, Zsidisin and Wagner (2010) and Carvalho et al. (2012a) expose that safety stock can be a good solution to emergency situations, a subject which Sheffi (2001) had previously discussed while considering the difference between emergency stock and safety stock. Normally, safety stock is used to cover a day-to-day demand fluctuation which is the opposite aim of emergency stock. The latter tries to keep redundant stock in order to mitigate effects from extreme disruptions. Sheffi (2005) exemplifies this point by reporting the case of Pentagon and its key supplier - Johnson & Johnson (J&J). As a major provider of medical supplies, J&J has uncertainty demands due to the high variability of cause diseases, such as flu, fever, cold and many other outbreak diseases. Because of that, Pentagon has to be sure that J&J will be able to cover any request at any time. To correspond to all the requirements, J&J keeps an extra stock exclusively to Pentagon which must not be used to cover daily demand fluctuations. In this way, Stecke and Kumar (2009) point out the

advantage of creating redundancy for critical components which should be maintained with limited investment.

The current network has been characterised by its complexity, in which numerous flows across different global companies may impact the reliability of deliveries and the customer satisfaction. In this context, Zsidisin and Wagner (2010) state that long supply chains may create problems that arise from political instability in certain regions of the world, greater uncertainty transportation and complexity for example. Furthermore, Christopher et al. (2011) asserts that it may increase risk along the supply chains from a variety of reasons such as disruptions, bankruptcies and breakdowns. Thus, once a disruption hits one member of the supply chain, the effects will be transferred to the interconnected members in the same network. Therefore, increasing network complexity can enhance vulnerability and reduce agility along the supply chains (Yang and Yang, 2010).

For this reason, collaboration among functions, as well as inter-organisational alignment, is required among supply chain members (Pettit et al. 2010). Moreover, visibility and alignment should be improved so that Procurement may not only quickly recognise disruptions occurring at upstream of the supply chain, but also to monitor inventories, demand and supply conditions in order to manage purchasing schedules (Christopher and Peck, 2004; Sheffi and Rice, 2005; Johnson et al., 2013). In this regard, Tang (2006a), Christopher et al. (2011), Blackhurst et al. (2011), Carvalho et al. (2012a) and Scholten et al. (2014) depict that one possible solution to deal with complexity would be the redesing network to increase capabilities like visibility and alignment, and hence mitigate risky situations.

Regarding the growing level of risk faced by companies nowadays, Ponomarov and Holcomb (2009, p.137) assert that "risk assessment and sharing among the members of a supply chain is an essential element of risk mitigation". Also Jüttner and Maklan (2011) state, as a result of their study, that monitoring supply risks has a positive impact on the supply chain visibility. Therefore, risk management seems to be a prominent Procurement activity which intends to closely monitor the contingencies from various risk resources, normally focused on the upstream of the enterprise.

In terms of product, flexibility also enables a rapid change in product design by providing a range of products which will respond effectively in case of an immediate change (Yi et al., 2011). To do so, Procurement has the role of developing purchasing strategies in order to match and fulfil the internal requirements. However, although flexibility seems to be an advantageous way of increasing agility and resilience, a high level of product flexibility

may cause complexity and difficulties to handle all specifications in only one manufacturing plant. For this reason, Stecke and Kumar (2009) and Blackhurst et al. (2011) propose practices such as postponement, mass customisation and centralised inventory management which aims to reduce complexity by creating a modular product. These practices help reduce risk and vulnerability by sharing risk among members of the supply chain.

Flexibility in terms of transportation is also a very well-discussed strategy when the topic is uncertain and unexpected events (Sheffi and Rice, 2005; Tang, 2006a; Stecke and Kumar, 2009; Azevedo et al., 2013b). In this regard, the widespread case of Ford and Chrysler after the 9/11 terrorist attack is a good example. Chrysler, by quickly changing the transportation mode of delivery, could load its delivery in time and without huge losses. Because of this transportation flexibility, Chrysler had a more resilient reaction than Ford (Sheffi, 2005) which bore the loss from five non-working manufacturing plants.

In terms of information sharing, workers' knowledge is a very important capability that companies should record and share (Blackhurst et al., 2011). In addition, technology tools are considered powerful ways of maintaining the information flow among functions and companies, for instance. In support of that, Lee et al. (2009) highlight the positive effect of technological changes in strategic purchasing and supplier alliances. Nix (2001) and Sobhani et al. (2014) still complement by pointing out its value to manage complex purchasing activities and facilitate the integration across a company's board.

In summary, Procurement has been proved to be a key interface function with great capacity to quickly communicate changes in market demand to suppliers (Chiang et al., 2012); it therefore makes big difference in a turbulent environment (Lee et al., 2009). In this context, it is clear that resilient enablers and barriers are closely linked to Procurement activities, which in turn can make a significant contribution to creating supply chain resilience if well-managed. Also, as referred earlier, barriers have the same concept as that of enablers, but used in opposite way. For this reason, this discussion was mostly focused on enablers and their implications on Procurement activities. Table 17 shows an overview of the most often used enablers and how they are related to Procurement activities according to the above discussion.

**Table 17.** Interconnection of Procurement activities and the most often cited enablers

| Key points related to Procurement activities/action/tools | Flexibility | Redundancy | Visibility | Agility | Collaboration | Integration | Information Sharing |
|---|---|---|---|---|---|---|---|
| Supplier base | √ | √ | √ | √ | | | |
| Supplier selection criteria | √ | | | √ | | | √ |
| Supplier relationships | √ | | √ | √ | √ | √ | √ |
| Developing suppliers | √ | | √ | √ | √ | √ | √ |
| Network configuration | √ | √ | √ | √ | | | |
| Transportation modes | √ | | | √ | | | |
| Risk management | | | √ | √ | √ | √ | |
| Knowledge backup/ Lessons learned | | | | | √ | √ | √ |
| Internal communication | | | | | √ | √ | √ |
| Inventory management | √ | √ | | √ | | | |
| Redundance of critical components | | √ | | √ | | | |
| Product flexibility | √ | | | √ | | | |
| Communication tools | | | √ | | | √ | √ |
| Technological methods to discover, recover and redesign the supply chain | | | √ | | | √ | √ |

Source: created by the author

***RvQ3: What are the intra- and inter-organisational issues which must be addressed if Procurement activities are to make a significant contribution to supply chain resilience?***

Generally, it is known that Procurement seeks to ensure that all orders are placed with the right amount, at the right time, and at the right place with the right quality (Zeng, 2000), and resilience is not a state but a dynamic set of conditions within a system (Mitchell and Harris, 2010). Thus, based on what has been exposed and discussed so far about the influence of enablers and barriers into Procurement activities, it is clear that Procurement does make relevant contributions to supply chain resilience.

Table 17 illustrates the connections among enablers to key points related to Procurement activities/actions/tools which are the most discussed points by authors in literature (it is not necessarily including all those highlighted in Figure 19). In addition, company's knowledge, supply chain design and risk management, which were pointed out as enablers previously, were considered here as issues to be addressed to achieve supply chain resilience. Therefore, based on the findings from existing literature and the analysis of the key points within this literature, intra- and inter-organisational issues to creating supply chain resilience from a Procurement perspective are addressed below.

### 3.3 Intra-organisational issues from a Procurement perspective

Table 18 shows possible intra-organisational issues found in the literature which were grouped into four key general points of understanding. A brief explanation from each one of them is presented as follows, considering that they were already introduced in the previous discussion from RvQ 2.

**Table 18.** Intra-organisational issues

| General points | Intra-organisational issues | Authors |
|---|---|---|
| **Knowledge** | Knowledge acquired and backup | Sheffi (2001); Ponomarov and Holcomb (2009); Blackhurst et al. (2011); Juttner and Maklan (2011); Scholten et al. (2014) |
| | Internal communication | Christopher and Peck (2004); Zsidisin et al. (2005); Svahn and Westerlund (2009); Chiang et al. (2012) |
| **Inventory** | Redundancy of critical items | Christopher and Peck (2004); Zsidisin and Wagner (2010); Carvalho et al (2012); Azevedo et al. (2013) |
| | Emergent stock | Sheffi (2001); Stecke and Kumar (2009) |
| **Product** | Product flexibility (design and variety) | Tang (2006a,b); Sheffi and Rice (2005); Stecke and Kumar (2009); Yang and Yang (2010); Blackhurst et al. (2011). |
| **Technology** | Communication tools | Christopher and Lee (2004); Tachizawa and Gimenez (2010) |
| | Technological methods to discover, recover and redesign the supply chain | Sheffi (2001); Blackhurst et al. (2005); Sheffi and Rice (2005); Tang (2006b); Christopher and Holweg (2011); Carvalho et al. (2012b) |

Source: created by the author

#### Knowledge

*- Knowledge acquired and backup*

Recognising that the knowledge built by companies from their experiences throughout the years makes them more prepared and competitive in general, the backup of any information from company's development should be an important data to be kept safe. In this regard, developing and updating this kind of database can support Procurement professionals to manage and monitor risk from previous experiences and hence being more capable of mitigating future risks and creating resilience. From this point of view, Sheffi (2001, p.4) states that "companies cannot afford to maintain redundant employees around “just in case”; companies should ensure that their knowledge is backed up". The same author therefore divides the knowledge's backup in three: company's processes, company's knowledge and company's relationships.

Furthermore, all information recorded by the company can be used to train employees, conduct effective post disruption analysis, understand the total cost of supply chain management (Blackhurst et al., 2011), and closely monitor the contingencies from various risk resources (Jüttner and Maklan, 2011). In this context of knowledge generated from experience, Tang (2006a) portrays the case of companies that held their business in World Trade Centre after 1993 bombing. Because of this incident, 150 out of 350 companies decided to move from that location. In doing so, these companies avoided the unpredictable and more tragic event in their business years later (9/11 terrorist attack).

Therefore "the capacity to learn from past disruptions to develop better preparedness for future events is a principal property of resilience" (Ponomarov and Holcomb, 2009, p.137). In line with this, Scholten et al. (2014) point out that knowledge management is part of the planning process to build supply chain resilience.

*- Internal communication*

As Procurement is a key function responsible for connecting internal customer's needs to supplier's corresponding resources, it should develop a great communication among internal functions as well as the company's suppliers. In this regard, Svahn and Westerlund (2009) point out the importance of internal communication among functions in order to transfer information regarding type of product and lead-time to Procurement, for instance. So that, this function may know exactly what kind of supplier would attend all requirements from internal specifications.

However, if the company has a very rigid organisational structure where functions do not communicate among each other, it can limit the flow of information and hence become a barrier to visibility and resilience, as well (Christopher and Peck, 2004). For this reason, Zsidisin et al. (2005) and Chiang et al. (2012) affirm that by improving the communication between Procurement and other functions, the organisation may reduce cost and lead-time, while enhancing flexibility, quality, and its overall competitiveness. As a result, it can facilitate the organisational agility in response to unexpected events.

**Inventory**

*- Redundancy of critical items*

Inventory is also an important part of the company in which Procurement has a big involvement. By being responsible for balancing day-to-day fluctuations, Procurement normally uses safety stock to manage this unavoidable effect. However, it is asserted by

Christopher and Peck (2004) that safety stock or a "slack" in the inventory can also be a fundamental way to create supply chain resilience. So that, if any unexpected incident happens, the company can overcome that situation easily by holding a minimal extra stock (Zsidisin and Wagner, 2010). Carvalho et al. (2012) therefore complement saying that this strategy allows covering gaps in the delivery of material and hence satisfies customers with in-time delivery.

Although internal stock may be considered a good strategy to create responsiveness through redundancy, it is important to remind what was pointed out by Zsidisin et al. (2000). These authors stressed that despite safety stock is a good strategy to improve agility and responsiveness in case of unforeseen changes, it only affords the company with extra time to think about next actions. Currently, this strategy has been avoided due to the wide application of lean manufacturing system, which has already proved to hamper the agility in response somehow. Therefore, in spite of safety stock goes against the lean approach besides requiring economic investment to keep them, it is a traditional strategy widely applied to companies thus far.

*- Emergent stock*

Differently from daily and minimal safety stock, emergent stock is designated to extreme cases of disruptions and their consequent needs, such as the case of J&J and Pentagon mentioned previously. This strategy must be carefully analysed by companies to check if there is a real need for that; otherwise, keeping it must be a very costly decision. Therefore, paying attention to develop good inventory management helps to quickly react to critical events and, at the same time, gives time to companies sort out solutions (Stecke and Kumar, 2009).

In this context, Sheffi (2001) reports the strategic oil reserves that United States government usually keeps to protect itself from any severe disruption in the flow of oil. If there is a need, small quantity of this reserve is used but replenishment is promptly done to maintain their availability for the primary purpose. Thus, companies that work with critical components should address this issue to keep its survival.

**Product**

*- Product flexibility (design and variety)*

The way products are designed and assembled may be a strategic manner to cope with unpredictability. At first glance, it seems not to be related to Procurement, however reducing

product complexity and, at the same time, providing product flexibility may result in a cost reduction to Procurement in terms of sourcing management. It can also increase flexibility and responsiveness of the processes.

The success from Dell after the earthquake incident in Taiwan is a good example of this context. As product designs and supply chain processes are demand-based, Dell was able to change the configuration of their computers and keep its manufacturing and sales without huge losses; which was the opposite situation of Apple (Sheffi and Rice, 2005; Tang, 2006b). Another well-known example is the Nokia's recovering from Philips' fire plant. The postponement strategy employed by Nokia enabled it to quickly reconfigure its generic mobile with a slightly different component from American and Japanese suppliers. Because of this product flexibility, Nokia could recover from a serious disruption without any significant problem (Tang, 2006a,b; Yang and Yang, 2010). In this sense, it is noticed that the more complex the products' configuration becomes, the more difficult is the recovery from any supply chain disruption (Blackhurst et al., 2011).

**Technology**

*- Communication tools*

Technology is considered a powerful tool to share and spread information nowadays. It can be therefore very useful to manage the increasing number of Procurement activities within and across the company. Tachizawa and Gimenez (2010) affirm that the adoption of technology tools, such as EDI (Electronic Data Interchange), can help to integrate organisational processes. In this sense, having tools to facilitate the communication is a good way to improve responsiveness in times of disruption.

In this regard, Christopher and Lee (2004) reported the example of Benetton that employed EDI system along its supply chain to improve confidence and visibility. It could monitor and manage its outsourced manufacturers, sales agents, retail outlets, transportation carriers and logistics centres by sharing information in a real time. Overall, technology to improve communication can be considered an issue, recognising its importance to identify and respond the demand in the real.

*- Technological ways to discover recover and redesign the supply chain*

With the aim to help companies to overcome disruptions, some specific tools have been created to this proposal. This would be particularly useful for Procurement function since it is the key function that manages suppliers or any problems at upstream of the supply

chain. In this regard, Sheffi and Rice (2005) report the case of UPS after the shutdown of the air hub for United Parcel Service of America due to a severe blizzard in Louisville (January, 1996). After its recovery, which was successful owing to its interchangeable processes, UPS developed its own weather service in order to avoid future disruptions like that. In addition, it is reported by the same authors that this software can work much better than National Weather Service in forecast accuracy.

In the same vein, Tang (2006b) reports the Continental Airlines case after 9/11. He says that even before this critical incident, Continental Airlines worked with Caleb Technologies (technological company) to develop a decision support system which aims at identifying an optimal recovery solution, such as reassign crews quickly to cover open flights and returning them to their original schedules in a cost-effective manner. Because of this system, Continental Airline was able to save approximately US$40 million by itself over a 5-years period from major disruptions. Many other examples can be found in the literature in which different methods or tools were very useful, such as simulation (Christopher and Holweg, 2011; Carvalho et al., 2012b; Azevedo et al. 2013b), bar codes and Low-Earth-Orbiting-Satellite (LEOS) systems (Sheffi, 2001), modelling methodology (Blackhurst et al., 2005); RFID (Tang, 2006b) or shipment visibility systems (Sheffi and Rice, 2005). Using these tools, it is possible to reroute and solve problems of transportation and supply deliveries faster.

### 3.4 Inter-organisational issues from Procurement perspective

Similar to the previous item, inter-organisational issues are presented in Table 19 and are also grouped into four different key general points of understanding. Brief explanation about each of them is presented as follows.

**Strategic Sourcing**

*- Supplier base*

Much has been discussed about the number of suppliers that companies should keep relationships with, and the advantages and disadvantages of each one. In this regard, it is clear that sole supplier can be a source of risk to companies which leave them with no short-term alternative in case of an unforeseen event (Zsidisin et al., 2000). On the other hand, this strategy has also proved to be valuable by being able to reduce cost as well as to improve quality (Christopher and Peck, 2004). Thus, Tang (2006a) asserts that it is better to have a

good and reliable supplier than multiple suppliers with no quality and confidence to share information and experiences.

**Table 19.** Inter-organisational issues

| General points | Inter-organisational issues | Authors |
|---|---|---|
| **Strategic Sourcing** | Supplier base | Zsidisin et al. (2000); Sheffi (2001); Zsidisin (2003); Sheffi and Rice (2005); Svahn and Westerlund (2009); Zsidisin and Wagner (2010); Yang and Yang (2010); Blackhurst et al. (2011); Christopher et al. (2011); Stecke and Kumar (2009); Carvalho et al. (2012a); Simangunsong et al. (2012); Azevedo et al. (2013b) |
| | Criteria for supplier selection | Zsidisin et al. (2000); Sheffi (2001); Zsidisin (2003); Blackhurst et al. (2005); Tang (2006a); Stecke and Kumar (2009); Zsidisin and Wagner (2010); Backhurst et al (2011); Christopher et al. (2011); Carvalho et al. (2012b). |
| | Supplier relationship | Zsidisin et al. (2000); Sheffi (2001); Tang (2006a); Svahn and Westerlund (2009); Yang and Yang (2010); Zsidisin and Wagner (2010); Blackhurst et al (2011); Christopher et al. (2011). |
| | Supplier development | Zsidisin et al. (2000); Tang (2006b); Chiang et al. (2012). |
| **Supply Chain Design** | Supply chain configuration | Christopher and Peck (2004); Blackhurst et al. (2005); Tang (2006a); Christopher et al. (2011); Blackhurst et al (2011); Carvalho et al (2012b); Spiegler et al. (2012); Scholten et al. (2014) |
| **Transportation** | Transportation modes | Sheffi and Rice (2005); Tang (2006a); Stecke and Kumar (2009); Azevedo et al. (2013) |
| **Risk** | Risk Management | Christopher and Peck (2004); Zsidisin (2003); Colicchia et al. (2010); Christopher et al. (2011); Scholten et al. (2014) |

Source: created by the author

In this context, Sheffi and Rice (2005) depict the case of Toyota after the fire plant incident at one of its key suppliers (Aisin Seiki) in 1997. Toyota faced an unexpected halt in production and it took just nine days to return to its normal production, this incident caused considerable financial losses. Thus, Toyota decided to reduce its supplier base to be able to better manage its suppliers and, consequently, to reduce the cost of managing multiple suppliers as well. However, years later Svahn and Westerlund (2009) and Pettit et al. (2010) reported another incident in which Toyota was involved. After an earthquake of 8.5 magnitude in 2007 in Japan, Toyota was forced to shut down 12 of its assembly plants because most of its suppliers were located in the same area where the earthquake happened. Strategically, this plan should work well in a stable system; however this event caused a delay in the delivery of about 55,000 vehicles. The main cause for this great loss was the lack of supplier alternative that could cover this break of resources.

Therefore, having a multiple source of suppliers is seen to be a good option. It is able to reduce the cost, protect against failures, and enable the sourcing flexibility which is one of the key resilient enablers (Zeng, 2000; Azevedo et al., 2013). However, keeping multiple

suppliers may increase the supply risk, such as quality issues or delivery reliability, especially for critical components. Furthermore, the cost might be higher to manage multiple suppliers (Simangunsong et al., 2012). Thus, determining the right number of suppliers is one of the key elements of supplier management (Pochard, 2003), and it is therefore one of the key ways to build resilience. A couple of advantages and disadvantages of this choice are illustrated in Table 20.

**Table 20.** Characteristics of choosing single or multiple sourcing

| Single Sourcing | Multiple Sourcing |
|---|---|
| Get better pricing through higher volumes | Protect the buyer during times of shortages, strikes or other emergencies |
| Achieve higher quality standards through continuous improvements | Provide a backup source |
| Lower costs that are incurred to source, process, expedidte and inspect | Maintain competition |
| Increase involvement and had better information | Keep a market feeling |
| Build stronger and longer-term relationships | Avoid complacency on the part of a single supplier |
| Obtain more influence with the supplier | Meet local requirement for intenational manufacturing locations |
| Reduce lead-times | Meet customer's volume requirements |
| Reduce inventory | When the technology path is uncertain |
| Streamline the procedure | |

Source: Pochard (2003)

It is also agreed that both approaches are right. Currently, companies have decided to use both types of sourcing in order to balance the strategies. Procurement functions have aimed to reduce their supply bases to become more efficient in selecting and managing supplier relationships, besides being able to improve relationship due to working closely with their suppliers (Sheffi, 2001; Sheffi and Rice, 2005).

*- Criteria for supplier selection*

Another issue that should be addressed by Procurement to determine the suppliers is the criteria for supplier selection. Authors have highlighted some criteria which might increase supply chain resilience. Zsidisin et al. (2000), for instance, points out the need to observe the financial strength of suppliers as that can be a risk for long-term relationships. Sheffi (2001) lists similarities in terms of business processes, practices and culture. In this regard, he mentions the case of Japanese manufacturers in times of supremacy of the lean manufacturing and JIT system. They used to visit their supplier's plants and training them to work as their plants, so that they could achieve collaboration and alignment.

Tang (2006a), Zsidisin and Wagner (2010) and Carvalho (2012b), for example, discuss the location of suppliers. In this regard, much has been talked about globalization. Although it is an emergent market situation, it requires longer lead-time and therefore it becomes more susceptible to disruptions related to transportation (Sheffi, 2001). In this regard, companies have to figure out the right strategy for their business. For example, local suppliers can be efficient in terms of delivery; however in case of local disaster it can worsen the situation (Sheffi, 2001; Blackhurst et al., 2011). The best choice advised by Sheffi (2001) would be to have different suppliers in different locations for different aims. Thus, he states that it should be good to have "offshore suppliers for the bulk of the Procurement volume while making sure that a local supplier has the capability to fill the needs, by giving it a fraction of the business". Through the strategic location and supply chain knowledge, it is possible to build a flexible network. In the same vein, he shows an example about dual suppliers, but with an interesting strategy for supplier selection - in order to supply inkjet printers to North America, Hewlett-Packard (HP) held a supplier in Washington to launch the product and deal with demand peaks, whilst another low price supplier in Singapore to handle its stable production.

Therefore, regarding supplier selection many criterias have to be considered: supplier locations (e.g. Sheffi, 2001; Christopher et al., 2011); processes, practices and culture (Sheffi, 2001); common platforms for products (Zsidisin et al., 2000; Stecke and Kumar, 2009); capacity constraints (Christopher et al., 2011); financial stability (Zsidisin et al., 2000); and effectiveness of the supplier's management team (Zsidisin and Wagner, 2010).

*- Supplier relationship*

Based on the above discussion about supplier base, how to relate to its sole, dual or multiple suppliers is a prominent decision that should be taken by Procurement. One of the decisions making referenced by Christopher et al. (2011) regarding risk management is the type of relationship. In this context, they assert that in terms of single supplier, the close relationship is advised, while for a number of different suppliers, a less close relationship is appropriate in order to spread risks. Not only Christopher et al. (2011) but also, Svahn and Westerlund (2009) and Zsidisin and Wagner (2010) also discuss and claim the same point. Furthermore, enhancing the relationship between buyer and suppliers may increase the collaboration, alignment and visibility.

The supplier relationships can be made through partnerships and/or alliances. Tang (2006b, p.43) states that "alliances can serve as a “safety net” for each member, one will

receive help from other members if a disruption strikes". Furthermore, long contracts allow enhanced relationships and reduced annual cost (Svahn and Westerlund, 2009). Also developing partnerships with strong suppliers can be advantageous to get a good quality product and keep contact with suppliers capable of delivering critical components in case of need (Zsidisin et al., 2000).

As discussed in the Basic Literature Review (item 2.1.3), buyer-supplier relationship is also a relevant point to be addressed. From discussions about the difference interface structures by Christopher (2000), Jüttner and Christopher (2000) and McDonald and Woodburn (2007), it is noticed that the cooperative relationships seems to be dangerous due to the limited level of information sharing (Blackhurst et al., 2005) and the interface structure challenges. The integrated relationships keep a sole supplier and companies will be very dependent on each other (Sheffi, 2001). Therefore, the basic relationship seems to present feasible characteristics to creating resilience which emphases multiple suppliers, for instance (e.g. Blackhurst et al., 2011; Christopher et al., 2011; Stecke and Kumar, 2009 and Carvalho et al., 2012a); however managers still have to pay attention to the limited amount of information sharing.

- *Supplier development*

Developing members of the supply chain to be as responsive as possible in times of disturbance can also be an issue to Procurement. Thus, if the company helps its suppliers to develop their processes, they become aligned and more responsive to changes (Zsidisin et al., 2000). Furthermore, it can help to improve information sharing, integration and also flexibility (Lee et al., 2009; Yi et al., 2011). All these efforts to work closely with suppliers make companies more prepared to change needs under specific customer requirements of quality (Chiang et al., 2012). Therefore, Chiang et al. (2012, p.54) affirm that "supplier development has been shown to have a positive relationship on supplier's performance".

However, when there is no supplier available in the market to cover the company's need, Procurement should create incentives for those interested and hence take advantage and developing additional suppliers to its own business. In this context, Tang (2006b) reports the case of American government which created incentives to suppliers willing to produce a specific flu vaccine formula. For this reason, the government could share financial risk with suppliers, and having the flexibility to change its orders from different suppliers quickly when facing major disruptions.

**Supply Chain Design**

*- Supply chain configuration*

Regarding supplier locations criteria, companies can normally build a strategic supply chain to deal with market uncertainties. Christopher et al. (2011) affirm that companies, in general, are knowledgeable when the matter is downstream of the supply chain; however this is not so true regarding upstream side. Because of that, they claim that companies embedded in a global context should redesign their supply chains in order to avoid current risks presented in the organisational environment.

Although the design of the supply chain can be the result of companies' choices regarding strategic sourcing, there are also cases in which redesign will be needed to mitigate risk and create a more resilient supply chain. In this context, Tang (2006a) portrays that Liz Claiborne moved all its textile supply chains to China which caused the reduction of 10-50 weeks to fewer than 60 days in the lead time of this company. Therefore, how to design the supply chain is also pointed out as an issues here, considering that rearrangements on it may enable a quicker response. Notwithstanding, there is a need to pay attention to risk locations, as previously discussed.

**Transportation**

*- Transportation modes*

Although transportation is the main responsibility of Logistics, deciding how raw materials and resources will arrive at the company is a Procurement business. So that, having at least more than one option to make the delivery help companies to avoid from small to big problems regarding flow disruptions. A good example of this is the case of Ford and Chrysler in that shows how different types of transportation were able to overcome a considerable disruption. Also, Brazilian post office (Correios) has recently used this strategy to deal with the protest against the government that blocked hundreds of roads. It therefore hampered the Correios' service. However, Correios had the advantage of working with other modals, such as airplane. Hence, it could be able to overcome the situation by delivering the urgent loads by plane.

In this regard, Tang (2006b) proposes three strategies to improve the transportation flexibility:

- multi-modal transportation: it is related to different and well-known types of transportation, such as water, air and road.

- multiple routes: it is used to avoid breaks of the flows along the supply chain due to problems, such as traffic jam or any unexpected problem arise from natural events (floods, mudslide or snows).

- multi-carrier transportation: it is a particular alliance made normally by airline companies, such as Aeroméxico Cargo, KLM Cargo, Delta Air Logistics, Air France Cargo and Korean Air Cargo to quickly switch quickly carriers in case of political disruptions. This alliance was named SkyTeam Cargo, which provides a low-cost global delivery to 500 destinations in 110 countries.

**Risk**

*- Risk Management*

Risk is a topic discussed very much in the literature which is boosting the development of many studies nowadays. Thus, identifying the sources of risk is also an important issue which Procurement should be aware of. Despite risk from suppliers that must be observed before any selection, Procurement should also concern about internal, external and environment risk (Christopher and Peck, 2004). As discussed in previous items, these risks have increased in today's business and can therefore be dangerous to continuity of business in the current market.

Furthermore, Colicchia et al. (2010) assert that "a better understanding of the risk sources for specific supply chain settings can enable the design of a more resilient supply chain". Additionally, Zsidisin et al. (2005) describes four processes to prevent discontinuities: risk identification (enumerating the causes/sources of potential supply chain disruptions); risk assessment (evaluation of the probability of occurrence and the impact an event will have on the business); risk treatment (strategies development for reducing their probability and/or mitigating their impact on the business); and risk monitoring (look at developments in the supply chain that may increase or decrease risks on an on-going basis). Therefore, by identifying the sources of risk and their effects on business, Procurement, in addition to other functions, becomes a more prepared function to manage those and hence to deal with disruptive situations.

## 3.5 Theoretical Findings and Research Framework

The theoretical knowledge grounded in this topic during the past 14 years (2000 a 2014) was able to reasonably answer the proposed review questions and also explore new points of interest to contribute not only to theory building but also to guide practitioners to deal with

daily or unpredictable incidents. Overall, enablers and barriers identified here are fairly generic which might have additional or different connections considering that all those can contribute to improve or reduce the effectiveness of resilient strategies in the supply chain. Moreover, it was clearly observed that those enablers and barriers have great influence in Procurement activities. Therefore, Procurement does make a significant contribution to create supply chain resilience. Recognizing that, organisational issues related to this function were extracted from the literature and grouped into general topics related to intra-organisational (within the company) and inter-organisational (between companies). As a result, a comprehensive theoretical framework (Figure 21) was developed in order to represent those issues which Procurement (building a bridge between internal and external of the company) must address to create supply chain resilience.

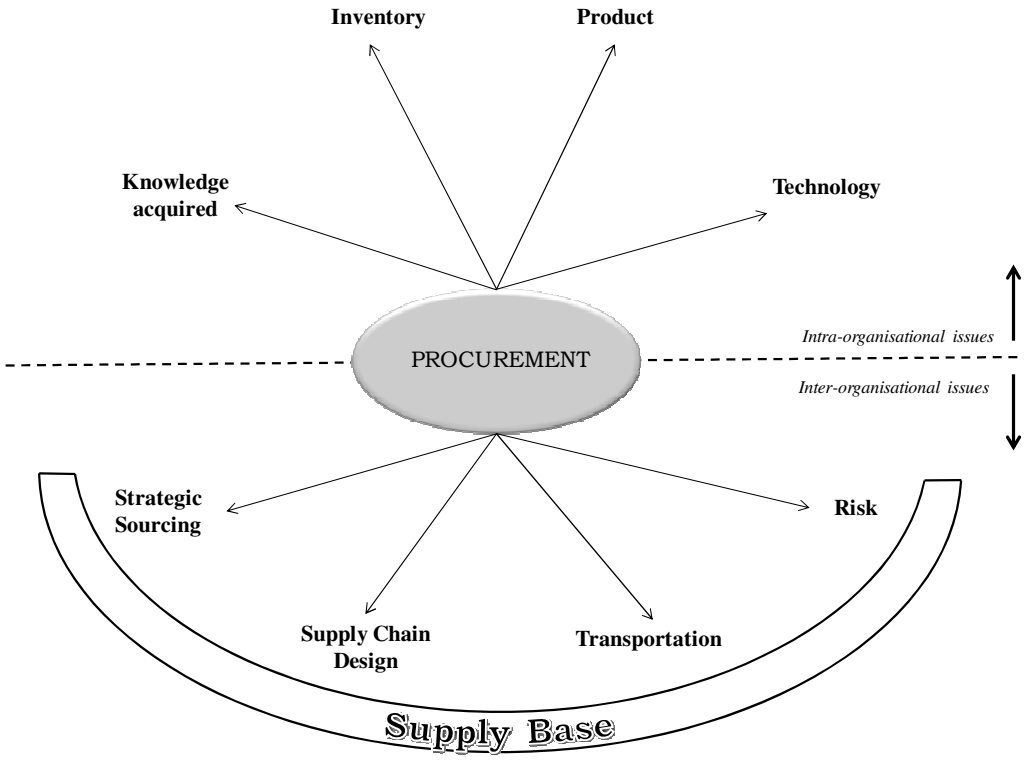


**Figure 21.** Theoretical framework for Procurement issues to supply chain resilience
Source: created by the author

The aim of this framework is to put together the theoretical findings to align and manage the flow of information, goods and service in a more effective and harmonic way. Those organisational issues were identified in the literature as relevant to companies by enabling them to bounce back easily from emergency situations, when Procurement acts like

a bridge between internal and external organisation. Thus, intra-organisational issues were grouped into knowledge acquired, inventory, product and technology areas, whilst inter-organisational issues were grouped into strategic sourcing, supply chain design, transportation and risk areas.

Considering the intra-organisational issues, knowledge acquired is characterised as a key general point which enables companies to overcome problems by lessons learnt from difficult experiences. Moreover, there is daily knowledge acquired through internal communication among functions within the company. It is noticed that different ways to manage inventory can enable companies to think and act wisely to quickly return and performance. Developing product flexibility is also a strategy that helps companies in critical situations; however it should be combined to the other general points, such as strategic sourcing and inventory. Technology, particularly IT, is also an important issue which is considered by The World Economic Forum (2013) as one of the ways to create supply chain resilience. It mainly assists data sharing and visibility.

Regarding inter-organisational issues, strategic sourcing is underpinned by four fundamental issues. By managing those issues properly, Procurement managers will be able to develop a good relationship with suppliers, and hence to find beneficial ways to make strategic and effective decisions. Strategic sourcing can help the supply chain design (or supply chain configuration or even re-engineering) to reduce complexity and enhance the alignment of the flows throughout the supply chains. How to transport products is also an issue to be carefully observed and managed if the need arises. Finally it is vital that supplier risk be regularly monitored and assessed by Procurement managers.

Overall, there is a need to analyse trade-offs involved in each of these issues, so that managers will be more aware of the current situation of the market, the environment and the company's operation in order to make decisions that less likely to lead to disruptions. Bearing this in mind, by managing and controlling those intra and inter-organisational issues, which have proved to be closely linked to resilient enablers and Procurement activities, it is possible to achieve supply chain resilience. Figure 22 summarises therefore this rationale which resulted from the discussion and findings of this study.

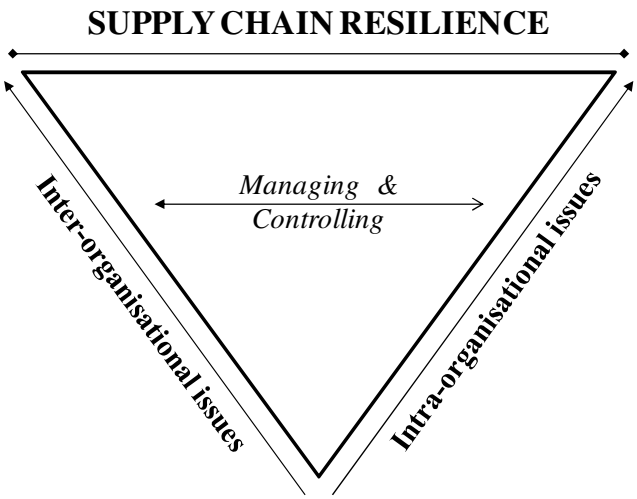


**Figure 22.** Achieving supply chain resilience through intra- and inter-organisational issues from Procurement perspective
Source: created by the author

### 3.6 Summary

This chapter is a result of an extensive literature review about supply chain resilience and Procurement functions to understand the general content from both subjects, and posteriorly combine them to clarify how Procurement activities can play a fundamental role in creating supply chain resilience. Although supply chain resilience is pointed out by some scholars as a subject in its infancy (*e.g.* Christopher and Peck, 2004; Blackhurst et al., 2005; Blackhurst et al., 2011), a growing number of studies have been published on this topic along with supply chain risk and vulnerability due to changes in the market and the environment. This exploratory study used the systematic literature review method to investigate intra-organisational and inter-organisational issues present in the literature that Procurement should address to create supply chain resilience. Tables 18 and 19 exhibit the findings of this theoretical study to exposs the intra-organisational and inter-organisation issues elicited from the above discussion about the implications of enablers (and barriers) on Procurement activities. These issues were still grouped into eight general points related to Procurement function which makes the link between internal and external environment of the company (Figure 21). A good management and control of both intra- and inter-organisational issues by Procurement managers will make the company achieve the supply chain resilience (Figure 22). In addition to this, a number of interesting points from this theoretical part can be pointed out from the body of literature:

- there are a number of enablers that can be applied not only to Procurement activities, but also to other functions or processes which are able to enhance supply chain resilience (Figure 19);
- issues about process, regulation, and security were also found in the literature; however they were not included in this study since their contents are very broad and also not closely linked to Procurement activities;
- a number of resilient practices were found in the literature which are related to the successful companies after great disruptions;
- the phenomena analysed here (the creation of supply chain resilience from a Procurement perspective) might be created not only from Procurement effort but from a set of business functions and efforts from the focal company members of its supply chain. So, actions to create resilience within the company should be further explored.

## 4. RESEARCH METHODOLOGY

The research methology used by researchers to design and conduct their studies is determined through a range of factors that need to be carefully defined in order to understand the process of scientific investigation. Thus, this chapter presents the main theoretical and empirical steps conducted for this research (Figure 23).

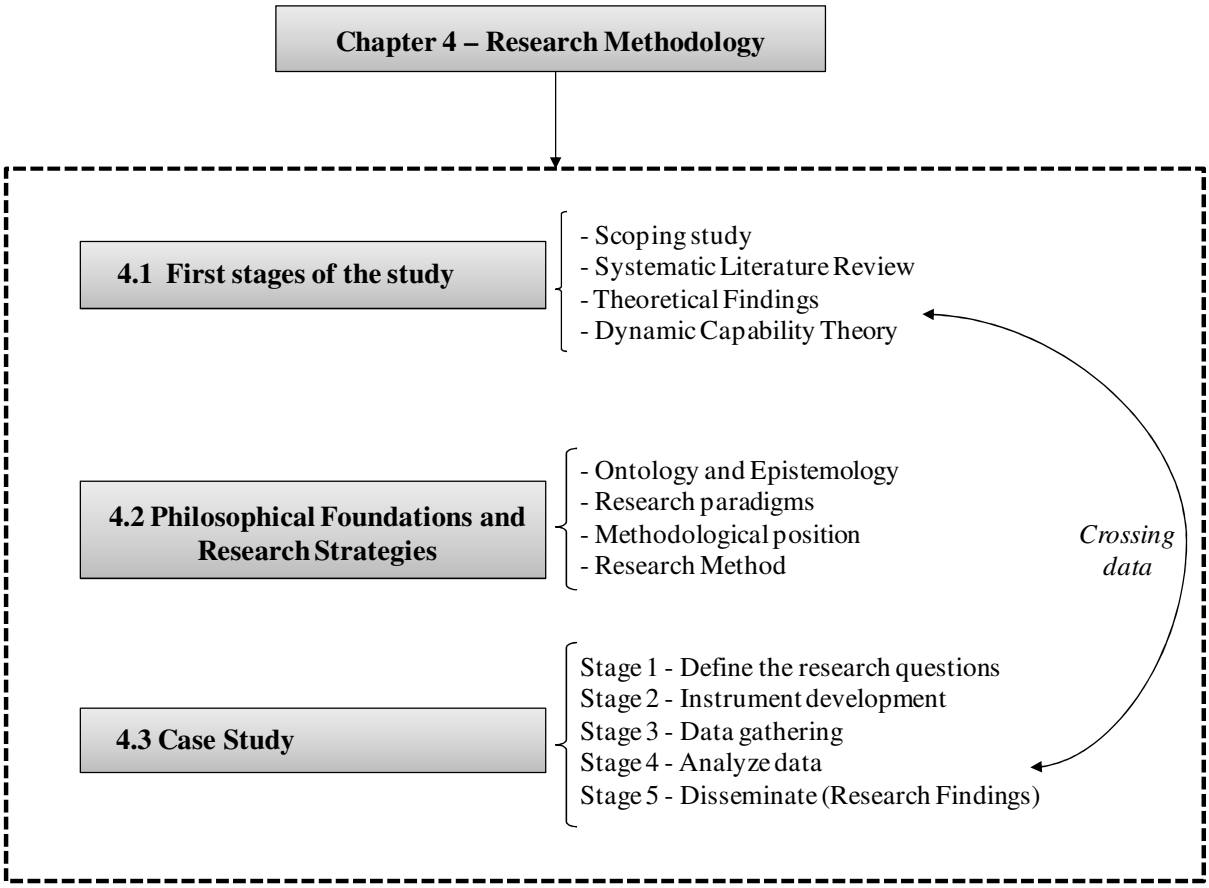


**Figure 23.** Structure of the research methodology
Source: created by the author

### 4.1 First stages of the study

This study started with the development of the scoping study about supply chain resilience and its application in today's business. A considerable amount of primary and secondary research was conducted before starting the Literature Review, in order to understand the topic, investigate gaps and develop study opportunities. Comments and suggestions of scholars in this area were also considered to clearly define the aim of the study. Furthermore, the method of Systematic Literature Review (SLR) was conducted to develop the literature

review. All the steps of this method are discussed in chapter 3 (Systematic Literature Review). As a result of the SLR, theoretical findings were further explored by the empirical investigation.

Moreover, an organisational theory was used to support the research findings and better explain the organizational capabilities and resources involved in creating and maintaining a resilient supply chain (Corley and Gioia, 2011). Among several organisational theories within the literature, dynamic capability theory was chosen due to considerable internal, external and environmental changes through resource and processe adaptation. Details of this theory are given at the end of chapter 2 (Basic Literature Review). Later, the theoretical findings as well as the rationale of the dynamic capability were used to support the empirical data analysis, and subsequently to generate the research findings.

### 4.2 Philosophical Foundations and Research Strategies

Based on the social science research methodologies, every scientific research should be classified according to its ontology, epistemology, methodology and method. This classification will guide researchers to ground their studies under scientific bases in order to guarantee trustworthiness and soundness of their results. Solem (2003) and Blaikie (2010) define ontology as the way in which social reality is considered in the research; epistemology as the nature and scope of knowledge; methodology as the different ways in which data can be collected and analysed (methodological position); and finally method as the best way to collect and analyse data for a particular research.

Regarding ontology, research can be classified as realist or relativist. Overall, realism means that the external world exists independently of our mental representations or perceptions, whereas relativism approaches the world according to mental representations or perceptions (Denzin and Lincoln, 2000). In terms of epistemology, it seeks to question what kinds of knowledge are possible and how they can be acquired (Solem, 2003). So that, two classifications are possible: objectivism or subjectivism. The former (objectivism) represents the true meaning of a given object regardless of perceptions or mental representation, while the latter (subjectivism) proposes the opposite idea by imposing the meaning on the object through a unique consciousness or experience that the subject (observer) created through the interaction between object and subject (Crotty, 1998).

Although ontology and epistemology can be studied and classified differently, both can be seen as complementary approaches: realism is closely linked to objectivism, whilst relativism is related to subjectivism (Solem, 2003). Considering all the explanations, this

research fits into the realism approach by affirming that unexpected events from environmental or market changes will affect companies and supply chains' performance regardless of perceptions or representations. Moreover, it is characterised as objectivism for the epistemology approach because it complements the previous decisions about ontology.

Understanding such primary approaches to ground this study, the next step is to define the research paradigms, which corresponds to the methodological position in which researchers assume to conduct their studies. Research paradigms can range in a horizontal perspective line from positivist to social constructivism/interpretivism. On the one hand, the positivism approach emphasises the objective measurement of the fact by using quantitative methods where theory is tested through pre-defined hypotheses (Blaikie, 2010). In this approach, the researcher is independent of what is being studied and the methodological decisions on how to carry out the research are determined by a set of objective criteria. On the other hand, social constructivism is related to subjective experiences where the reality may be socially constructed by the researcher's interpretation. Normally, this approach is closely linked to qualitative research by building theory through data interpretation (Easterby-Smith, 2002; Blaikie, 2010). There is still the critical realism which makes a bridge between both extreme paradigms. It means that the external world is known by the researchers' perceptions, however it is accepted that these perceptions do not cover all reality (Blaikie, 2010). In this case, there is a need to construct various views of this reality in order to comprehend the phenomenon of interest through a specific time and space (Riege, 2003). Therefore, considering those approaches mentioned, this research follows the critical realism paradigm by intending to explore a particular view of the reality embedded in the unstable environment and volatile market. To support this, views from different managers who work on different companies (from different supply chains) were gathered in order to understand the phenomenon of interest - the creation of supply chain resilience from a Procurement perspective.

The process of collecting and analysing data is also an important decision that has to be made in order to define the methodological position. In this stage, the research should be classified according to its qualitative or quantitative nature. However this decision has probably been influenced by previous decisions. In a critical realism approach - which is the focus of this research - both techniques can be used, characterising the mixed method. This method has been highlighted to achieve soundness and validity of the results (Brannen, 2005; Creswell and Plano Clark, 2007). However, only the qualitative technique was conducted to obtain a deeper insight about the issues of the phenomenon. This approach appeared to be

adequate since the concept of supply chain resilience is not well known among practitioners, so these terms could be clarified in the course of the interviews (Reuter et al., 2010). Therefore, a mixed method might be a good future research opportunity of deepening the knowledge into this topic.

Among many qualitative techniques to conduct the data (*e.g*. participatory action research, experiment, case study and phenomenology), the case study approach was considered an appropriated method that fits this research requirements by investigating the phenomenon in a current real-life context without interfering on the phenomenon. All the steps and procedures to conduct this method are carefully detailed in the next section. Overall, Figure 24 summarizes the key points of the philosophical foundations and the decisions made to develop this research.

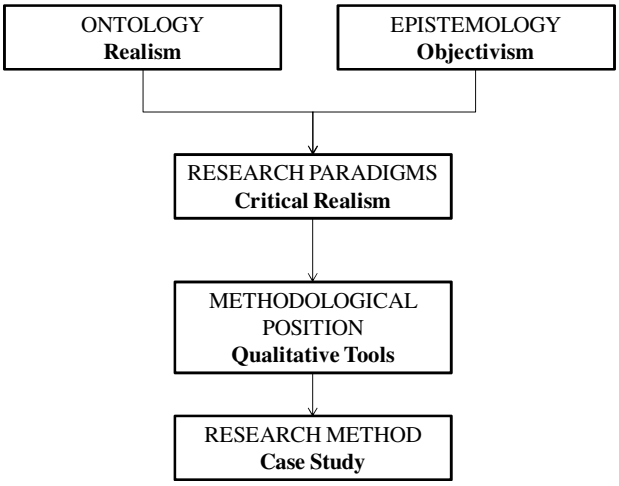


**Figure 24.** An overview of the philosophical foundation
Source: created by the author

### 4.3 Case Study Method

Qualitative case study is defined by Barrat et al. (2010, p.329) as "an empirical research that primarily uses contextually rich data from bounded real-world settings to investigate a focused phenomenon". Similar to this definition, Yin (2009, p.18) specifically defines case study as "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident". Case study is therefore considered a relevant method that focuses on the understanding of the dynamic environment within a desired settings (Eisenhardt, 1989; Meredith, 1998; Stuart et al., 2002), besides being able to explore, explain and describe the phenomenon of interest (Ellram, 1996; Voss, 2008).

Despite this method has been criticized for the lack of transparency, rigor and trustworthiness (Morgan and Smircich, 1986; Näslund, 2002; Johansson, 2003; Seuring, 2008; Yin, 2009; Ketokivi and Choi, 2014), it has shown to be a valuable tool in diagnosing the real context and generating advantageous actions for businesses (Ellram, 1996). Furthermore, it has been fully developed over the last years which makes its procedures complete and robust (Stuart et al., 2002; Seuring, 2008). Therefore, case studies are recognised to be "one of the best ways to make sure that researchers are making valid observations and contributions to the body of operations management knowledge" (Stuart et al., 2002, p.421), as well as the great contributions to theory (Harrison, 2002; Voss, 2009; Ketokivi and Choi, 2014). Furthermore, taking into consideration the theory chosen to help explain the phenomenon in study, Cavusgil et al. (2007) has stated that although the dynamic capability is still a relatively recent view, it can be best fit through in-depth qualitative research.

Aiming to achieve the rigor and reliability required for empirical research, this part of the study follows five stages suggested by Stuart et al. (2002). These stages are shown in Figure 25.

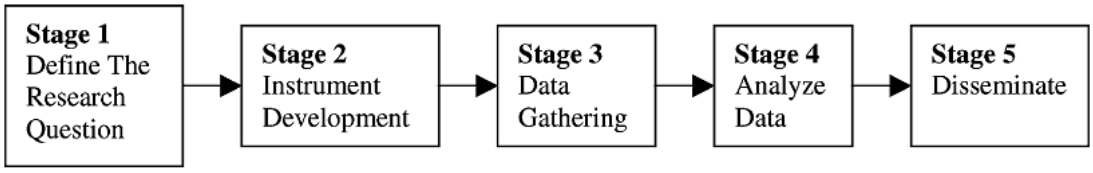


**Figure 25.** Stages of conducting a case study
Source: Stuart et al. (2002, p.420)

***Stage 1 - Define the research question***

This study is classified as exploratory which seeks to investigate an unexplored point within the literature (Yin, 2009; Barrat et al., 2011). Toward this end, research questions were developed based on the results from the systematic literature review (after identifying what is known in the literature so far) as well as based on the dynamic capability theory chosen previously to support the study. According to Corley and Gioia (2011), the use of theory as a support to the study is a helpful tool to identify what factors should be studied and how and/or why they are related. Thus, the research questions addressed to this study are:

*RQ1) What are the intra-organisational issues that must be addressed to Procurement in dealing with unexpected supply chain disruptions in practice?*

*RQ2) What are the inter-organisational issues that must be addressed to Procurement in dealing with unexpected supply chain disruptions in practice?*

*RQ3) How can Procurement manage these intra- and inter-organisational issues in order to help create supply chain resilience, through the lens of dynamic capability theory?*

***Stage 2 - Instrument development***

The key instrument to develop a rigorous case study is the protocol. It aims to help researchers focus on all steps needed to conduct the case study by documenting the evidences thoroughly (Stuart et al., 2002; Voss, 2008). Thus, a case study protocol was developed through the specification of all details and requirements of this study (Appendix I). Establishing the phenomenon of interest as the creation of supply chain resilience from a Procurement perspective, a multiple case study (holistic design) was carried out (Yin, 2009). The reason for choosing a multiple case study is that it is considered less vulnerable than using a single case study in which all efforts are invested in only one "shot" (Stuart et al., 2002). Furthermore, Yin (2009) points out that the unit of analysis should be related to the research questions. Therefore, the unit of analysis addressed in this study is the Procurement function within the focal company.

Eisenhardt (1989) suggests a sample size of four to ten useable sites that will vary according to the number of critical causal variables proposed to build theory. Nevertheless, the intention of this research is not building theory; it aims to elaborate theory by applying an existing general theory in a context that is "not known well enough to obtain sufficiently detailed premises that could be used in conjunction with the general theory to deduce testable hypotheses" (Ketokivi and Choi, 2014, p.236). Therefore, it intends to formulate theoretical insight that can be understood through the outcome of the interaction between a general theory the extant literature (dynamic capability theory) and the empirical context in study (the creation of supply chain resilience from a Procurement perspective under an unstable environment and volatile market).

Moreover, Stuart et al. (2002) and other current studies (*e.g.* Blackhurst et al., 2005; Szwejczewski et al., 2005; Zsidisin et al., 2005; Blackhurst et al., 2011; Jüttner and Maklan, 2011; Carvalho et al., 2012; Scholten et al., 2014) have been successful in using up to three cases. In this context, Barratt (2000) and Yin (2009) point out that the typical criteria regarding sample size is irrelevant, because the evidence from a rigorous multiple cases have often been considered more compelling, with more robust results, and higher probability to

create knowledge about the phenomenon of interest. Based on these explanations, four focal companies including two key suppliers from each focal company were selected to be part of this empirical study. Specific criteria for focal companies' selection were established as the following:

- medium to large-size companies, where the practice of risk and disruption management should be more well-developed than in small enterprises that hold limited supply chains;
- focus on manufacturing companies, excluding service companies; it was mainly chosen to limit the scope of the study, besides considering that most of the interesting cases of resilient solutions are related to product manufacturing;
- companies with well-developed Procurement function (or related function) which includes two or more employees (managers and leaders); so that it is possible to cross opinions and generate valuable results;
- companies from different sectors; the variety of sector provides a rich view from extreme situations, and it helps to clarify common issues among companies as well as identify existent differences (Christopher et al., 2007);
- companies located in Brazil; it was considered not only because of the researcher location but also due to the lack of studies about supply chain resilience within Brazilian database.
- suppliers responsible for supplying the focal company with critical items; the reason is to analyse the truly consequences that unexpected breaks may cause to the focal company. How procurement managers react to unexpected breaks and create resilience in the supply chains.

After identifying companies that fit into these criteria, contacts were made by e-mail and telephone where the aim of the study, the methods of data collection and contributions were presented. In addition, a formal letter (Appendix II) was attached to the e-mail, providing all the details of the research including the confidentiality of the data shared by them. In the end, four focal companies agreed to be part of this research, and they also helped in getting contact with their suppliers for this research. The following key industry sectors are:

- beverage;

- household appliance;
- food;
- agribusiness;

***Stage 3 - Data gathering***

Regarding data gathering, semi-structured interviews and secondary data (archival data provided by suppliers and focal companies as well as information from the homepages) were conducted with individuals from the focal companies as well as from their key suppliers. According to Yin (2009), this type of interviews helps to provide a flexible instrument to get in-deep information from the field. To do so, three types of questionnaire were developed to attend the research interest (Appendix III). The proposal of the first questionnaire is to check if the company fits into the research's aims and also if it helps identify the right interviewees in order to provide relevant information. The second one is focused on individuals from the focal company (Procurement employees or any other function related), while the third one is for individuals from the companies' key suppliers. In respect of the suppliers, it was prioritized individuals that have direct contact to Procurement individuals from the focal company. Thus, they are normally positioned within Sales or Account Management departments; however it did not exclude any individual from other department (who has direct contact to Procurement people) to participate.

During the interviews additional were asked to the participants regarding the structure of the departments (hierarchy), ways to manage and control supplier base, as well as purchasing raw materials, or any other information that could help to improve the reliability of the research data. Further information about company's history, situation within the national and global market, besides their products and customers were collected from company website or through other sound websites.

The questionnaires were assessed by knowledgeable people in the field (Table 21) and validated after conducting the pilot test, which according to Ellram (1996) and Yin (2009) it is responsible for testing the questionnaire before starting the real data collection. The pilot test was conducted in England, where a Purchasing manager from a stair lifts company was interviewed. The final questionnaire is attached to this document (Appendix III).

**Table 21.** Professors who assessed the research questionnaire

| Professor | Position | University |
|---|---|---|
| **Atanu T. Chaudhuri** | Fellow in Operations Management | Indian Institute of Management - IN |
| **Andrea Lago da Silva** | Professor in Marketing and Service Operations (supervisor) | Federal University of Sao Carlos - BR |
| **Lisa Ellram** | Professor in Procurement & Supply Management | Miami University - USA |
| **Martin Christopher** | Emeritus Professor (co-supervisor) | Cranfield University - UK |
| **Wendy Tate** | Professor in Procurement & Supply Management | University of Tennessee - USA |

Considering that different companies have distinct names and configurations for Procurement function, the interviewees were selected only after a conversation with one of the knowledgeable managers within the company. The reason is that the head of the company is considered a capable person to guide which managerial positions are more involved in what this research seeks to explore. As a result, six to nine individuals from each of the four supply chains (focal company and suppliers) were interviewed (details in Table 22). In doing so, interviews were mostly conducted by Skype due to the distance between one company and another (*e.g.* the focal company from the food supply chain is located in São Paulo while one of its suppliers is in north of Brazil). Deakin and Wakefield (2013) have stated that although traditional face-to-face interviews remain prominent, it can be problematic due to time and financial constraints as well as other logistical considerations. Thus, online methods, such as Skype, have facilitated the access to research participants considering the increasingly geographically dispersed. These authors therefore argue that synchronous online interviewing is a useful supplement or replacement to face-to-face interviews.

In total, 30 individuals from focal companies and their suppliers were interviewed. From this amount, it was possible to conduct face-to-face interviews with only eleven participants, while the rest of the interviews were conducted using Skype following the date and time previously agreed with each of them (e-mail or telephone contact). The interviews lasted around 45 minutes each, and were conducted between January and May of 2014. The following table (Table 22) portrays some main information about the companies, their participants and the method of data collection.

**Table 22.** Characteristics of the surveyed companies

| Case | Sector | Annual Production Volume | Employees | Interviewees | Way of conducting interviews |
|---|---|---|---|---|---|
| **BEV** | Carbonated and non carbonated drinks, including beer and water | 180 million litters | 600 | Strategic Procurement Manager (Mproc1), Plant Manager (Mplan1), Purchasing Manager (Mpurc1), Commodity Manager (Mcom1) and Production and Material Planning Manager (Mpmp1) | Personally (Mplan1) and by Skype (the rest of the interviewees) |
| | Plastic packaging | 110 tons | N/A | Market Intelligence (Mmint1s1) and Sales Manager (Msale1s1) | Skype |
| | Plastic film | 80 tons | 350 | Sales Person (Psale1s2) and SAC Manager (Msac1s2) | Skype |
| **KAPPL** | Household appliance | Disclosure not allowed | 1000 | Inbound Logistics Manager (Minlog2), Production and Planning Control Manager (Mppc2), Transport Manager (Mtransp2) and Purchasing Manager (Mpurc2) | Personally |
| | Metallurgical | 960 thousand components | 20 | Head of the company (Hcomp2s1) and Admin assistant (Aasm2s1) | Skype |
| | Wood structure | 360 thousand items | 25 | Sales Person (Psale2s2) | Personally |
| **FOOD** | Food | 1.4 million tons | 220.000 | Regional Head of Procurement (Mproc3); Metal Commodity Buyer (Bmet3), Coffee Commodity Buyer (Bcof3), Logistics Buyer (Blog3) and Nuts Commodity Buyer (Bnut3) | Personally |
| | Juices and concentrates raw materials | N/A | N/A | Sales Manager (Msales3s1) | Skype |
| | Nuts | 90 thousand tons | 2.200 | Sales Manager (Msales3s2) and Procurement Manager (Mproc3s2) | Skype |
| **AGRO** | Agribusiness | N/A | 1800 | Procurement Manager (Mproc4), Commodity Manager (Mcom4), Materials Analyst (Amat4) | Skype |
| | Chemical (pigments) | Disclosure not allowed | 10.000 | Supply Chain Manager - Latin America (Mscm4s1) and Sales Person (Psale4s1) | Skype |
| | Chemical (surfactants and specialty chemicals) | 2 million tons | 1800 | Sales Manager (Msale4s2) | Skype |

Overall, the data gathering process took over five months due to time constraints of the participants. All interviews were recorded and transcribed for further analysis. Additionally, notes, impressions and ideas occurred during the data collection were also recorded and added on the case study database (Yin, 2009; Reuter, 2010). Furthermore, to

increase the reliability of the data gathered, a follow up with e-mails were made in case of missing details during the analysis (Voss et al., 2008).

***Stage 4 - Data analysis***

After all the interviews have been transcribed, the data were analysed qualitatively by means of the content analysis method (Hsieh and Shannon, 2005; Bardin, 2008; Gibbs, 2008; Voss, 2008). The content analysis is defined by Hsieh and Shannon (2005, p.1278) as a "research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns". Thus, the aim of this technique is to help the researcher to extract useful information in order to provide understanding of the phenomenon in study and, consequently, building knowledge (Bardin, 2008).

To support this analysis, a qualitative software named QDA Miner was used to codify the interviews (data fragmenting and re-assembling), which makes it easier to interpretate them by being possible to visualise the outcomes from different ways. This software is used to analyse qualitative data from small to big database (*e.g.* transcriptions, journal articles and book) and even from images (QDA Miner, 2014). Additionally, it made the data analysis process feasible to manage in a systematic and consistent manner (Sholten et al., 2014). Thus, open codes were developed based on the findings of the literature review and the results from the interviews, which according to Gibbs (2009), the codification is based on concepts from the literature (previous studies and interview protocol, for instance) and the empirical data. Therefore, the interviews were initially coded through the concepts from the literature, and when required new categories and codes were added by means of an inductive way of analysis (Bardin, 2008). As new codes emerged from the empirical data, the previous transcriptions, which had already been coded, were reassessed in order to verify the occurrence of the new codes. The entire codebook of this analysis can be found in Appendix IV.

From the codebook, it is possible to observe extra categories and codes (*e.g.* companies' general information, Procurement and SCResilience) that were essentially useful to characterise and understand the company structure and manager's knowledge and responsibilities within the four cases. Subsequent to this, information from the interviews were broken down into other codes (Figure 26) to examine, compare, contrast, and categorize them into intra and inter-organisational issues and create supply chain resilience. Figure 26 is based on the interviews process, where interviewees have reported examples of

disruptions as well as procedures and actions to overcome them, common sources of risk and uncertainties in the sectors, points of improvements, and also barriers and enablers to improve resilience in the supply chains.

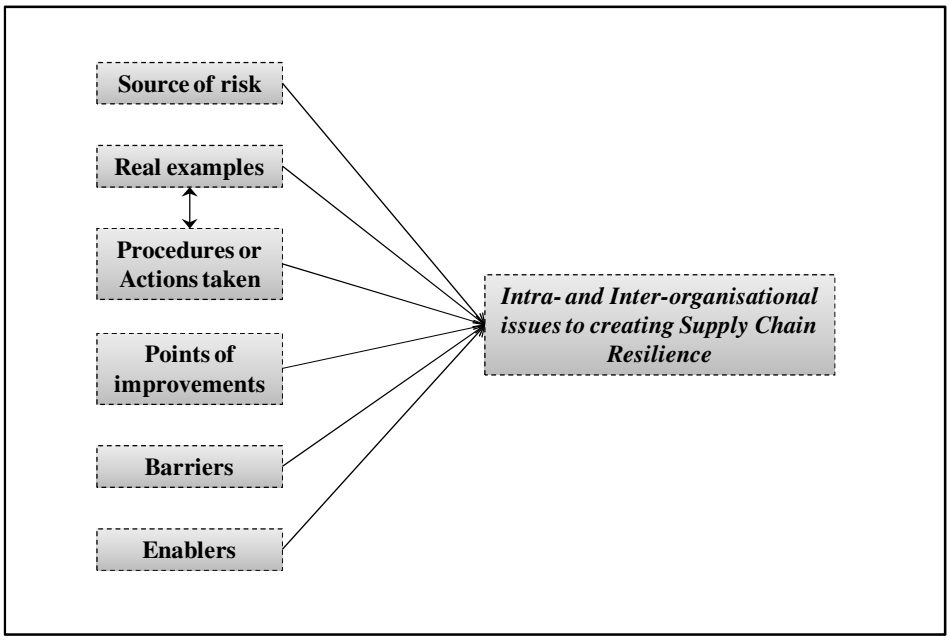


**Figure 26.** Key points involved in the analysis of the cases

Beginning with the first case, the same procedure was repeated for all of the three other cases. Furthermore, how Procurement manages and controls the issues were also exploited along the analysis according to the different contexts of the cases. In doing so, statements from the suppliers as well as internal business functions in each of the cases were taken into account to support the information provided by Procurement individuals from the focal companies (Figure 27). It is worth highlighting that codes were also created to name companies and interviewees in order to keep them anonymous to respect the agreements done with them.

Thus, all these points are part of the within-cases discussion to more thoroughly extract the intra- and inter-organisational issues that Procurement should observe to help create supply chain resilience. Moreover, at the end of each within-case, the analysis of the content in conjunction with the dynamic capability theory was exposed. To finish the data analysis, the result from these categories (intra- and inter-organisational issues) was therefore merged in order to analyse all cases (Bardin, 2008; Voss, 2008; Reuter et al., 2010). Overall, a recursive iterative process was conducted to relate the empirical findings to the existing

theoretical framework (Eisenhardt and Graebner, 2007; Sholten et al., 2014) that is represented in Figure 21 in the chapter 3. The results of this codification has helped to support the theoretical findings, or additionally highlighting new issues (issues that have showed up from the empirical data).

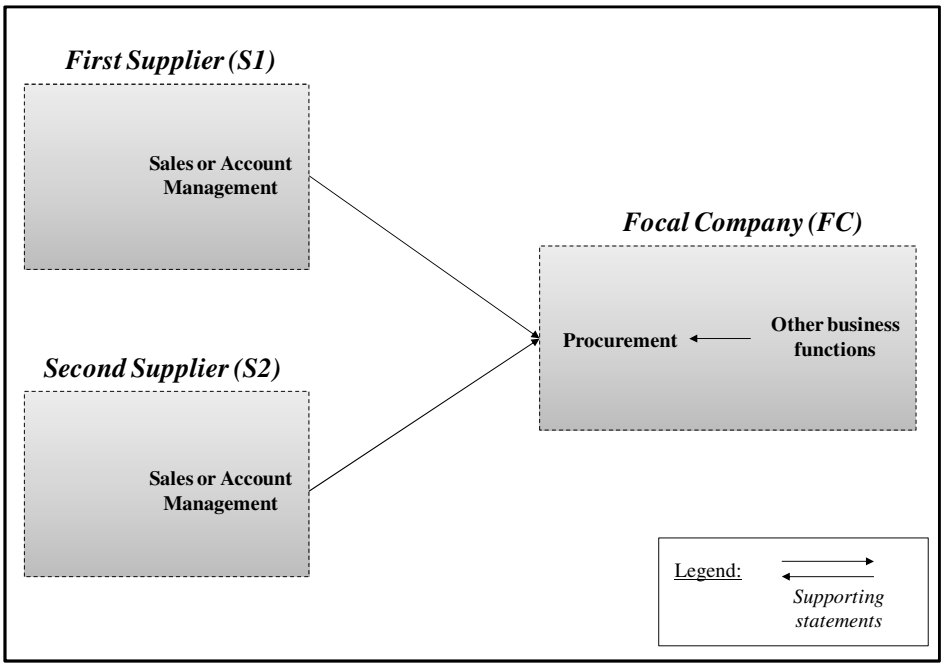


**Figure 27.** Internal and external supporting statements

To sum up, Eisenhardt (1989) and Barratt (2000) states that researchers must become familiar with each case as a stand-alone entity; so that it is possible to understand the sequence of the events or factors, and therefore cross the information (Melnyk and Handfield, 1998). In this sense, all four cases were firstly coded and analysed individually so as to get acquainted with them. Subsequently, the data analyse was conducted through cross-case analyses. The QDA Miner software was always the base to organise and understand the interpretation of data. A report of Global Sourcing and Logistics from Cranfield University (Christopher et al., 2007) was used to guide some steps of the within-case and cross-case analysis in terms of data representation. Finally, the triangulation was achieve through interviews, secondary data (previously detailed), and findings from the literature (Christopher et al., 2007; Scholten et al., 2014).

***Stage 5 - Disseminate***

Aware of several criticism regarding the quality of the case studies (Ellram, 1996; Stuart et al., 2002; Seuring, 2008; Yin, 2009), some considerations were taken in order to ensure rigor and accuracy of this research. In this regard, Ellram (1996) and Yin (2009) advice that all case studies should have clear designs before starting the data collection. So that, it is arguably relevant to consider the research questions, the unit of analysis, the links between data and research questions, and the procedures for interpretations of the data.

Thus, along of all these points, four tests should be applied to ensure quality of the empirical research (Yin, 2009). Each one of these tests has an appropriate phase to put into practice (Voss, 2008) as can be seen in Table 23. All the four criteria described below (Denzin and Lincoln, 1994; Ellram, 1996; Dul and Hak, 2008; Yin, 2009) are considered important to be followed so as to generate reliable results (Barrat et al., 2011).

**Table 23.** Criteria to reliability of the results

| Test | What and where is applied | How it was applied to this study |
|---|---|---|
| **External validity** | It reflects how accurately the results represent the phenomenon to be studied.<br><br>(research design) | One of the company' selection criteria is to select companies from different sectors, in addition to interview key suppliers of the focal company and not only managers within the focal company. |
| **Internal validity** | Demonstrate the degree to which findings correctly map the phenomenon in question (for explanatory or causal studies only, excluding descriptive or exploratory studies).<br><br>(data analysis) | Considering that the present study is classified as exploratory, this test is not applicable. |
| **Construct validity** | It seeks to address a proper operational measure to the concept in study. This test is applied to the data collection phase and it is required a multiple source of evidence in order to ensure the data triangulation.<br><br>(data collection) | In this case, interviews were conduct not only with Procurement managers but also with Key Account/Sales managers from suppliers; additionally, other people from different functions which work somehow with suppliers and supply chain disruption were interviewed as well. For this reason, there are three types of questionnaires to extract specific information from each type of interviewee. Additional information was also gathered by observation and extra documents provided by the interviewees. |
| **Reliability** | It demonstrates the repeatability of the study in order to enhance the quality of the results. In case study method, it is achieved by using a case study protocol and also maintaining a case study database.<br><br>(data collection) | The case study protocol was developed (Appendix I) to be used during the empirical study. The case study database (copy of the completed interview guide, transcriptions and notes) were also made. |

Source: Based on Yin (2009) and Christopher et al. (2007)

There is a limitation regarding generalisability due to the location of the data gathered (they are all from Brazil, excluding other countries), and the sizes and types of other companies. Furthermore, Stuart et al. (2002, p.423) affirm that "the researcher does not need to assume that what is observed is truly representative of all similar situations". So that, the intention of this research is to understand a particular view of how Procurement can help create supply chain resilience through intra- and inter-organisational issues.

Finally, considering that all data were conducted in Portuguese and this thesis has been written in English, it is intended to apply the "back translation" technique to ensure the conceptual equivalence of the quotation's meaning in the analysis. It is therefore achieved through translating the quotations to English and then to Portuguese again (Douglas and Craig, 2006; Borloz et al., 2012). To do so, a native in English will be part of this process.

## 5. RESULTS AND DATA ANALYSIS OF THE MULTIPLE CASE STUDY

This chapter aims to present the general results of the four within-case analysis and the cross-case analysis. Each one of the case is composed by one focal company and two of its suppliers. Results from the interviews are complemented by information from companies' documents and websites are primarily presented followed by the discussion about the intra- and inter-organisational issues identified in the cases and how Procurement can manage and control those issues in order to create supply chain resilience. As in the previous chapters, Figure 28 illustrates the main contents of this chapter.

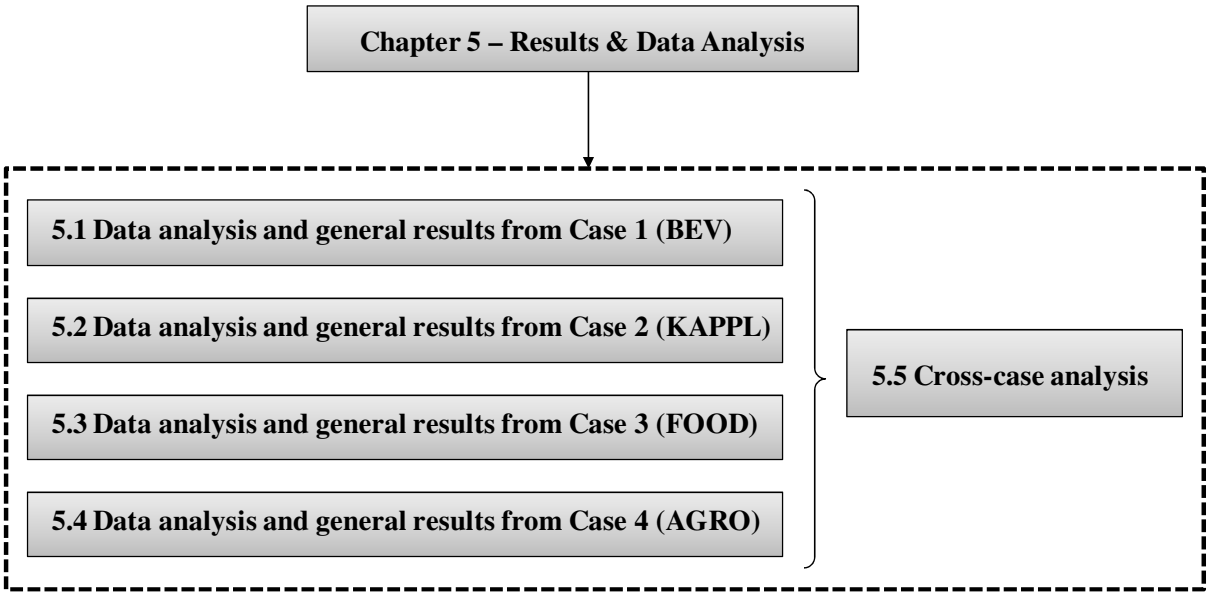


**Figure 28.** Structure of the results and data analysis of the multiple case study
Source: created by the author

### 5.1 Data analysis and general results from Case 1 (BEV)

The first case is composed by a triad (corporation, focal company, and two of its first tier suppliers) that makes part of a beverage supply chain. The focal company is one of the 40 Brazilian plants of a multinational organisation, but it has thousands of other plants in over 200 countries. The production volume of this particular focal company is around 180 million out of 11 billion litters of beverage produced per year in Brazil. In order to keep anonymous the name of the organisations, they are titled in this case as: BEV-FC for the focal company, BEV-S1 for the first supplier, and BEV-S2 for the second supplier.

BEV-S1 and BEV-S2 are both large companies that provide important raw materials not only to BEV-FC but also to other multinational companies. BEV-S1 is a national plastic packaging company that weekly supplies BEV-FC with one of the main input to produce several final products. Thus, BEV-S1 is considered one of the largest companies in the plastic segment (with a resin consumption of 110 tons per day); for this reason, it also provides raw materials to FOOD-FC (Case 4), which is another multinational company. The second supplier (BEV-S2) is a national plastic film company which holds additional plants abroad. In Brazil, it has three plants with a production volume of around 80 tons per year. Recognising them as two large suppliers, BEV-FC is not their main customer, however they do provide critical items to BEV-FC which means that any problem with these suppliers might cause a supply disruption to BEV-FC.

This study is focused on identifying particular Procurement actions that cope with critical supply disruptions so as to create supply chain resilience. Nine people were interviewed from three companies contacted in this case. Table 24 illustrates the companies, roles, and codes that represent each of the nine interviewees in this first case analysis.

**Table 24.** Interviewed people in Case 1

| Company | Role | Codes |
|---|---|---|
| BEV-FC | Strategic Procurement Manager | Mproc1 |
| BEV-FC | Plant Manager | Mplan1 |
| BEV-FC | Purchasing Manager | Mpurc1 |
| BEV-FC | Commodity Manager | Mcom1 |
| BEV-FC | Production and Material Planning Manager | Mpmp1 |
| BEV-S1 | Market Intelligence | Mmint1s1 |
| BEV-S1 | Sales Manager | Msale1s1 |
| BEV-S2 | Sales Person | Psale1s2 |
| BEV-S2 | SAC Manager | Msac1s2 |

The three companies in this case have a traditional vertical hierarchy in which directors are at the top of the company's hierarchy followed by managers from different business functions, such as Procurement, Sales, and Production. The focus of this study is to identify the Procurement intra- and inter-organisational issues to creating supply chain resilience. Furthermore, the focus of this analysis is on the horizontal relationship between focal company and its suppliers. Figure 29 shows the general structure of this relationship that involves these three companies.

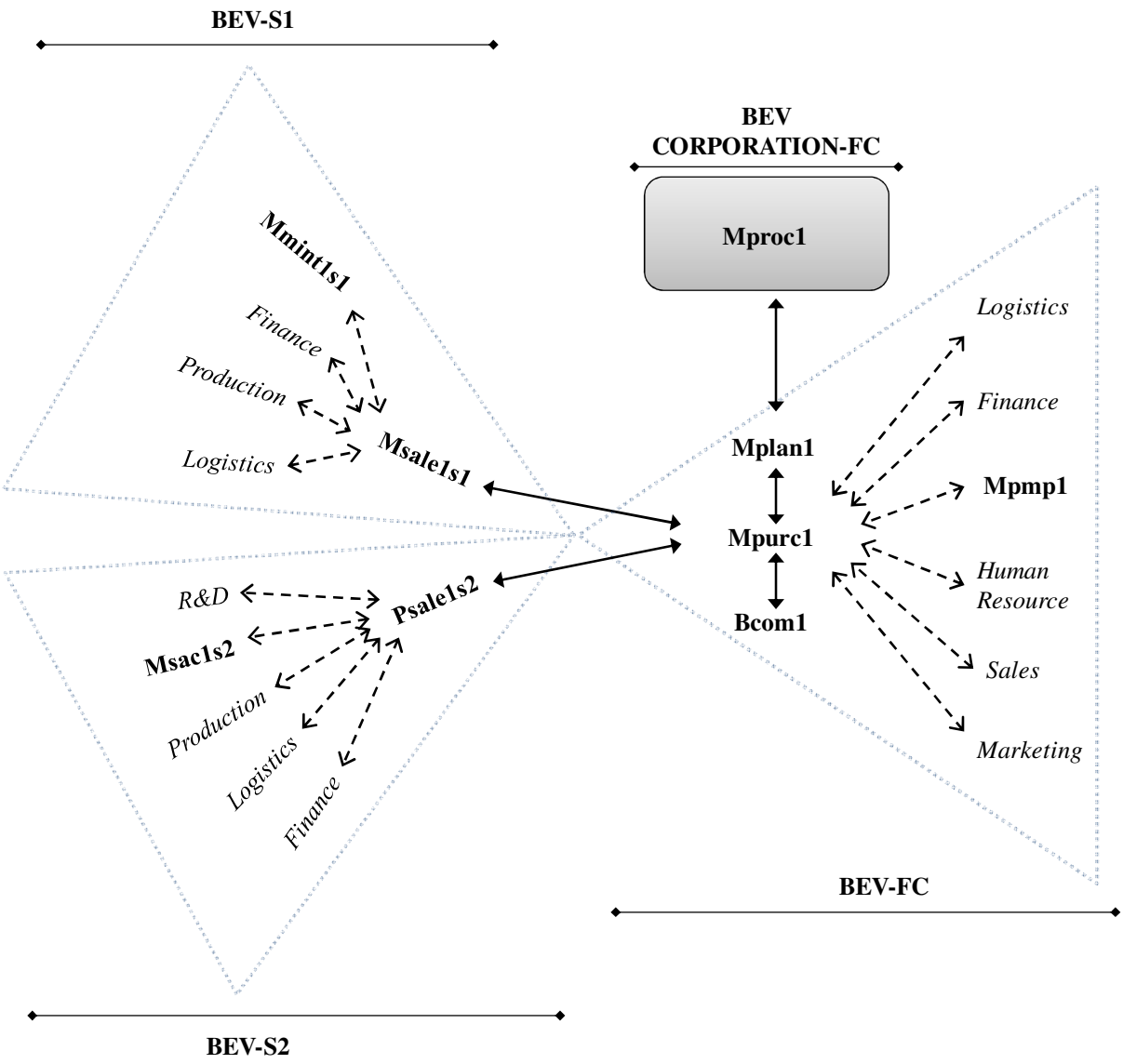


**Figure 29.** General structure of a triadic in Case 1

First and foremost, it is important to make clear the Procurement structure from BEV-FC. As one can see Figure 29, Mproc1 is located in BEV Corporation where some strategic decisions are developed and made by them, and the rest of the plants have to follow those decisions in terms of purchasing. However, managers from BEV Corporation make decisions only for the main items (classified by them as Items A), while each franchises has its own Procurement structure and is responsible for the items B and C. Therefore, Mproc1 is responsible for searching and approving capable suppliers to provide high quality raw materials regarding items A to all plants. In doing so, it aims to mitigate risk, in addition to being a way to make standard products. On the other hand, plants managers (as they are

located in different places throughout Brazil) are more flexible in identifying suppliers located nearby which reduces the lead-time.

> My job, among other things, is to coordinate things between suppliers' approval and the franchises. To support the needs of the manufacturers as well as the inputs, and ensure that the desired suppliers are up to our standards [...] also to help my colleagues from Procurement follow, obviously (Mproc1) [1]

In this regard, they have a negotiating committee of key inputs in which plant managers negotiate price, volume, and the supplier that is going to supply each plant. Mplan1 makes part to this committee and consequently passes the orientation to Mpurc1 to make operational purchasing transactions of items A only with the chosen suppliers. The Procurement function in BEV-FC is composed by a manager (Mpurc1) and three commodity buyers (Bcom1 is one of them). In this structure, strategic decisions regarding suppliers are also the responsibility of Mplan and Mpurc.

Mpurc1 is the key contact of both suppliers (BEV-S1 and BEV-S2) in this study, and they both provide items A to BEV-FC. Thus, information sharing is mostly exchanged between Mpurc1 and Msale2s1, and/or Mpurc1 and Psale1s2 in this particular dyadic. Of course, there are additional contacts among employees from these companies. However, all supply decisions between them have to pass through Mpurc1. Figure 29 illustrates the buyer-supplier relationship of these triadic in Case 1.

> [...] in this case, I work in the Sales department and, for example, I have direct contact with Procurement from BEV-FC. They send me the orders but, for example, when the problem is related to the plastic film, I do my best here to keep the customer supplied. (Psale1s2) [2]

The general relationship between these companies seems to work like a "bow-tie" or a "basic" buyer-supplier relationship, as portrayed in Figure 7a in chapter 2 (Basic Literature Review). The basic relationship states that Procurement manager and Key Account manager are normally in regular contact, and the organisations are just aligned behind this function and not along them. Additionally this is also the only channel to exchange information. As it is illustrated in Figure 29, Procurement function of BEV-FC and Sales function of BEV-S1 and BEV-S2 have transparent communication and are supported by the internal business functions, such as Quality, Finance and Logistics.

When the term disruption was presented for the interviewees, some of them understood it as only internal disruptions; for example, problems in the production line. In this case, Production function would be mainly responsible for dealing with this kind of

drawback in their companies. They were informed about the focus on the supply side of the company. Interviewees have confirmed that Procurement activities are vital in balancing and avoiding the supply disruption. However, this is not the only function. It also needs support from other business functions in order to align and synchronise supply and demand.

> The Procurement function is the main element in monitoring this, but it can only work if it has information from the other sectors of the company. (Mmint1s1) [3]

According to the interviewees, Procurement from BEV-FC plays a strategic role by being responsible for balancing the needs from its internal customers and the availablility of raw materials from its suppliers. In this context, some of the Procurement activities in this case are identification and classification of suppliers capable of providing specific raw materials in good quality, at the right time, with the right quantity, at the right place, and specially at the right price; volume and price negotiation; supplier relationship management; purchasing of the required items (A, B and C); development of contingency plans; contracts; participation of the negotiating committee of key inputs; participation to the S&OP (Sales and Operational Planning); suppliers KPI's management; suppliers' assessment; Procurement benchmarking in order to continuous improve it; and the development of RF (Required for...) documents for all purchasing. Through all the information gathered from the interviews, it is possible to conclude that BEV-FC has well-established Procurement practices as well as well-developed processes.

Regarding supply chain resilience, only one out of nine interviewees knew how to define this concept and what it is applied for. The rest of the interviewees responded that they had never heard about the term before. Regardless of their knowledge, all the interviewees have reported many resilient strategies and actions to deal with critical supply disruptions. In fact, managers from BEV-FC seemed to have so much concern about supply disruptions, that they made use of strategic alternatives in order to keep continuity of their operations. These actions and alternatives are further discussed in this analysis, especially risk management which is mentioned as an intra-organisational issue.

Procurement function from BEV-FC presented good practices to mitigate risk through reconfiguring internal and external resources in order to manage them differently to particular situations, which match the general rationale of dynamic capability theory. However, it does not seem to be a formal practice as can be realised through Mproc1 assessment - "*I'm not sure, but I think I'm already addicted to the model. We don't have a formal procedure, right. So maybe we subconsciously already do this, but not in a structured way*"[4].

Related to BEV-FC suppliers, interviewees from BEV-S1 demonstrated interest to work with additional suppliers, carry extra stock, implement strong communication with its customers, and solve logistics issues, whereas BEV-S2 stated to strongly make use of extra stock and raw material exchanges among its plants. These strategies are further discussed through examples and discussions. Lastly, all interviewees recognised the great importance of supply chain resilience after the explanation of this concept.

Figure 26 illustrates data analysis, sources of risk and uncertainties which cover internal, external and environmental risks and were fully cited by the interviewees in this case. Figure 30 portrays the sources cited by them. It is noticed that transportation issues was the most cited risk source that is likely to cause a disruption to BEV-FC, and it corresponds to general transportation problems, such as delays in deliveries due to breaks trucks, accidents and traffic jam. In sequence, demand vulnerability, problems in the supplier's production line and the poor Brazilian infrastructure of the roads are the most cited sources of risk. At this point, it is worth noting that some of the transportation issues might be caused by the poor infrastructure of the Brazilian roads.

> I'm fed up of hearing that the truck is stuck because of tax barriers. Often when the truck is carrying fractioned freight, it's bringing lots of people's material, and when there's a problem on a single route, everything gets stopped; or the road floods and the truck has to turn back, this has happened many times. So yeah, this is a weakness within this country (Mmint1s1) [5]

An interesting point to note is that only one out of twelve cited sources of risk can be considered an environmental risk, whilst the others are all external risks. So, although external risk is more likely to be manageable and avoidable, interviewees are aware of the events' unpredictability. Psale1s2 have asserted "*[...] the last holiday, for example, there was a lot of traffic on the motorways and consequently there were delays in deliveries. So, although we try to avoid it, this can happen*" [6]. Furthermore, most of the risk mentioned by the interviewees could be well-managed through effective communication between buyer and supplier so that managers would be better prepared to manage the available resources and respond in an effective way. Therefore, through identifying the intra- and inter-organisational issues, Procurement managers will be able to rearrange resources and mitigate risk. Along the discussion about the highlighted issues, some of these sources will be recalled in order to justify the importance of managing those issues.

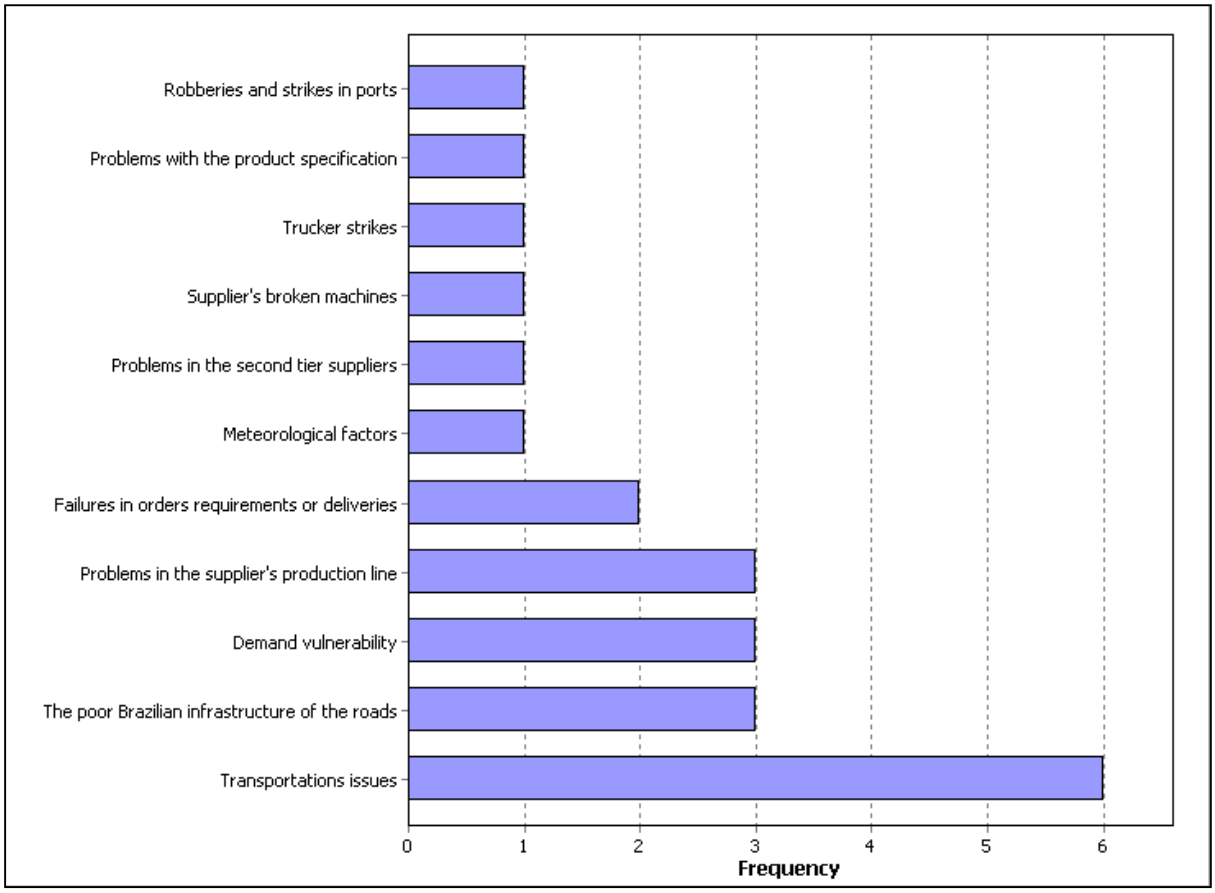


**Figure 30.** Sources of risk and uncertainties cited by interviewees in Case 1

Interviewees were also asked to give some examples of critical supply disruptions they have faced and the corresponding solutions taken by them in that situation. The examples covered a wide range of problems that mostly emerged upside of the supply chain, and were normally caused by external and environmental events. Table 25 exposes the examples, the actions taken to reverse the situation, and the main points/actions to overcome the situation.

**Table 25.** Real examples of supply disruptions in Case 1

| Examples | What happened and consequences | Actions taken to mitigate and/or cope with the disruption | Main points regarding actions and/or strategies to overcome the disruption |
|---|---|---|---|
| **Supplier's broken machine** | We had a vendor that had a broken machine. It was the major supplier of preforms, for pet bottles. We do not buy bottles, we buy pre-forms, which is an earlier stage of the bottle. And so, the machine broke; it took 30 days to get it fixed. Many manufacturers depended on it. (Mproc1)[7] | Thus, the spare capacity from other suppliers was used in order to meet this unmet demand by the other supplier. It's really difficult to have a break in production, especially when it's big break due to a lack of inputs. We don't have ... and there are 40 factories in Brazil. However, they're different groups, they are different companies; but in a crisis we can develop plans to switch the production to other factories. So there are a number of alternative solutions we can use in order to keep the market supplied. (Mproc1) [8] | ➢ Extra capacity from additional suppliers (multiple sourcing)<br>➢ Aid of BEV-FC franchises |
| **Bottle cap blackout** | In 2012, we had a blackout of covers. Why? We went into promotional campaigns involving a pincode on the cover. [...] but it's not just the cover. There's the cover, the label ... so there's no point, for example, sending out the cover without the pincode on the label. You're deceiving the consumer, right? Because you're telling them about the promotion and then the lid doesn't have the pincode on it, and there's also no point having the pincode and not communicating the promotion, because that's ineffective. So what happened, we had a series of campaigns, that the supplier ended up not being able to support, from inventories of semi-finished product to finished product, and when a blackout occurred, no one had covers. [...] So at certain points I had demand but production was stopped; which caused external breaks, segmented SKUs, some disruptions, sales disruptions. So it had a great impact, a negative impact. (Mplan1)[9] | What are the solutions we came up with? Let's work on the mainline for the cover and try to get the label from another supplier, right? So we transferred a little of the onus on the cover supplier to the label supplier: you need to manufacture all of that for me. And in the interim, we looked for other players, right, that had already been approved by the BEV. It was like this that we had handled this blackout, first, organisation. We have already the guy, committee's president that had already looked at everything. We have these suppliers with all these plants, with that consumption, what can we do? We can redistribute volumes among plants which have any surplus. We can distribute better volumes among players even if he cannot serve me. And why not develop, import? We have imported plants as well and we have retaken the supplier that had supplied us before, but that was no longer supplying. So then, how was the system answer? It was quick, organized, centralized. Everyone sought there for alternatives, either with new suppliers or importation or the use of cover without promotion, and even neglecting a campaign. (Mplan1) [10] | ➢ Product flexibility (standardization)<br>➢ Dual sourcing<br>➢ Knowledge acquired<br>➢ Aid of franchises<br>➢ Supplier development<br>➢ Importation |
| **Supplier's fire plant** | There was a fire at the supplier's plant and we lost almost all of our order. So we stopped production. [...] He called me overnight and said: 'the whole of next month's order, I can't deliver it to you because my plant caught on fire (Mproc1)[11] | So then, we were fine... But we appealed to the committee, right, the manufacturers' association, and they took the whole order and gave it to another supplier (Mproc1) [12] | ➢ Negotiating committee of key inputs<br>➢ Dual sourcing |

**Table 25.** Real examples of supply disruptions in Case 1 (continue)

| Examples | What happened and consequences | Actions taken to mitigate and/or cope with the disruption | Main points regarding actions and/or strategies to overcome the disruption |
|---|---|---|---|
| **Problem in supplier's production line (national)** | Well, there was a situation in which the manufacturer had a serious problem with his production line. In this specific case, it wasn't a logistic problem; it was an issue with lack of product. (Mmint1s1)[13] | And then what happened was that with their help, we had to import, ok? We imported from Argentina that is, it's the shortest delivery time. It isn't worth bringing it from Asia or Mexico, right? The shipping time would be very delayed. We brought by ship as well, and what happened? They identified the failure sometime in advance and it was possible to take these actions, right? But this happened a long time ago, this is not something that happens very often. And what we can do today is to keep a certain inventory level in an external warehouse, and we use big resin silos. (Mmint1s1) [14] | ➢ Supplier relationship (rapid identification of risk and information sharing)<br>➢ Importation<br>➢ Knowledge acquired<br>➢ Supply chain configuration<br>➢ Transportation mode<br>➢ Safety stock<br>➢ External inventory |
| **Brazilian protests against the government** | Yes, the protests have had a large effect! (Msac1s2) [19]<br>Very, very, very much, wow! We had many problems because of this, a lot of them. Because of the protests, the main roads were blocked, right? So we were stuck for three or four days. (Psale1s2)[20] | We had to reroute transport to other places, and so logistics was greatly impacted, because we had to check. For example, I left here to go to BH. So you go one way and get stuck, so then you have to come back and try another route, you understand? Basically, this has a huge impact. As is happening now in RJ, there are demonstrations against the World Cup, so we don't know what might happen. It might have an impact, you know? We're already seeing others. Then you have to look for other ways to overcome it, you see? It is unstable, though. (Msac1s2) [21]<br>We had to send goods from one side to the other; we received from one client and delivered to another. Here we've got a lot of distributors, right, so this is also spread all over Brazil. So what used to happen? Oh, the truck is stuck, it's in Rio de Janeiro and the delivery is to Paraná, what are we going to do? We call a nearby distributor and they send it. Afterwards, we sent it to the client. What's good for us is that we have three plants and there are many distributors spread across Brazil. So we're able to do it. But if we didn't have this, yeah, I don't know how we'd do it. (Psale1s2) [22] | ➢ Transportation mode<br>➢ Knowledge acquired/Lessons learned<br>➢ Multiple sourcing<br>➢ Supplier franchises |

**Table 25.** Real examples of supply disruptions in Case 1 (continue)

| Examples | What happened and consequences | Actions taken to mitigate and/or cope with the disruption | Main points regarding actions and/or strategies to overcome the disruption |
|---|---|---|---|
| **Shipping accident** | There's a resin that BEV-FC use, the pet bottle resin. It's a resin with a bias, it's not hugely different, but there is a sustainable bias and environmental issues and so on. It's a resin that contains a lower amount of pollutants, and this resin is imported; it is not made in Brazil; it comes from China or from Argentina. There was a situation where the ship bringing it from Argentina sank, and the resin didn't arrive. BEV-FC would go without. (Psale1s1) [15] | Our action was to inform [the customer] that we could provide the pre-form that they wanted with the normal resin. Because of this, BEV-FC had to do it, I think the label was already finished without knowing that the resin was for the pet bottle, but we had to ask to produce it, and this was the action. Informing [the customer] as soon as possible, so that BEV-FC could produce the label. (Psale1s1) [16] | ➢ Supplier relationship (communication) |
| **Traffic jam due to a Holliday** | What's been happening is that because of distance issues there have been lots of transportation problems. So, for example, I have a delivery estimate of 7 days from Bahia to the South, which is normal. But sometimes it can be 10-12 - why? Because there was a holiday, for example, and then there was a lot of traffic, and consequently, a delay. So, even if we try to avoid this, it still may occur. The load left our unit and unfortunately, it was affected by the traffic on the roads which caused a 2-day delay and affected the client.(Msac1s2) [17] | As we realized that we wouldn't be able to supply on time, we had to get material from their division and send it to the other. This has happened before: Curitiba provided the Porto Alegre unit with goods. This is my client's unit, so then we have to pay for the transport expenses, you see? (Msac1s2)[18] | ➢ Exchange between franchises |
| **Energy blackout in supplier's plant region** | At the end of the last year - we have a plant here in Itamonte where we only produce printed film now - but we used to produce out film there too, and due to the rain, one of those transmission towers, you know, fell down. Two towers fell and the whole city was blacked out. And so, there was no forecast for getting back to work, and it was at the end of the year, when our orders increase. Wow, a period like that is very hard. We talked to the clients, they didn't understand, we even had to send the news reports about the city blackout. So we completely lost power for a few days (Psale1s2)[23] | [The plan was] to get aid from Bahia, get aid from Lorena, but this had a huge impact on our sales; we even lost clients because of this. Because we didn't have material on time (Psale1s2)[24] | ➢ Supply chain configuration<br>➢ Supplier franchises |

Taking into account the examples illustrated in Table 25, it is possible that not only were the strategies found in the literature used to overcome those incidents, but new strategies have showed up, such as the aiding of franchises, importation, and the negotiating committee of key inputs. Importation is included in the supply base issue, considering that one of the suppliers may be located abroad. Furthermore, it was also interesting that not only franchises from BEV-FC were useful to ease bouncing back from disruptions, but BEV-S2 also has made use of this opportunity to respond to untoward events and restore its operation. Therefore, taking into account those examples, the key actions or strategies to mitigate disruptions reported by the interviewees from both sides of the focal company are; supplier development and relationship, knowledge acquired/lessons learned, multiple sourcing (supply base), negotiating committee of key inputs, franchises, safety stock (redundancy of critical items), external inventory, product flexibility, transportation mode, and supply chain configuration.

In addition to those actions or practices, interviewees have also suggested points of improvements that should be applied to their routines in order to achieve a more resilient supply chain. Internally, the suggestions were that the efforts and actions focused on risk mitigation (Table 26), while externally they were increasing commitment and collaboration from all members along the supply chain, especially from large companies to its suppliers; better supplier's alignment with the focal company planning; creation of groups to discuss possible risks within a particular supply chain and hence how to manage and cope with them; empowerment to make decisions; improving preventive actions; minimal safety stock in customer plants; and having its own transportation (Table 27). These suggestions are therefore considered to define the intra- and inter-organisational issues of this first case.

**Table 26.** Points of improvements regarding internal resources

| Internal suggestions | Statements of the interviewees |
|---|---|
| **Efforts and actions focused on risk mitigation** | I tell you: the company has been always concerned about holding periodic meetings to discuss the main problems, ok? From this, we make an action plan to face those problems and we follow up the actions periodically. But what happens is that we have a very lean company and often the daily routine overlaps these strategic affairs. Because nobody denies the importance of strategy, but in practice you need to make the thing work. If you worry only about strategy and the thing doesn't work, it's over. You need to find the balance between the operational and the strategic. But if they're separate, the operational always becomes more important. Yes, a lot of attention is paid to the diagnosis of major problems, the main difficulties, the main addictions and to treating them with defined actions. Also, we are assisted by some external consulting groups, and so on and so forth. But it is always a challenge. (Mmint1s1) [25] |

Regarding the external points of improvements reported by the interviewees, it is worth emphasizing that both BEV-FC suppliers have pointed out the need for improvements in members' collaboration along the supply chain.

**Table 27.** Points of improvements regarding external resources

| External suggestions | Statements of the interviewees |
|---|---|
| **Increasing commitment and collaboration from all members along the supply chain. Especially from large companies to its suppliers** | I think that one of the most important things that I see is people's commitment. Commitment in the way each does their job, but mainly looking at where it has an impact. What can be done to make the other successful? Collaboration. I think that if everyone does their tasks well, but also looks at how their job may affect others, how they can improve, I everything flows far more easily. (Msac1s2)[25]<br>Actually it's the following, like I said, it's a matter that is greatly based upon the difference in size of the companies. […] There are situations in which the size of the client influences the whole chain. […] So ultimately, there is some concern with the chain's efficiency from certain chain participants that are quite big. (Mmint1s1) [26] |
| **Better supplier's alignment with the focal company planning** | Planning sometimes takes place, but it's bad planning that generates a series of crises that could have been avoided if the planning had been done properly. So my suggestion is to focus more on that. I feel that we don't focus on this subject, as least in our sector. (Mmint1s1) [28] |
| **Creation of groups to discuss the possible risks within a particular supply chain and how to manage and cope with those** | I think it's interesting, the development of studies on this topic, because we suffer a lot here. And we are in the Northeast and a big share of our suppliers is in the Southeast, so we suffer a lot with logistics. […] We had a division in Manaus which is not operating anymore; it was even worse there, because the river rose and it was over. So, I think it's interesting to point out, to discuss that. I mean, I am mainly talking about logistics, but the chain as a whole must be discussed, in order to be aware of loads of situations that occur (Mmint1s1)[29] |
| **Autonomy to make decisions** | Maybe that suggestion that I talked about, of improving autonomy, or of having a more autonomous buyer or closer to their buyers there, maybe something like that would really help. (Msale1s1) [30] |
| **Improving preventive actions** | It's too superficial, I guess. And as we always have a solution to their problems, we let it go, we chill out sometimes, you know? I think it should be more preventive. The Procurement staff should work more on prevention. And, well, in terms of solving problems… They, when it happens, just demand from me, because someone is telling them that the plant is going to stop, you see? (Psale1s2)[31] |
| **Minimal safety stock in the customer's plant** | So, it's like I said: a lot of clients, they realise that they're missing films at the last minute, yeah. And I think there must be a minimum stock, a safety stock, you know? Because even if we have film ready, we also have to rely on other things, like transport, right we must trust that the transport will be swift and so on. So, I mean, I think it would really help to have a safety stock, you see? (Psale1s2) [32] |

Following this data analysis, the interviewees additionally reported barriers and enablers to creating supply chain resilience. Table 28 summarizes internal as well as external barriers and enablers pointed out in this case. Two considerations about them have to be made. First, barriers and enablers are still recognised in this study as opposites in some points (for example: enabler - integration; barrier - lack of integration). Second, some of the barriers and enablers stressed in this case go beyond the Procurement actions, in the sense that it is

not under Procurement or even companies actions (*e.g.* high tax transportation or bureaucracy from different states). It is therefore not included in the discussion.

**Table 28.** Barriers and enablers to helping create resilience in supply chains

| Barriers | Enablers |
|---|---|
| ***Internal*** | |
| Lack of capacity<br>Leadership profile<br>Vertical hierarchy | Internal integration<br>Alignment<br>S&OP<br>Information sharing<br>Physical proximity of workplaces |
| ***External*** | |
| Lack of external integration<br>Lack of collaboration and communication<br>Production planning mistakes<br>Lack of supplier capacity<br>Supplier financial problem<br>External approvals<br>Lack of substitutable supplier<br>Lack of alignment between buyer and supplier<br>Long distances<br>Poor road infrastructure<br>High tax transportation<br>Bureaucracy from different states<br>Outsourcing transportation<br>Rare and poor service of outsourcing transportation at north of Brazil | Franchises acting like an emergency unit<br>Negotiating committee of key inputs<br>Contingency plan<br>Flexibility<br>Visibility along the supply chain<br>Agility in communication<br>Autonomy to make decisions<br>Quick reaction to supply customer<br>Team coaching<br>Supplier's preventive machine maintenance<br>Acquisition of good quality raw materials<br>Critical contract analysis<br>Commitment and knowledge to find solutions |

It is important to identify the issues of creating supply chain resilience. The following analysis is more directly focused on Procurement intra- and inter-organisational issues responsible for preparing the company from unexpected events, responding to disruptions and recovering from them. Moreover, considering the amount of information reported by the knowledgeable interviewees (most of them have worked for more than 10 years in this beverage supply chain), this analysis is especially focused on actions and strategies taken to overcome uncommon disruptive events which might derive from internal, external or environmental causes. The following paragraphs present the issues found in this first case study. Table 29 summarises all of them by classifying into intra- and inter-organisational issues and from where they showed up throughout the data collection.

**Table 29.** Intra- and inter-organisational issues from Case 1

| Type | Issues | What is it included into it? | Sources of risk | Example | Points of improvements | Barriers | Enablers | Discussion |
|---|---|---|---|---|---|---|---|---|
| INTRA-ORGANISATIONAL | **Knowledge acquired and backup** | lessons learned from past experiences; knowledge to find solutions | √ | √ | | | √ | √ |
| | **Internal communication** | information sharing | | | | | √ | √ |
| | **Technological methods to discover, recover and redesign the supply chain** | quality tools to identify likely risk | | | | | | √ |
| | **Redundancy of critical items** | safety stock | √ | √ | √ | | | √ |
| | **Product flexibility** | increasy internal production capacity; | | √ | | √ | | √ |
| | **Risk management** | groups to discuss possible risk and how to manage them; preventive actions development; supplier's assessment (financial health and capacity); contracts | | | √ | √ | √ | √ |
| | **Procurement structure** | empowerment to make decisions; leadership profile; vertical hierarchy; | | | √ | √ | √ | √ |
| INTER-ORGANISATIONAL | **Supply base** | importation from na international supplier; multiple sourcing vs. single sourcing; branches | √ | √ | | | √ | √ |
| | **Supplier development** | substitutable supplier | | √ | | √ | | √ |
| | **Supplier relationship** | buyer-supplier communication; rapid identification of risk and information sharing; commitment and collaboration; alignment and visibility along the supply chain; external integration; | √ | | √ | √ | √ | √ |
| | **Supply chain configuration** | plants and supplier's plants location | √ | √ | | | | √ |
| | **Transportation modes** | choose alternative mode to increase the response | √ | √ | | √ | | √ |

**Knowledge acquired and backup.** All interviewees from this triadic have emphasized the great importance of knowledge acquired to prepare the company to deal with critical supply disruptions, especially when this knowledge comes from lessons learned. This issue was clearly demonstrated through the above examples, in which BEV-FC as well as BEV-S1 and BEV-S2 made use of this intangible resource. Furthermore, in dealing with different types of disruptions over the years, managers become capable of better managing internal and external companies' resources in order to re-establish the normal operating performance. Mmint1s1 exemplifies this issue by emphasizing another further discussed issue (supplier base).

> Ah yes; look, in the past we've had problems of this nature [with suppliers]. So today, well not just today as we've been doing it for some time, our solution is to not have any kind of exclusivity with certain suppliers. (Mmint1s1) [33]

Although no formal way to record the lessons learned was found in BEV-FC and BEV-S1, Mproc1 justify it by affirming that the close work environment (internal enabler previously exposed by them) helps to effectively share important information (which points out the next issue). On the other hand, BEV-S2 has affirmed the existence of a formal way to register problems and solutions through customer service registrations.

**Internal communication.** Interviewees have fully agreed that communication is a strong business tool to share useful information and get ready to respond to and recover from unusual situations. This communication was emphasized not only within the organisations, but also along the suppliers (between BEV-FC and BEV-S1/BEV-S2). "*The better the communication, the faster the problem gets solved, both internally and externally. Remember those barriers that I told you about - I believe that a greater proximity can help with them*" (Msale1s1)[34]. The external communication is considered as an element of good supplier relationship. In regards to internal communication, Procurement was especially pointed out as an important function that plays a strategic role between internal customers and suppliers.

> In fact, we have a strong connection with all our internal customers. So you could say that the whole company works in purchasing, right? This is because everyone has a particular need. We are a function that attends to the company as a whole. There are functions with higher demand, others with lower, but all of them need something from us. (Mpurc1) [35]

**Communication tools.** Regarding communication, no electronic data interchange (EDI) that connected focal company (BEV-FC) system to its suppliers (BEV-S1 and BEV-

S2) was found. The technological ways used to improve communication were e-mail, Skype and internal system similar to the ERP (Enterprise Resource Planning).

**Technological ways to discover, recover and redesign the supply chain.** On the other hand, BEV-FC has a system that integrates all information about the consequences and results of a problem, and then helps develop an action plan to cope with that particular problem. To do so, it makes use of quality tools, such as PDCA and Ishikawa graph, and involves internal business functions as well as the corresponding suppliers. Regarding suppliers, only Mmint1s1 from BEV-S1 has confirmed the existence of a quite similar system to the BEV-FC, however he also states that it is not well used on a daily basis.

> We have a governance system of integrated management. If there's an external break; ok, let's make an action plan, let's execute the PDCA, root cause, Ishikawa, let's see what we can do. The action plan, in a well-defined way, communicates, involves suppliers, and involves other function areas such as sales - if there is a disruption, and no product, they need to be involved (Mplan1) [36]

**Redundancy of critical items.** It is known that redundancy is a well known characteristic of developing supply chain resilience. Thus, in all three companies, interviewees have affirmed the importance of holding additional inventory to mitigate the variability of the raw materials along the supply chain. Although all interviewees have asserted the need of a trustful safety stock, BEV-FC seems to work with low volume of stock aiming to reduce cost. This is technically and theoretically all right to some extent, however interviewees from both suppliers have asserted that BEV-FC requires a higher stock from its suppliers so that they are able to promptly supply it in case of any emergency. This can be observed even through Mpmp1 statement: *"[...] We depend on them; so their stocks have to handle the changes in demand in order to keep us supplied. Otherwise we can't do anything. This is our limitation"*[37]. However, Mproc1 from the BEV Corporation has stated that in times of high demand, they do increase the internal stock volume (raw material as final product).

Furthermore, interviewees from BEV-S1 and BEV-S2 have affirmed that stock is therefore their main tool to deal with supply disruptions. In this vein, the impact of this issue is sometimes criticized due to the high cost to maintain it. Nevertheless it gives time to the companies to find an effective way to solve the problem. To complement this discussion, Mmint1s1 highlights the importance of studies focused on finding other efficient ways to maintain the business working without holding to much stock.

> I find it interesting, the development of studies in this direction, because we suffer a lot regarding this subject [stock]. We are in the northeast and many of our suppliers are in the southeast, so we suffer a lot with logistical issues. With regards to road problems, the cost of freight is very high, especially when there's increasing bureaucracy in some states; Because of all of these factors, I'm forced to increase my stock. (Mmint1s1) [38]

Regarding suppliers holding higher stock to promptly supply their customers, interviewees from both suppliers have reported that this is not a good option considering that BEV-FC might change the specification of its production, which in turn, would imply that raw material changes. So that, all the stock from that particular item have to be discarded and the cost will not be returned. "*My customer might change their product specification and this will impact on my stock. Basically it's wasted money*" (Msac1s2) [39].

**Product flexibility**. In this regard, interviewees from BEV-FC admitted to have a sort of flexibility in product manufacturing by having substitutable items. In fact, they affirmed that substitutable products and communication are critical factors to be managed. "*I don't know if it's a barrier or an impact, but we work to avoid the impact when it happens. We try to work with substitutable products, whether it is final product or raw material, or even communication. I think these are critical factors* " (Mpmp1)[40]. Regarding BEV-S1 and BEV-S2, interviewees have reported that they do not have such flexibility to customer's product due to their product's standardization. On the other hand, they have a simple process to manufacture the raw material required by BEV-FC. In this regard, **standardization** can be considered a way of having further product flexibility. "*It doesn't work like that, so I have a problem regarding flexibility, but at the same time I keep my process simple because I don't have a lot of different raw materials*"(Mmint1s1)[41]. They also affirmed that it is possible to make some exchanges in the composition of the focal company's item. However, the cost is always higher. In this respect, Psale1s2 has asserted that BEV-S2 has a specialist in customer's product, and in case of any emergency they study ways of changing the raw material specification to fit in what customer wants.

> [...] in this case, product flexibility that aims to simplify the process is already embedded in the process, because the production process is simple... it's not complex to do. (Mmint1s1)[42]

**Risk Management**. Recognising that resilience is a result of some companys' strategic actions and decisions which aims to prepare the supply chain to effectively respond and recovery from disruption, risk management is an essential issue that needs to be considered. By observing the business environment and market behaviour, managers usually

apply their knowledge to manage risks likely to happen. In this regard, BEV-FC as well as BEV-S1 and BEV-S2 showed to be aware of incidents that might happen even though they continuously execute practices to mitigate them. "*Can incidents happen? Yes. Could [a plant] catch fire? Yes. But this is the responsibility of this committee, to analyse and deal with these incidents that may occur*" (Mplan1)[43]. Interviewees from BEV-FC reported other risk management practices, such as strategic safety stock, contracts, KPI's management, supply audits, supplier relationship focused on long term partnership (it provides visibility and collaboration to share risk along the supply chain), verification of supplier's capacity, dual or multiple sourcing for critical items, analysis of supply and demand, and contingency plans. The last practices are performed by the members of the negotiating committee of key inputs so that the decisions are centrally made. In this context, Mplan states "*So I see it this way; our supply chain is focused on purchasing (Procurement); that's how I understand it. This is the main strategy to mitigate anything*"[44].

Furthermore, Procurement from BEV-FC has a strategic purchasing matrix (spending vs. product complexity) in which each item is located in a quadrant, and each of these four quadrants has different strategies to purchase them. Additionally, Mplan1 reported the existence of a corporation's group of incidents management that is located in the headquarters of BEV (in the United States). Thus, when a very critical incident occurs, it is reported to this group, which will decide what kind of action is going to take place in order to diminish the economical losses as well as the consequences for the company's image.

> "The structure of all this assures me that I mitigate the disruptions; it is more or less because of this that we see a supply chain, or a procurement process, that is able to create resilience in a supply chain." (Mplan1)[45]

Risk management is also applied by BEV-FC suppliers' (BEV-S1 and BEV-S2). Interviewees from BEV-S1 reported multiple sourcing for critical items, strong external communication, changes in transportation, verification of possible changes into the focal company' scheduling (BEV-FC), and strategic safety stock. Regarding BEV-S2, interviewees asserted strategic safety stock, multiple sourcing, supply chain configurations of their franchises, risk analysis especially made by customer service department, and product development specialists who help change product configuration in order to adapt to customer needs in times of emergency. These specialists are strategicly located nearby the customers. Msac1s2 from BEV-S2 affirmed that when there is a critical supply disruption, they take urgent actions (such as finding a way to send the needed raw material as soon as possible)

and only after attending the first customer's needs, they follow the formal procedures to register the problems and further solutions.

> And we have specialists that BEV-S2 offers to customers for free. [...] So, we have about 10 technical specialists, with each in a region located as close as possible to the customer, right, so that we call them and they immediately can go to the customer. (Msac1s2)[46]

Although both suppliers presented well-established risk management practices, it is interesting to highlight that they take all these risk mitigation actions without having them as a formal procedure; at least from the Sales perspective. This can be realised through Psale1s2 assessment: "*Well, I think they are in place [assessment procedures and risk identification], but I can't tell you how it's done*"[47]. Thus, as a result of the risk management analysis, it is observed that risk management (issue) additionally involves the management of other issues, such as redundancy of critical items that has already been discussed.

**Supply base.** Looking at outside of the focal company (BEV-S1), there are some other issues that have to be considered by Procurement to create supply chain resilience. Not surprisingly, the supply base is definitely an issue to BEV-FC. However, BEV-S1 and BEV-S2 are also aware of the benefits of not depending on a single supplier. Therefore, they prefer having more than one supplier for a critical item in order to not risk any shortages in supply to their customers (in this case, BEV-FC). What it is particular interesting from BEV-FC and also from BEV-S2 perspective is that the aid of their franchises in acting as suppliers when a disruption happens.Although this company may depend on a single supplier when there is no substitutable suppliers in the market, they normally make exchanges between franchises. Also, as the negotiating committee of key inputs has a list of main suppliers, BEV-FC will always have multiple options to overcome any shortage. Also, they do have a special item in which they depend on a single supplier, but in this case, they have strongly affirmed that this supplier has a robust process besides having an extra capacity to supply all the BEV plants.

> Cover, for example, is a case. In this situation, we had 70% of cover orders from only one supplier, and we slowly began to lower this percentage, why? Because if you have all your eggs in one basket, the potential risk is greater. (Mplan1) [48]

> In the past, we have had problems like this, so today we don't have any kind of exclusivity with any suppliers. [...] I never give a purchase order to just one supplier. I go even further than two suppliers; today we work with 3 or 4 suppliers. [...] Increasing inventory is not a desired solution, but it's necessary to avoid the kind of problem we have when we have few suppliers, and few supply alternatives, right? (Mmint1s1) [49]

Strategically, they also import items from suppliers abroad due to the lack of national substitutable supplier. It can also be considered as a supply chain configuration strategy (further issue), in which companies choose to have suppliers in different locations so as to avoid general losses if some disastrous event happens at that particular location. "*Today we have one supplier within the country, and we also import resin from some Asian manufacturers and one Argentine manufacturer*" (Mmint1s1)[50].

**Supplier development**. Regarding the lack of substitutable suppliers, some companies choose to develop new suppliers. However, this is not the main concern of the BEV-FC, knowing that it prioritizes large suppliers that are capable of having enough capacity to supply the BEV's plants. Nevertheless, they opt to develop new suppliers after critical situations. In this regard, Mmint1s1 from BEV-S1 asserted that there was an occasion in which they had to develop new suppliers, but it did not aim to supply large suppliers, such as BEV-FC. For BEV-FC products, Mmint1s1 affirmed that besides receiving the product specification, they must also purchase raw materials from the specific suppliers approved by BEV-FC.

> what happens? each manufacturer works with a particular resin, and our major customers, which are the most demanding, they say, look: I accept pre-forms with these types of resins: X, Y and Z, from manufacturer A, B and C. (Mmint1s1)[51]

**Supplier relationship**. The results from both sides of the focal company have shown a good relationship between BEV-FC and its suppliers BEV-S1 and BEV-S. In this context, Mplan1 have asserted that "*[...] disruption is something we mitigate through partnership*"[52]. Thus, BEV-FC promotes coaching and workshops to their suppliers as a way to get all of them together and make the relationship stronger. Interviewees from the focal company have emphasized that besides intensively sharing information, they also share possible risks with suppliers and this increases the level of collaboration and trust. For this reason, they support each other in time of need.

Procurement managers and Sales managers are constantly exchanging useful information in order to guarantee good results for both sides. According to Figure 29, the relationship happens especially through Procurement from BEV-FC and Sales from BEV-S1 and BEV-S2. In this respect, Mmint1s1 from BEV-S1 affirmed that they must always be aware of BEV-FC changes in products and demand, so that they are capable of adapting and preparing their processes to promptly attend them. In order to increase the supply response,

Msale1s1 complements that BEV-S1 has an employee who stays in BEV-FC plant; so that, any information is more rapidly exchange between these companies.

> Every customer decision I make is related to sales; so in that situation I'm in the Sales department. So for example, I have direct contact with Procurement there. [...] I try to work in the most transparent way possible, so that they trust me and I'll trust them too, you know? (Psale1s2)[53]

**Supply chain configuration.** This was also considered a relevant issue in this case due to strategic decisions to reconfigure the supply chain in order to mitigate risk. It is well observed in one of the above examples - the energy blackout in the supplier's plant area - where they made use of the strategic location of the franchises to overcome the crises. Additionally, Procurement managers from BEV-corporation and BEV-FC observe the location of the suppliers to reduce lead time. If the closes supplier has any problem, they have other suppliers that will probably supply them. Regarding this issue, it is worth to note that due to BEV-FC and BEV-S2 work with franchises, they can fully use them to change routes in case any operation fails. Furthermore, interviewees from BEV-S2 reported that they already borrowed items from one customer's additional stock to delivery to another customer nearby. This could help them to give a rapid response to its customer and therefore easily bounce back to its original operation.

> As we have other franchises, sometimes we can even borrow from the other franchises, which we do here, which the other franchises also do.. if there is a lack of some item in the market, they call us, we check if we have this item in our stock, then we transfer it and they pay us, got it? You have this resource when you have franchises that work with the same things.. it's easier for us. This is a resource we have. This is different from some other companies, in that they are on their own. (Mpurc1)[54]

**Transportation modes**. When the matter is transportation to supply the focal company on the right time, it becomes a critical point. Especially in this case in which the most cited sources of risk and uncertainties were the transportation issues. Thus, to overcome supply disruptions emerging from transportation or any other source, changing the transportation mode or the route can help the company be resilient. Both suppliers in this study (BEV-S1 and BEV-S2) are responsible for delivering the order at BEV-FC. Although most of the deliveries from these suppliers are made by road, BEV-S1 has shown to make use of this strategy as a way to improve the response to its customer if an unexpected event took place (*e.g.* the Brazilian protest against the government). Therefore, in case of turbulence, Procurement and Sales managers discuss to find an effective way to delivery to raw materials to the focal company. Interviewees reported situations in which airplane was used as a way to

make the delivery faster and consequently mitigate the consequences of a supply's fail (*e.g.* problem in supplier's production line).

> This is a problem here in Brazil. So, to avoid this, we purchase resin in two ways, through two modes; coastal shipping and road transport. Coastal shipping is lower cost, however the transit time is much higher; so we have road transport as plan B. If we have problems with delays in shipping, or if a ship is cancelled at Salvador port, we can bring the resin by truck in two days (Mmint1s1)[55]

Overall, it was observed that focal company as well as suppliers are very concerned about the importance of an effective recovery from any disruption. Therefore, they are always looking for ways to improve their actions through the daily knowledge acquired.

> No, it can't be ok. It's never going to be ok, I think we have to constantly seek improvement because if everything is alright, things aren't good. We're always having meetings to assess what we can improve, looking at possible suggestions from other functions, the volume demand from the functions themselves, the interfaces between each other that can always be better connected, so that things flow more easily, you know? (Msac1s2)[56]

To sum up, Table 29 illustrates all of the issues found in this case, in addition to classify them into intra- and inter-organisational issues and representing where they have emerged. Through these issues, we found that Procurement function in BEV-FC plays an important role in managing those intra- and inter-organisational issues so as to create supply chain resilience. In order to achieve this, Procurement adapts, integrates and reconfigures BEV-FC's resources (which are information, knowledge, franchises, critical items, technologies, products and suppliers) through practices and routines (*e.g.* supplier's assessment and identification of the negotiating committee of key inputs, volume and price negotiation in the supplier relationship, and development of contingency plans which have to be supported by internal customers) in order to cope with supply disruptions. Furthermore, Procurement managers have reported their increasing experience considering the knowledge acquired from lessons learned of past critical disruptions (examples highlighted above). As a result, Procurement managers or commodity buyers, in this case, are responsible for managing and controlling intra- and inter-organisational issues strategically, by rearranging company's resource through knowledge acquired. This procedure fits the rationale of dynamic capability theory presented in chapter 2 (Basic Literature Review) in which Procurement builds dynamic capabilities through value-creating strategies (resilient strategies) so as to achieve or sustain competitive advantage under an uncertain and volatile environment. Ultimately, interviewees' statements can justify this affirmation from BEV-FC as well as BEV-S1 and BEV-S2.

## 5.2 Data analysis and general results from Case 2 (KAPPL)

The second case is composed by a dyadic (focal company and two of its first tier suppliers) embedded in a household appliance supply chain. The focal company is a well-known multinational company, which has been ranked as the world's second-largest appliance maker by units sold. Currently, it has sold more than 5 million products from 8 strong brands in around 150 countries, however the highest sales have been in US and Brazil. In Brazil, it holds 5 plants in three different cities in which it employs around 8000 people. Both suppliers included in this study are responsible for supplying the focal company (which is named as KAPPL-FC) with specific raw materials to manufacturer three important products. Regarding the suppliers, one of them is titled as KAPPL-S1, while the second one is KAPPL-S2.

KAPPL-S1 and KAPPL-S2 are both small companies but important suppliers to KAPPL-FC. KAPPL-S1 is a national metallurgical company created in 1960, and provides a specific component to KAPPL-FC products since 2004. The production volume of this particular item is around 80 thousand components per month, and 50% of them are destined to KAPPL-FC whilst the other 50% goes to a KAPPL-FC competitor company. KAPPL-S2 is also a national organisation with 23 years in market, and it is responsible for providing wood structure (pallets) to pack KAPPL-FC products. The production volume of this item is around 30 thousand items per month. Both suppliers provide raw materials to other large companies, so that they have additional production capacity within a competitive market.

As this study is focused on identifying particular Procurement actions that cope with critical supply disruptions so as to create supply chain resilience, seven people were interviewed from these three companies contacted for this case. Table 30 illustrates companies, roles and codes that represent each interviewee in this second case analysis.

**Table 30.** Interviewed people in Case 2

| Company | Role | Codes |
|---|---|---|
| KAPPL-FC | Inbound Logistics Manager | Minlog2 |
| KAPPL-FC | Production and Planning Control Manager | Mppc2 |
| KAPPL-FC | Transport Manager | Mtransp2 |
| KAPPL-FC | Purchasing Manager | Mpurc2 |
| KAPPL-S1 | Head of the company | Hcomp2s1 |
| KAPPL-S1 | Admin assistant | Aadm2s1 |
| KAPPL-S2 | Sales Person | Psale2s2 |

Following the rationale of the first case for structure, the three companies in this case have a traditional vertical hierarchy as well, but as it was stated before the main interest in this study is to focus on the horizontal relationship between buyer and suppliers. Ergo, Figure 31 shows the general structure of the relationship between focal company (KAPPL-FC) and its suppliers (KAPPL-S1 and KAPPL-S2).

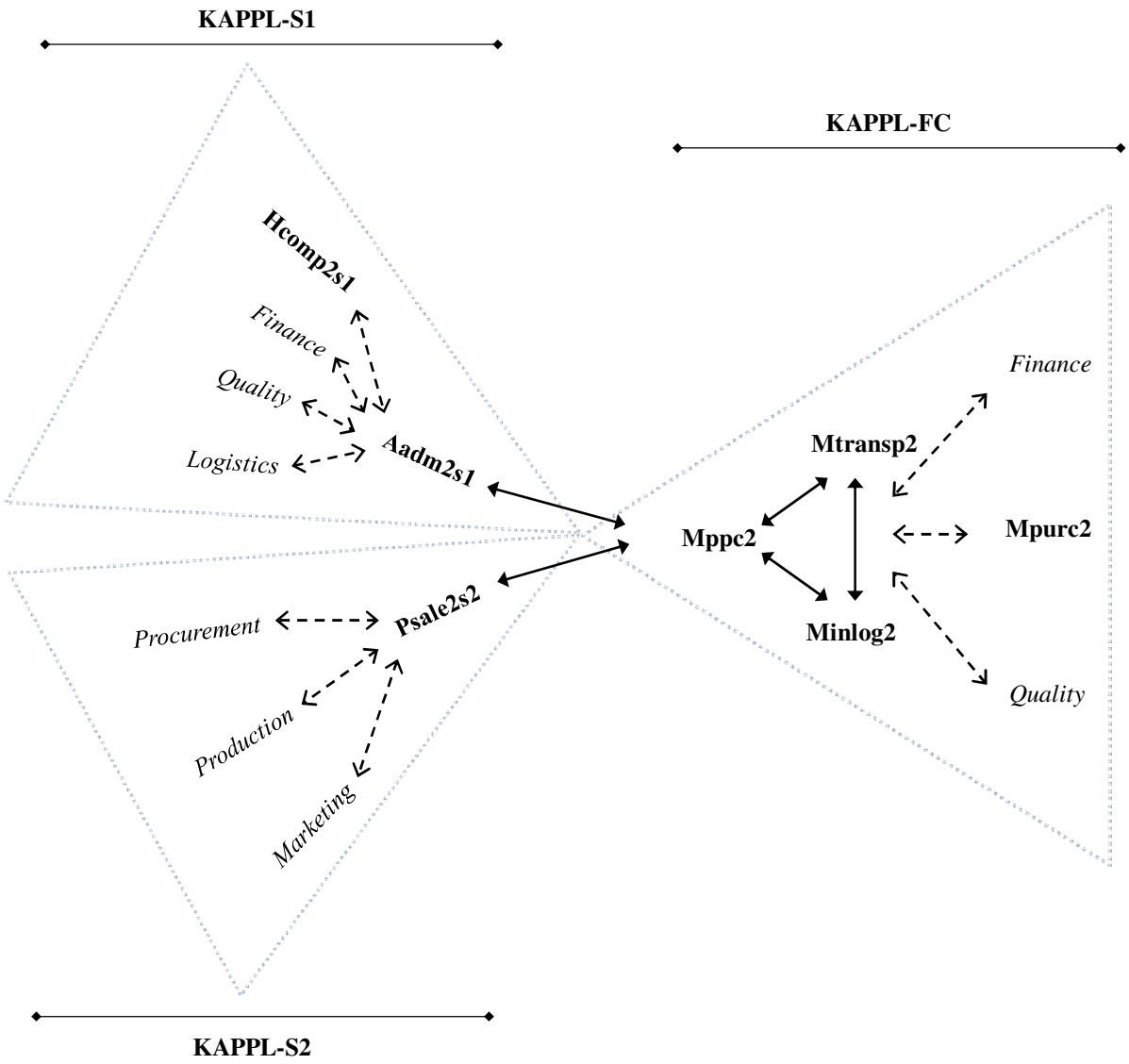


**Figure 31.** General structure of the double dyadic in Case 2

As in Case 1, this follows the bow-tie or basic buyer-supplier relationship in which one particular person from each side of the dyadic is responsible for sharing information and managing the flow of raw materials between companies. Differently from Case 1, however, the main function responsible for updating and often sharing information with the suppliers is

the Planning and Production Control (manager and its assistants). Hence, they work in the Production department, which is closely linked to inbound Logistics and Transportation. For this reason, they must be aligned in order to constantly share information.

Information about purchasing orders and level of stock between this dyadic pass through Mppc2 and Aadm2s1 from KAPPL-S1, or Mppc2 and Psale2s2 from KAPPL-S2. It is worth emphasizing that Mppc2 is responsible purchasing more than 150 different types of raw materials; thereby this person has a team to execute this task in an effective manner. In this sense, Aadm2s1 and Psale2s2 may directly contact Mppc2 as well as one of the team workers.

The reason why Production people directly contact suppliers is because this plant works with the kanban system, which means often and controlled deliveries, and low levels of stock. Thus, Production people are checking the delivery orders and updating the inventory level on a daily basis, while Procurement function is responsible for price negotiation and other strategic decisions. Consequently, Procurement employees (in this particular focal company) take control when a critical supplier problem arrives (for instance, supplier financial crash), since Mppc2 does not have power to deal with it.

> So we act like this, but the first sign from suppliers is given by inbound logistics and PCM. They tell me: look, we're having sourcing issues with this supplier. Then, we make contact with the supplier in order to check what's going on, if there is problem, I'll go to the supplier plant. (Mpurc2)[1]

Each plant has an in dock buyer that has the role of linking production and company's strategy, and hence taking control of critical situations in case of any emergency with the suppliers. Nevertheless, they must report the case to the corporation managers afterwards, who in turn, sends orientation to deal with the critical supplier issues. The Procurement centre of the focal company is based at the corporation (other plant) where most of the supply strategies are developed. They are also responsible for planning and ordering commodity items or those items with long lead times (imported items, for example).

Figure 31 therefore represents a standard way to exchange information between focal company and suppliers. Internally, Sales and Production or inbound Logistics functions from each side of the dyadic are responsible for sharing information within internal functions so as to orchestrate and align the companies' activities. By understanding this structure, it is possible to realise how internal relationship among functions is important to Procurement developing strategic actions to mitigate risk or cope with supply disruptions. In this sense, Mpurc2 states that "*When large disruptions occur, all VP's, the vice presidents of logistics,*

*engineering, procurement..., everyone who has a connection to the situation will assemble in a work group [to discuss the problem]*" (Mpurc2) [2].

Even though Procurement does not have direct contact with suppliers in this particular plant, it does play a strategic role within the focal company regarding critical decisions related to suppliers. In this context, activities involved in Procurement function in this case are: identification and classification of capable suppliers; negotiation of the specific purchasing item, price, payments and volume; contracts; supplier development; analysis of supplier financial situation; and support to other areas, such as Production and inbound Logistics.

About supply chain resilience, six out of seven interviewees have never heard about this concept, and only one has heard this term but did not know how to explain it. Regardless of their knowledge about this new supply chain approach, interviewees have reported many resilient strategies and actions to deal with critical supply disruptions. However, they name it as activities to avoid flow breaks. In fact, KAPPL-FC seemed to have a huge concern with disruptions, especially because they apply just in time philosophy; so that they constantly work with information by checking the purchasing orders, deliveries and level of stock in order to maintain continuity of the operations. But as important and strategic as in Case 1, Procurement function from KAPPL-FC seemed to have a well-established and well-known procedures to manage risk in their routines through reconfiguring resources (internal or external) and managing them differently to particular situations. In this regard, Mtransp2 states "*Everyone here, from Production and Planning Control managed by Mppc2, to Goods In managed by Minlog2, or to transportation (me), we have the same goal - avoiding disruptions*"[3]. Conversely, interviewees from KAPPL-S1 and KAPPL-S2 have affirmed to work with extra suppliers and moderate safety stock as a way to reassure supply to KAPPL-FC. Subsequent to the concept (supply chain resilience) introduction, all interviewees recognised the great importance of this approach in their business, and hence mentioned corresponding activities responsible for coping with risk and uncertainties faced by the business.

Following the previous rationale for the data analysis, the internal, external and environmental sources of risk and uncertainties cited by the interviewees are exposed in Figure 32. And although KAPPL-FC showed it was alert to those risks, they are also aware that unexpected events are likely to occur. In this sense, Mpurc2 asserts "*KAPPL-FC, in general, is very concerned about these [risks] and invests a lot in avoiding them, through*

*security, through training, and in many other ways. But losses are likely to happen, even when taking care.*"[4].

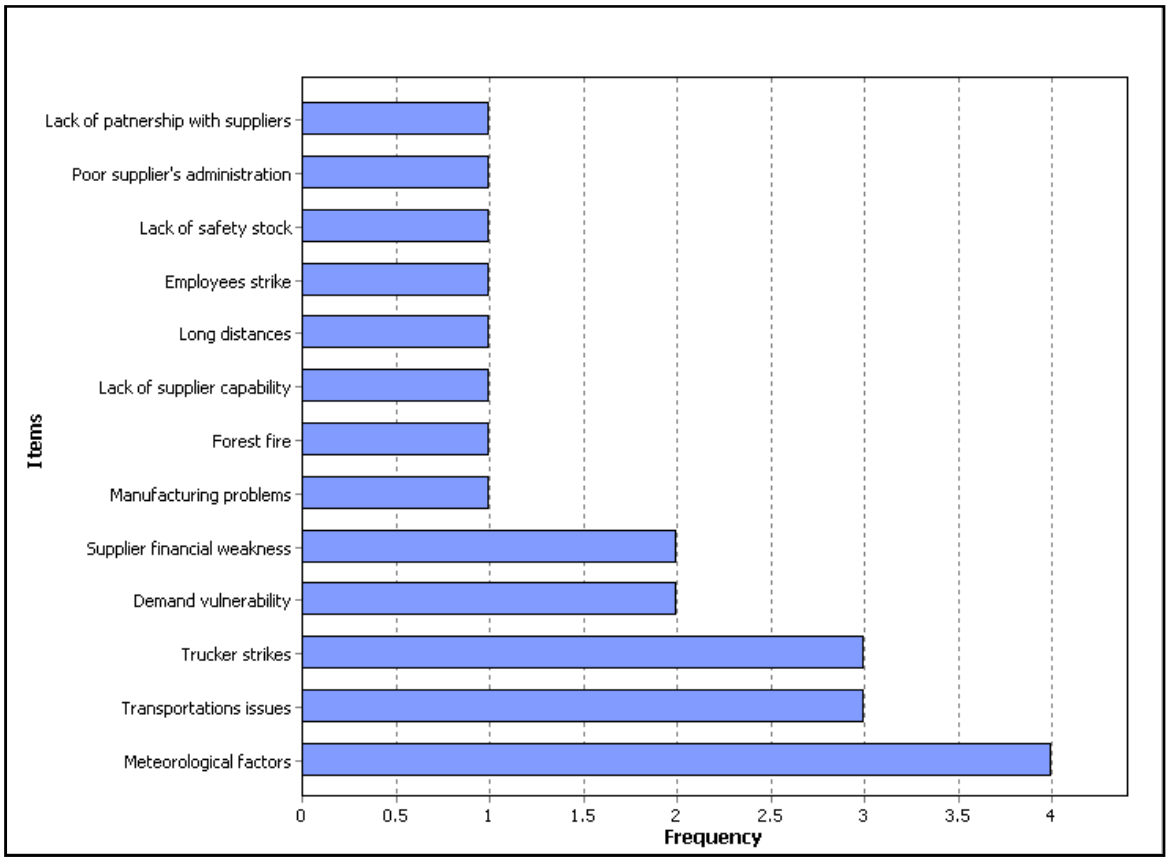


**Figure 32.** Sources of risk and uncertainties cited by interviewees in Case 2

Figure 32 shows that meteorological factors are more often cited than transportation issues in this second case. The reason is that KAPPL-FC requires on time suppliers' delivery, and both interviewed suppliers are highly vulnerable to changes in the weather to safely delivery the raw materials to KAPPL-FC. In this regard, high level of stock is their main action to avoid supply disruptions. Second, transportation is also a critical factor to KAPPL-FC since they apply the just in time system, as mentioned before. Thus, transportation issues and trucker strikes may really impact the focal company performance.

In spite of the fact the some risks will increasingly impact KAPPL-FC in comparison with others, Minlog2 highlights how different variables can influence the company's operation and performance, and how it is related to resilience.

> [...] you have lots of variables that can influence releasing or not releasing a manufacturing order. For example… a machine breaks, a batch gets rejected. So, resilience is not only a result of supply disruption, but other factors that can contribute"(Minlog2) [5]

In the same vein, interviewees of these dyadic were asked to give some examples of critical supply disruptions they have faced and the subsequent solutions taken by them in that situation. The examples given by them covered a wide range of problems that mostly surged upside of the supply chain, and normally emerged from external and environmental causes. Table 31 portrays the examples, actions, and key points of the decisions.

Taking into account the examples presented in Table 31, it is possible to realise that not only strategies or issues found in the literature were pointed out as actions to overcome untoward events but also new strategies have showed up, such as allocation of KAPPL-FC people to administrate supplier's production, purchasing raw material to suppliers, and changes in production scheduling. Regarding these actions, it is worth mentioning that purchasing raw material from suppliers and allocation of KAPPL-FC people into the supplier's administration was just an emergent action to temporarily mitigate that problem. The permanent solution was the identification of a second supplier for that particular item, so that they will no longer depend on a single supplier. On the other hand, changes in production scheduling are considered a particular case for Production decision in this study so that it is not under Procurement role. However, it is up to Procurement managers to share external information with internal customers and keep them updated about unexpected events.

Therefore, taking into account those examples, the key actions and strategies to mitigate disruptions reported by the interviewees from both sides of the dyadic are: supplier development and relationship, lessons learned, product flexibility, dual sourcing, safety stock and supply chain configuration.

**Table 31.** Real examples of supply disruptions in Case 2

| Examples | What happened and consequences | Actions taken to mitigate and/or cope with the disruption | Main points regarding actions and/or strategies to overcome the disruption |
|---|---|---|---|
| **Supplier financial problem** | We had a supplier that provided a specific item to the product X line which is essential and is used in all of them. And suddenly we had some disruptions, problems. When we evaluated this supplier, we did a financial evaluation and we saw that they were broke. For example, they had serious financial problems, serious managerial (administrative) problems and we took several actions to control it. Nowadays, they are better, but still under analysis, right? We know that they've been sick and are not yet fully healed. (Mpurc2)[6] | We've been monitoring them, mainly with regards to the planning part (because there wasn't anyone that scheduled their plant right), so we left allocated people there all day for several days, in this supplier's plant in order to be able to manage the stock, the production management for this vendor, because they started to lose people. They went through a bad financial period, where people, mainly from management, started to quit. The management part, we fixed by putting our people there that were able to control and tell them: look, this raw material is running out, you'll need to buy it, because it's lead time is 10 days, and there are only 11 days left… Then, we also had to act to buy raw material to get them to industrialize, because they had no credit in the market. They had started to provide the service of processing the raw material, but they stopped buying it. And [there were] follow-ups that we carried out on what they had been doing. This solved the problem, in quotes. Parallel to this, we started development other suppliers - we had only that one for this item. And the commodity strategy will be, at least... not to cut this supplier out because we believe that they can overcome [their problems]. Though we cannot be 100% dependent on them. Hence we have been developing other national and international suppliers to replace them and make us secure in case of disruptions, right? We've had other cases like that as well. (Mpurc2) [7] | ➢ Financial monitoring of the supplier in crises<br>➢ Allocation of KAPPL-FC people to administrate supplier's production<br>➢ purchasing raw material to suppliers<br>➢ Supplier development<br>➢ Lessons learned from other similar cases |
| **Flood in second tier supplier's location** | Recently, we had problems with a supplier based in Minas Gerais, not exactly at the supplier, but at the sub-supplier. Their supplier was in a region affected by the flood [8] | …it maybe didn't cause the disruption, because we had strategies… we had similar imported items which we ended up shifting so that it wouldn't affect our production, but there was a flood that happened there, and it ended up disrupting us.(Mpurc2) [9] | ➢ Product flexibility |

**Table 31.** Real examples of supply disruptions in Case 2 (continue)

| Examples | What happened and consequences | Actions taken to mitigate and/or cope with the disruption | Main points regarding actions and/or strategies to overcome the disruption |
|---|---|---|---|
| **Warehouse fire** | We had problem with a fire in one of our warehouses in [another location] which complicated the service to our clients. And I guess it took about 2 months or so, for this problem to be solved. And of course there are things that you don't get back. Unmet demand is lost demand, right? (Mpurc2)[10] | Well, first, we left the warehouse and we rented another warehouse, right? The actions were to try... there, for example, there weren't just refrigeration components being produced, which made it more complicated. Because product, you lost the product, you lost… You have to produce another. But we had components from other products and were stocked in there. The actions were: immediate importation of some parts to try to serve our clients as soon as possible. There were actions that took 10-15 days and we were able to get the products back. And other actions took even longer for other products, for other damaged equipment. But you see a lot of things and there's a lot of money that we depend on from this, but we had to serve our clients (Mpurc2) [11] | ➢ Changes in warehouse location<br>➢ Urgent importation of some components |
| **Demand vulnerability** | ...consumer behaviour, this is an unknown seasonality. This makes us change the mix of products very quickly. But it's an unusual year, you know, in that actually nobody knows how much the World Cup will influence volumes, you know, how much the elections will influence the volumes. So it is a tough year of surprises. (Mpurc2)[12] | We try to talk, just in case, with the supplier, to get them prepared to a peak. For example, we say: look, you need to be prepared for this peak that may happen. And it may happen at any time (Mpurc2) [13] | ➢ Supplier relationship |
| **Broken machine of the supplier** | What happened was that Minas said, the mill has broken and we won't have cement for 15 days. (Hcomp2s1) [14] | So, the stock that I had here was enough to supply for these 15 days. And we turned to the second supplier and we were ready. (Hcomp2s1) [15] | ➢ Safety stock<br>➢ Dual sourcing |
| **Traffic accident** | Accidents, for example, recently there was a truck that had an accident. Actually, the accident didn't happen to it. There was an accident on the road, it stopped traffic and the truck arrived late. (Mlog2) [16] | So, in this specific case, like... as we have the windows and, within the windows, we already know which items are coming. So, oh, there's been an accident and the item that was in the truck will be late. So we get this information and there's a chance of an inversion, right, of a change in the production scheduling, ok? This is what we can do. (Mlog2) [17] | ➢ Changes in production scheduling |

In addition to these actions or strategies, interviewees have also suggested points of improvements that should be applied to their routines in order to achieve a more resilient supply chain. Internally, the suggestions were: efforts to increase the level of information sharing, improvements in system to share information in a more rapid and effectively way, and internal process simplification (Table 32), while externally they were: innovation in supplier's technology/system to share a more accurate information, better supplier alignment with the focal company planning, and high level of employees turnover in focal company (Table 33).

**Table 32.** Points of improvements regarding internal resources

| Internal suggestions | Statements of the interviewees |
|---|---|
| **Efforts to increase the level of information sharing** | *For example, we currently have a serious problem in the chain: in the chain, the information must be clear, it must be clear to everyone. If it flows well, it reaches everybody and there's no reason to have a problem. I can't hide what I'll do in three months, right, from some guy. He has to see it, I have to call him, I have to tell him the company's strategy: Look, we will gain market share. To get the guy prepared to grow with us, information must be clear (Mppc2)* [18] |
| **Improvements in system to share information in a more rapid and effectively way** | *I think the biggest problem is not having good information. I think that, most of the time; decisions made are made based on useful information. So, we have to look for systems that make information easier and better. Better information is information that's more accurate and timely… Because it isn't worth having information at the wrong time, I'll make all the wrong decisions. So, I think that work on information is one of the most important things. Information in general, right. If I take a good order from a supplier, if I have a decent exchange of data and stock, I will reduce the risk, right. If I have my transportation supplier close, working with me, this would be a lot better. So, in general, I think that information is very important in order to have a long-lasting relationship with suppliers, and also to avoid disruption risks. […] To get a better answer, I need to invest in systems. Because otherwise, again, as I don't have a good system, I will invest in safety stock etc and so on and so forth… to compensate for the risk of resilience. (Minlog2)*[19] |
| **Internal processes simplification** | [...] w*hen we talk about improving information, it's not necessarily a case of investing just in technology. But changing, simplifying the process, procedures to execute tasks (Minlog2)* [20] |

Additionally, the interviewees cited barriers and enablers for creating supply chain resilience as well. Table 34 illustrates internal as well as external barriers and enablers pointed out in this second case. As mentioned in the first case, the idea of opposite meanings of barrier and enabler is also observed here (for example: enabler - dual sourcing; barrier - single sourcing). Furthermore, barriers that go beyond Procurement actions have also been highlighted. They are not considered in this study (*e.g.* inaccurate information in focal company demand system or often unknown changes in demand).

**Table 33.** Points of improvements regarding external resources

| External suggestions | Statements of the interviewees |
|---|---|
| **Innovation in supplier's technology/system to share a more accurate information** | I have to, today, I am able to supply profits with what I have, but I have a lot, a lot on my plate. I've even presented VMI to a guy and I asked him: What's your system? What is your ERP? You must have something! There is a glass manufacturer that told me: I don't use ERP. I have an excel sheet. So, I think there is much to come yet, we lack information quality when interfacing with suppliers. And nowadays, the speed we expect, the costs we expect and all of this… at speed, there's no time. If you're thinking of using an excel sheet, it's not possible. So, with this innovation, there are a lot of people left behind. So, I think, this is part of the supplier's innovation as well (Mppc2) [21] |
| **Better supplier alignment with the planning of the focal company** | The biggest problem we face today with suppliers is this change of mix, right, but who doesn't want to put that product on the line? Uh, today, I will only deliver this; another day, I will only deliver that… I mean, this dynamic will always exist in some way; it all comes from planning. We have a mix, a change of plan that we always pass to our suppliers (Mppc2) [22] |
| **Reduce the level of employees turnover in the focal company** | The suggestion is that, like, the only thing I see that happens and makes life a little difficult is that there is too much staff turnover there within KAPPL-FC. So, sometimes, you negotiate with someone, then two or three months later, when you are going to try to solve that problem or continue with it's solution, that person has already changed position, there's a new person responsible, so until you get to the same point again, it's tiring So it's this change of functions all the time that makes things slightly complicated (Hcomp2s1) [23] |

**Table 34.** Barriers and enablers to help create resilience in supply chains

| Barriers | Enablers |
|---|---|
| *Internal* | |
| Lack of production flexibility<br>Delay in internal approvals<br>Bureaucracy | Contingency plan<br>Agility<br>Flexibility (changes in production scheduling)<br>Redundancy<br>Technology to improving visibility and decreasing inventory |
| *External* | |
| Single sourcing<br>Lack of collaboration and communication<br>Lack of supplier capacity<br>Problems in suppliers' structure<br>Long lead times due to importations<br>Often unknown changes in demand<br>Problems in cost negotiation<br>Inaccurate information in focal company demand system<br>Supplier financial weakness | Dual sourcing - flexibility<br>Supplier capacity monitoring<br>Strong and wider communication<br>Collaboration<br>Visibility along the supply chain<br>Supplier open minded<br>Better process control<br>Trust relationship<br>Alignment along business planning |

Following the same rationale presented in Case 1, the next paragraphs present the issues found in this second case study. The intra- and inter-organisational issues are totally focused on Procurement, which is responsible for preparing the company for unexpected and uncommon events so as to respond to disruptions, and recover from them. Table 35 summarises all identified issues and classify them into intra- and inter-organisational issues. Moreover, it exposes from where those issues were found through the data collection.

**Table 35.** Intra- and inter-organisational issues from Case 2

| Type | Issues | What is it included into it? | Sources of risk | Example | Points of improvements | Barriers | Enablers | Discussion |
|---|---|---|---|---|---|---|---|---|
| INTRA-ORGANISATIONAL | **Knowledge acquired and backup** | past experiences; knowledge to manage the risk | √ | √ | | | | √ |
| | **Internal communication** | internal problems, demand variability; improving information sharing | √ | | √ | √ | | √ |
| | **Communication tools** | system improvements to increase the level of information sharing (internally and externally); increasing visibility | | | √ | √ | √ | √ |
| | **Redundancy of critical items** | safety stock, especially for those vulnerable to weather changes | √ | √ | | | √ | √ |
| | **Risk management** | assessment of the supplier's financial health; Financial monitoring of the supplier in crises; assessment of supplier's capacity; contingency plan; | √ | √ | | √ | √ | √ |
| | **Procurement structure** | procedures to simplify the decision making; reduce the level of employees turnover or keep the new employees updated about past agreements; delay in internal approvals; bureaucracy | | | √ | √ | | |
| | **Supply base** | additional suppliers (single sourcing, dual sourcing, multiple sourcing); suppliers abroad to importation; | | √ | | √ | √ | √ |
| INTER-ORGANISATIONAL | **Supplier development** | new supplier incentives | | √ | | | | √ |
| | **Criteria for supplier selection** | large or small suppliers; competitive supplier | | | | | | √ |
| | **Supplier relationship** | partnership with suppliers; external communication; support each other in times of disruptions; buyer and supplier alignment; collaboration and trust; negotiation | √ | √ | √ | √ | √ | √ |
| | **Supply chain configuration** | long distances; warehouse location | √ | √ | | | | √ |
| | **Transportation modes** | long lead times due to importation | | | | √ | | √ |

**Knowledge acquired and backup.** Interviewees have strongly affirmed the great importance of knowledge acquired through lessons learned in creating supply chain resilience - "*internal, external and any other knowledge possible*" (Mppc2)[24]. Also, it is well exemplified through the examples above (especially the first one - supplier financial problem) and during the interviews in which they mentioned ways to respond and recover from disruptions. In this context, it is vital to highlight that all interviewees from KAPPL-FC, KAPPL-S1 and KAPPL-S2 have worked in those companies for more than 20 years, except one interviewee from KAPPL-S1 (4 years). Therefore, it represents the great experience they have to expose real examples and procedures to deal with supply problems. As demonstrated, the experience is to achieve through daily work and information sharing with older employees from the company. Lastly, no way to record lessons learned was found in any of these three companies - "*No, we don't have this. It's more of a daily routine*" (Mtransp2)[25].

> Knowledge acquired is very important. That's why KAPPL-FC sometimes has strategic people, and departments are usually formed of young people with energy and drive, as well as with old folks like me (laughs) who have knowledge, experience, right (Mpurc2).[26]

**Internal communication.** Related to this issue, the size of the supplier's companies was highlighted as an enabler to improve internal communication. Thus, interviewees from KAPPL-S1 and KAPPL-S2 have reported no problem in sharing internal information, which makes easier for them to align decisions according to KAPPL-FC orders. Although the focal company (KAPPL-FC) is larger than these suppliers, the interviewed managers have asserted no critical barriers to share information internally, but it might be found in another branch that is five times larger than KAPPL-FC.

> For example, the Mppc2 team has a critical item - for some reason, an item became critical. Then this information must be rapidly sent to us, so that we can act as fast as possible. [...] So this information is critical. (Mtransp2) [27]

> Internal communication helps, and helps a lot. Here, as I told you, we're a small company. So, we have direct contact with production, quality, planning, with every other function, right? Everyone is together. So this contact is continuous (Hcomp2s1) [28]

**Redundancy of critical items**. Strategies to manage internal inventory is normally more related to Logistics or Production (depending on the company structure) than Procurement. However, how much stock the company has to hold as safety stock is a decision in which Procurement is involved. Nevertheless, KAPPL-FC does not hold much stock due to just in time system. In this case, they have to be constantly in contact with

suppliers to check if all the planning deliveries are going to arrive on time. However, to balance the demand as well as supply fluctuation, KAPPL-FC holds a very small safety stock of raw materials within the company. On the other hand, interviewees from KAPPL-S1 and KAPPL-S2 have asserted that the redundancy of some items (high volume of safety stock) is their best strategy to manage daily changes in demand, and continuously attending KAPPL-FC requirements if any trouble arrives upstream of their supply chain.

> There are many way of guaranteeing the deliveries, but I guarantee them myself... You're going to tell me that stock-keeping in this way these days is wrong, right?. Everyone is working with Just In Time. I do it myself by keeping at least one month of production stock. Final products and raw materials. There are some raw materials that don't need a month of stock, but these are those raw material that I'm sure I have. But otherwise, this is my security. (Hcomp2s1) [29]

However, when the raw material is scarce in the market or has a long lead time (imported items, for instance), KAPPL-FC must hold additional stock. In fact, holding stock is therefore a strategy in this situation. In this context, Mppc2 illustrates an example in which redundancy is needed.

> There was a time when it was hard to find aluminium in market. So, when there was stock available, I'm there, [competitor X] is there, [competitor Y] is there, everybody's there. Then whoever purchases the largest amount will get the stock. You can't say to the sales person: hey, just give me what I need today. No! If you have 10 000, I'll buy it. This is the strategy. (Mppc2) [30]

**External inventory**. Considering that KAPPL-FC is a multinational company that produces over 20 thousand products per day, it must have an alternative to reassure its daily supply. Thus, they make use of external inventory by holding it in a warehouse or in the suppliers' plant that are both located near the KAPPL-FC plant. The responsibility about the level of inventory in the warehouse is the suppliers. This way the focal company and its suppliers are connected through electronic data interchange (EDI) in order to operate the vendor-managed inventory (VMI) strategy.

> The suppliers will be responsible for their inventories. It's not KAPPL-FC stock, it's supplier's stock. So this is one of the projects that helps me; it solves the resilience problem. (Minlog2)[31]

> There are some suppliers, for example, I have one in ... in Araras. This guy doesn't need to occupy my hub as a logistics operator, because he's very close to the hub already. So, he finds a place within his factory where he keeps our items. And we will determine the level of stock. (Mppc2) [32]

**Communication tools.** In this respect, KAPPL-FC seems to fully make use of EDI by using a specific system to connect focal company and its suppliers. Information is shared in real time hence suppliers are able to visualise any changes made in the company's

inventory. Therefore, it improves the visibility along the supply chain as well as the response capacity if any unexpected event occurs. These benefits were previously pointed out as enablers to resilience.

> There's no way of living without [technology] right. So technology is fundamental to us. We now have our entire warehouse controlled by a WMS (warehouse management system), where you have the follow ups in real time, the exchanges in real time, right… we have some developments, some upgrades to be made on it that will give us more trust...from point to point within our place. It facilitates the decision-making, right. (Minlog2)[33]

**Product flexibility**. Although interviewees have positively affirmed the benefits of product flexibility for supply chain resilience, KAPPL-FC seems not to make use of it. Most of the interviewees and especially those from the suppliers (KAPPL-S1 and KAPPL-S2) have stated that each product has particular characteristics and because of that they need different and specific components. Nevertheless, interviewees from KAPPL-FC mentioned a possibility to change product's configuration in the absence of a specific item, but there is always additional cost in changing components to fit another product. Unlike KAPPL-FC, interviewees from KAPPL-S1 have affirmed their capability to change their products if there is a need. In this respect, Hcomp2s1 reported that if they lose a customer for any reason, they are capable of changing their processes in order to produce another item. Therefore, product flexibility can be considered an enabler to KAPPL-S1. It can easily recover from a demand disruption whilst KAPPL-FC does not have any flexibility to make easier, their recovery in case they lose a supplier.

> KAPPL-FC is very complicated [in terms of product]. This is a project that we're looking at, and demanding it. The engineering department does not standardize. For example, if you take a Styrofoam base, each SKU has a different base here. For God's sake, just make a single base for all of them. So KAPPL-FC has this very serious problem. Each product has a screw. We lose a lot of them. So I think the standardization of items, is something that reduces inventory, reduces labor, reduces risk. (Mppc2)[34]

> Well, in the case of KAPPL-F, there's no way, because everything is very specific and there is no way of getting away from the norm So other products I provide don't do the job. (Hcomp2s1) [35]

**Risk management.** Interviewees from KAPPL-FC reported well-developed procedures to mitigate risk by identifying possible risks from its suppliers and hence managing and reconfiguring internal and external resources to moderate them. These resources can be related to information sharing through internal communication, safety stock and location of inventories (internal or external), for example. Thus, risk analysis and risk management are constantly executed in daily activities, especially from Production and

Logistics which are the closest functions linked to suppliers in this case. Even if there is no team or department dedicated to this task, standard procedures are executed in daily activities, such as follow up of items to identify critical ones (based on inventory and classification of the ABC items), contingency plans for critical items, and daily meeting to discuss the current operation in which Procurement people are also involved. Hence, interviewees have mentioned risk management as a way to prevent breaks of the flows. Furthermore, Minlog2 reported a new practice in which they record the problem, and exploit it afterwards in order to find the cause.

> Internally, the company is forced to have contingency plans, right. We have to have them. We have to think about mitigating. [...] If this happens...what do you do? if that happens, what do you do? We have to have a strategy. Otherwise, when people talk about supply disruptions, we often talk about hours, but risk means months, or even years. (Minlog2)[36]

It is worth reminding that the first function to identify risk is Logistics - "*risk identification is firstly carried out by Logistics*" (Mppc2)[37]. It has a close relationship with Procurement, and if any critical problem is identified, Procurement takes over. This is well observed through the example of the warehouse fire in which Procurement managers with other top managers had to make important decisions to deal and to respond in an effective way to that situation. Apart from this example, any other critical problem with suppliers that Logistics and Production cannot solve, Procurement is responsible for taking additional actions and making decisions, such as financial analysis. Therefore, KAPPL-FC seems to have a robust risk management of daily and small disruptions. Now looking at the suppliers of this dyadic, both make use of dual sourcing, safety stock and supplier relationship as normal procedures to mitigate risk of disruptions. This consequently is going to help their customers (KAPPL-FC, for instance). Thus, as observed in Case 1, risk management (issue) additionally involves the management of other issues, such as redundancy of critical items that have already been discussed.

**Supplier base.** As stated, the role of Procurement is predominantly focused on upstream of the company (supplier sides; in this case KAPPL-S1 and KAPPL-S2). Is this function capable of identifying the best supplier? Where should this supplier be located? How should be the supplier relationship? Is it single or double sourcing? If single, should develop a new supplier? Through interviewees' discussion about these questions, interviewees from KAPPL-FC have showed many ways to deal with suppliers so as to better cope with unexpected events. In this regard, KAPPL-S1 and KAPPL-S2 have confirmed the statements of KAPPL-FC interviewees about avoiding single sourcing and improving supplier

relationships. Therefore, KAPPL-FC seeks to closely work with few suppliers but never depends on single sourcing. For this reason, these companies (KAPPL-FC as well as KAPPL-S1 and KAPPL-S2) always have an extra supplier approved for each item.

> KAPPL-FC has already been through several stages, and I have experienced several of these. For example, there was a time when KAPPL- FC existed as a global company which followed the Swedish train of thought that said: it is much better have few suppliers and consolidate volumes and get a better cost. You consolidated volume - theoretically if I buy 10 I have one price but if I buy 20 I'll get another price. But we are in Brazil; it's a bit tricky to do that, and fortunately the company realised that after a while. So now, for example, you have to have at least three approved suppliers - two of them for daily supplying and one as a backup, a stand-by. (Mpurc2)[38]

**Supplier development.** However, there are some occasions in which it happens due to the lack of capable supplier available in market (previously mentioned as a barrier), for instance. When this happens, KAPPL-FC seeks to develop new suppliers. In this regard, the head of the KAPPL-S1 has reported that KAPPL-FC helped to develop KAPPL-S1 due to a critical problem they had with an imported item. It turned out that having a national supplier would help them reduce the lead time, the level of stock, and consequently, have a rapid response due to closer location. Regarding this issue, some examples have mentioned the need for developing supplier.

> In parallel with this, we started a project to develop new suppliers, because the development of a new item is very complex; it involves construction of tools, devices, and KAPPL-FC approval is also quite rigorous. (Mpurc2) [39]

**Criteria for supplier selection**. In terms of suppliers, KAPPL-FC did not show any preference for large suppliers. In fact, it holds many small suppliers nearby, which helps them in terms of shorter lead time. Thus, the supplier criterion (which normally happens before the supplier developments) is the competitiveness of the supplier. Thereafter, the same supplier has to be approved by a list of requirements in which KAPPL-FC checks its capacity to effectively supply the plant. The analysis required is about product quality, supplier financial health, operational capacity, plant location, among others.

> Our first requirement for the suppliers is related to competitiveness. We live in a competitive world, if the supplier is competitive then we will arrange things so that they can be a KAPPL-FC-approved supplier. [...] Procurement is the entry point for the supplier within the company. No supplier starts supplying without going through Procurement. I think Procurement is primarily responsible for evaluation. (Mpurc2) [40]

**Supplier relationship.** It is through a close relationship between KAPPL-FC and KAPPL-S1/KAPPL-S2 that these companies practice strong communicate, share information,

and get to know the processes. It was reported that KAPPL-FC encouraged a closer relationship with its supplier by inviting them to visit the plant as well as visiting their plants, by providing workshops and coaching or by setting personal meetings to discuss future situations. Because most contact is done through an online system between Production and suppliers in this case, people from these functions normally meet each other when a problem has occurred or is about to occur. In that situation, the supplier automatically contacts the focal company (Procurement manager in this occasion) who aims to communicate the event and therefore make decisions together to solve the problem.

> There are many tasks. There's the suppliers workshop, where you bring them to show them your systems, show them the kind of work, what we're doing .. suppliers often require long-term information to understand their participation within the business. It's because they also depend on this investment, right. Thus, the closer and more open it [the relationship] is, the longer is the relationship I think. (Minlog2)[41]

> We are very engaged, there is no 'look, make it work, do it yourself etc'. We are very well engaged. (Psale2s2)[42]

**Supplier chain configuration.** As KAPPL-FC, both suppliers in this case make use of strategies related to set up the supply chain configuration in order to prepare itself to be capable of responding and recovering from untimely events. This strategy is clearly observed by the Mpurc2 statement in the "criteria for selection supplier", when it states that distance between buyer and supplier does influence on the decision to approve or not the supplier. Furthermore, distance is considered a barrier to developing supply chain resilience.

On this matter, it is worth emphasizing that KAPPL-S1 and KAPPL-S2 are located nearby KAPPL-FC, 90 Km away. Additionally, the warehouse recently set up by them is only 12 Km far from the focal company. It therefore enables KAPPL-FC to have a supply quick response, and it can sometimes reduce the total cost considering the transportation tax. However, although it is a positive characteristic to KAPPL-FC, other points are analysed as well, such as quality of the raw material and the supplier's capability. Thus, global suppliers also make part of KAPPL-FC supplier base considering it is a multinational company.

> We look for suppliers in the region, especially for those items that require space. Imagine the tank washer and basket for washing basic pieces… it's more or less this here...it carries air. If you pick a supplier from São Paulo, you pay 5 reais more per product to transport, and it costs 2000 reais to bring 400 pieces. Therefore this factor influences us too. So while we are here, this is the guy that will be important right. So we look for these suppliers, but we have international suppliers in China, India, France, Italy ... we have suppliers around the world, because we have global suppliers that supply every plant (Mpurc2)[43]

**Transportation modes.** Taking into account the distance among suppliers and the focal company (KAPPL-FC), road transportation is fully used to collect and deliver raw

materials at the first tiers of the KAPPL-FC supply chain, and shipping for imported items. They make use of "milk run" as an effective strategy for just in time system for gathering raw materials, which enables lower transportation cost and local inventory. Notwithstanding, there were special occasions in which changes in transportation modes were needed to overcome unavoidable supply disruptions. But it caused additional cost invariability. In this respect, Minlog2 has reported *look, it's very rare to use a airplane. We use it very rarely because it's too expensive!*"[44]. Mpurc2 complemented it by saying that "*such transportation is by ship. So perhaps the flexibility to streamline is infrequent air freight*"[45].

Lastly, as a way to avoid current supply disruptions, KAPPL-FC charges the suppliers with a huge fee if they do not deliver the request on time. Although the fee charged can cover the cost in the production breaks, this action can not maintain continuity of the operation. Therefore it is not considered as a resilient strategy in this study. Moreover, this attitude might undermine the supplier's financial health as well as its motivation to keep the relationship.

Table 35 therefore summarises all issues found in this second case. It also classifies them into intra- and inter-organisational issues and portrays where they emerged from. Although Procurement plays a different role in KAPPL-FC due to the company's structure, this function makes part of managing and controlling the identified intra- and inter-organisational issues to creating supply chain resilience. This is because Procurement can adapt, integrate and reconfigure KAPPL-FC's resources (which are information, knowledge, technologies, components or final products and suppliers) through practices and routines (*e.g.* use of dual sourcing in the supply base, identification and classification of suppliers in the supplier development, and communication and support from other functional areas, such as Logistics and Production) so as to deal with supply disruptions. Additionally, it was clear in the Mproc2 statement regarding experiences from younger and older employees that Procurement managers can always increase their knowledge and experience through lessons learned from past events. As a result, the Procurement manager in this case is responsible for managing and controlling intra- and inter-organisational issues in a strategic way, by rearranging company's resources through knowledge acquired. This procedure also corresponds to the rationale of the dynamic capability theory in which Procurement builds dynamic capabilities through value-creating strategies (resilient strategies) in order to achieve or sustain competitive advantage under an unstable environment. Furthermore, these statements can be justified by interviewees' statements from KAPPL-FC as well as KAPPL-S1 and KAPPL-S2.

## 5.3 Data analysis and general results from Case 3 (FOOD)

The third case is composed by a triadic (focal company and two of its suppliers - first and second tier) embedded in a food supply chain. The focal company is a multinational organisation that operates in more than 86 countries, and holds 30 plants in Brazil with more than 220.000 employees. In Brazil, it is responsible for 141 brands with a production volume around 1.4 million tons per year, and a gross sales of 16 billion reais. Both suppliers work in the same agribusiness sector, and they are responsible for supplying the focal company demand with a specific raw material in "nuts" segment. In order to keep anonymous the name of the organisations, they were titled in this case as: FOOD-FC for the focal company, FOOD-S1 for its first tier supplier, and FOOD-S2 for its second tier supplier.

The FOOD-S1 plays a strategic role by intermediating the second tier supplier (FOOD-S2) and the focal company (FOOD-FC). FOOD-S1 is a familiar company located in Sao Paulo state that mostly commercializes juice and concentrate raw materials. However, for this particular case, it holds a strategic role in the nuts sector by orchestrating the flow of goods (nuts) and information between FOOD-FC and FOOD-S2. It therefore provides buy & sell service to both organisations. On the other hand, FOOD-S2 is responsible for supplying FOOD-FC with nuts. This last organisation is a market leader in Brazil, which holds around 70% of the market and exports to over 40 countries. Thus, it holds a prominent position in other markets such as, United States, Europe and Japan.

As this study is focused on identifying particular Procurement issues that help to cope with critical supply disruptions so as to create supply chain resilience, eight people were interviewed from the three companies presented above. Table 36 illustrates companies, roles and codes that represent each interviewee in this third case analysis.

**Table 36.** Interviewed people in Case 3

| Company | Role | Codes |
|---|---|---|
| FOOD-FC | Buyer - Commodity manager | Bmet3 |
| FOOD-FC | Buyer - Commodity manager | Bcof3 |
| FOOD-FC | Buyer - Commodity manager | Blog3 |
| FOOD-FC | Buyer - Commodity manager | Bnut3 |
| FOOD-FC | Regional Head of Procurement - South America | Mproc3 |
| FOOD-S1 | Sales Manager | Msales3s1 |
| FOOD-S2 | Sales Manager | Msales3s2 |
| FOOD-S2 | Procurement Manager | Mproc3s2 |

Similarly to the other cases, these three companies have a traditional vertical hierarchy in which directors are at the top of the companies hierarchy followed by managers from different business functions. Thereby, the focus is on horizontal relationship between buyer and supplier. Figure 33 shows a general structure of the relationship among these three companies.

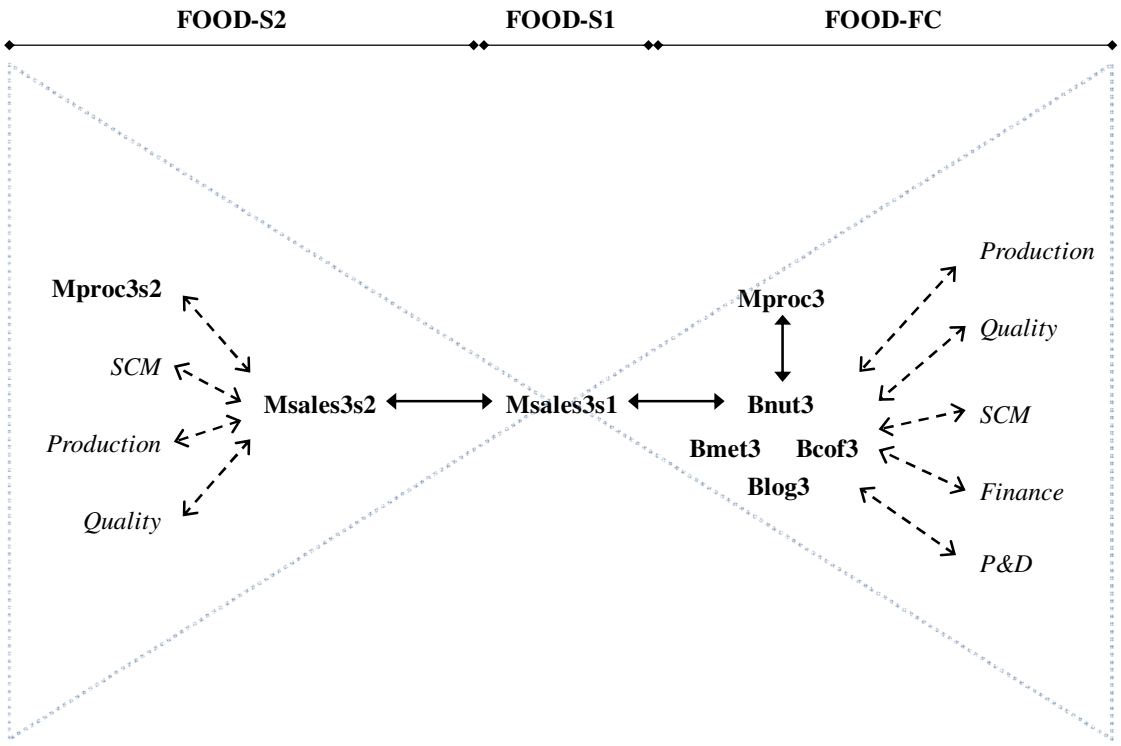


**Figure 33.** General structure of the triadic in Case 3

Case 3 is particular interesting and slightly different from the others due to FOOD-S1 being responsible for managing and controlling the flow of goods, information and capital between FOOD-FC and FOOD-S2. The sales manager (Msales3s1) therefore receives orders from the buyer, commodities manager (Bnut3) from FOOD-FC, negotiates them according to the production volume and price, besides managing the loads and deliveries, quality complaints and payments situations. To do so, sales manager (Msales3s1) needs to check if FOOD-S2 is able to supply the FOOD-FC requirements. In this sense, this manager is vigorously communicating and sharing information with its customer (FOOD-FC) and its supplier (FOOD-S2) in order to guarantee that purchase orders and deliveries are being fulfilled. Although interviewees have asserted that there were situations in which Production has directly communicated with sales managers from FOOD-S1, or sales manager from

FOOD-S2 has directly spoken with the buyer commodity manager (Bnut3), or even the same sales manager has directly contacted to Procurement manager (Mproc3), the most common flow of communication is through Msale3s1. Although this general structure looks different from the first two, it also follows the same "bow-tie" relationship, as portrayed in Figure 33.

Reaffirming the definition, the basic relationship states that Procurement manager and Key Account manager are normally in regular contact, and the organisations are just aligned behind these functions and not along them, while being the only channel to exchange information. Thus, in Figure 33 Procurement function from FOOD-FC as Sales function from FOOD-S1 are often supported (in terms of information and decisions) by other business functions, such as Quality, Finance and Product & Development.

> Procurement is not an isolated department. To consider using a supplier as contingency, for example, we need to have this supplier approved. The technical area is one of the functions that has to work together with us and ... in other words, the business unit has to be supported by other functions in order to make a decision about having A or B as contingency. (Bmet3)[1]

Additionally, according to the Procurement interviewees from FOOD-FC, they play a strategic role by being responsible for verifying the needs from its internal customers and then identifying qualified suppliers to deliver these needs. In this context, some of its activities are: identification and classification of suppliers capable of supplying the specific raw materials in a good quality, on the right time, on the right quantity, at the right place, and specially at the reasonable price; supplier relationship management; price and volume negotiation; purchase of the specific required items; attending internal requirements; and development of contingency plans.

Regarding supply chain resiliency, participants were asked about its meaning at the beginning of the interview. Only one out of eight had a clear idea about the concept, while other two of them guessed the meaning through their knowledge about the resilient term from material science. Even though most of the interviewees had never heard about this concept, they recognised the great importance of this approach in business after the term was introduced to them. They additionally highlighted activities and actions that seek to obtain a similar result, such as contingency plans, to avoid supply disruptions. In addition to it, interviewees have affirmed that Procurement plays an important role in this context. However its actions and strategies must be supported by other business functions, as stated before. What is worth highlighting is the interest aroused from the interviewees about this new supply chain management approach, especially because they have been facing many impacts in quality and productivity of their raw materials since 2007 due to meteorological changes.

In respect to the risk sources, all interviewees have mentioned types of uncertainties, which might come from internal, external and environmental events. In this case, however, none of the interviewees reported internal uncertainties; they have only highlighted external and environmental ones. Thus, the external sources of risk pointed out by the interviewees are: supplier financial weakness, problems in transportation, supplier's strikes and policy changes, while environmentally they are pests' incidents and meteorological factors. Considering these uncertainties, it is valuable to highlight that meteorological factors was the most cited risk source in this case. The reason is that food supply chain is very vulnerable to climate changes, and although it can normally be forecasted, it is quite impossible to reverse it. "*Eventually, we have pest problems, but you can combat the plague; it doesn't give you a shortfall in crops like the lack of water does*." *(Msales3s2)* [2]. Thus any extreme changes in the long term, such as rainfall frequency and warm weather, impact considerably on crops performance. Figure 34 shows the sources of risk and uncertainties cited by the interviewees in this case.

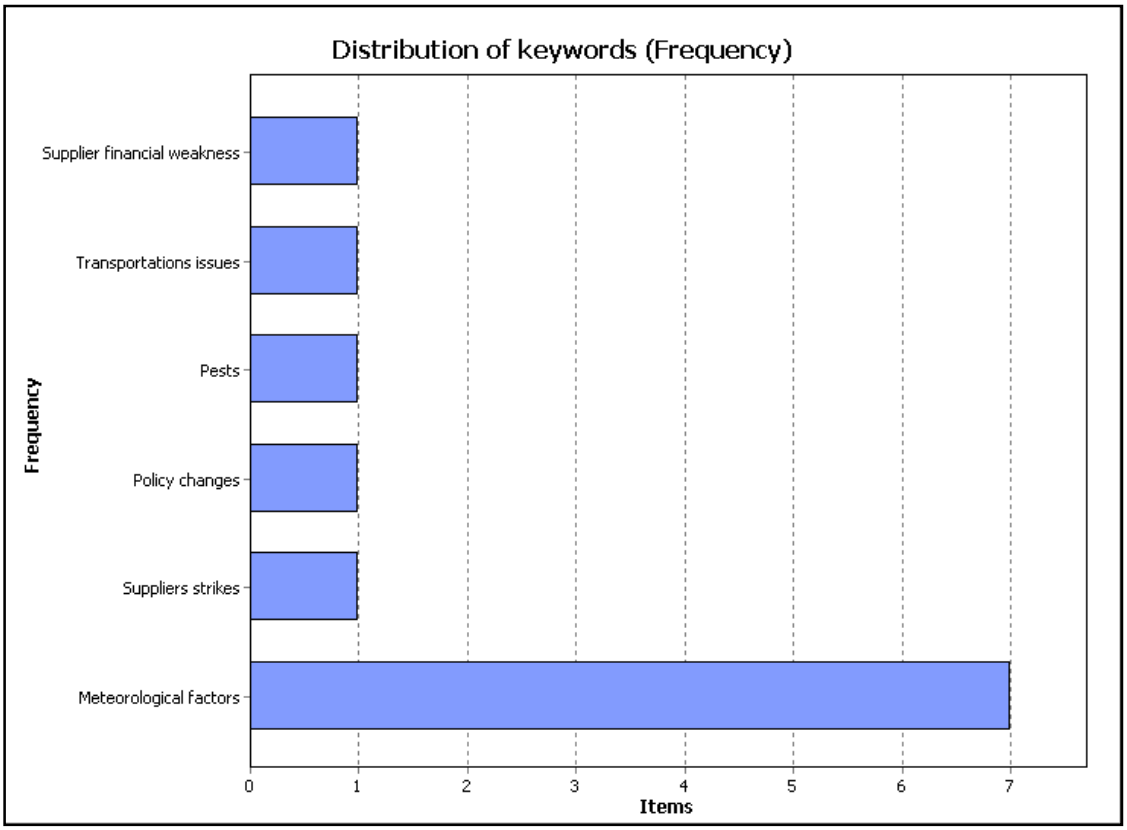


**Figure 34.** Sources of risk and uncertainties cited by interviewees in Case 3

Following this train of thought, the interviewees have also provided some examples of critical supply disruptions they have faced and have consequently impacted the company's

performance as well as some tiers ahead of its food supply chain. The examples given by the interviewees covered a wide range of problems that mostly emerged at upside of the supply chain and are generally from external and environmental causes. Table 37 illustrates the examples highlighted by the interviewees, in addition to the actions taken in that situation.

In this regard, one special and recent example reported by one of the FOOD-FC interviewees is worth exposing in more details - critical disruption in one of the main product of FOOD-FC made by coconut. In the past 12 years, this raw material has had importation restrictions due to government laws; however it has changed since a severe drought has impacted the coconut crops at the north of Brazil, and consequently damaged its productivity. For this reason, there was a need to import a high volume of this raw material. Therefore, FOOD-FC started importing it from Asia, which is considered the largest global coconut producer, in addition to holding a competitive price. In doing so, they were able to overcome the often supply disruptions created by the severe drought. In this case, the strategy of having more than one supplier for a critical item, and one located abroad could attend the contingency plan. Nevertheless this strategy has failed when a tornado has arisen in Asia and destroyed 30% of the coconut plants from this particular supplier. Because of that, the international market was closed, and all companies along this particular food supply chain have been facing great problems so far - "*In my case, the main reason for supply disruptions is due to a factor that we cannot predict - the climate. That situation is out of our control" (Bnut3)* [3].

In this context, Procurement managers are constantly in communication with other business functions to find effective solutions to the consequences of this kind of unpredictable situation. Since the contingency plan could not cope with this critical supply disruption, managers decided to reduce the quantity of raw material used in that particular product in the first place; however this action has no longer been effective considering that the situation was getting worse. Therefore, the next step will be the development of a substitutable product with similar price and specification, and at the same time, looking for other suppliers in different locations. Regarding the last actions (looking for new suppliers), interviewees have considered it as a barrier due to the long process of internal approvals.

**Table 37.** Real examples of supply disruptions in Case 3

| Examples | What happened and consequences | Actions taken to mitigate and/or cope with the disruption | Main points regarding actions and/or strategies to overcome the disruption |
|---|---|---|---|
| **Lack of product quality** | In 2008, I worked on an importation from Nigeria, that was, for us, the worst example of something that we've brought in a container, there were many quality problems with these nuts. In 2010, we started to realize that the crop wouldn't grow, and we wouldn't have product, we would have 2000 workers stuck, and there would be a breach of, uh, contracts (Mproc3s2) [6] | So, by predicting this in March, I was already in the field. I had already done the work previously, we started in November and in December we had already started to work, we created political pressure in order to break the standard regulations to allow importations. When it came to March, I was already in Africa to make the purchase, ok? Why? Because, from March, there is period between harvests, it lasts until August, and then? Would you wait through March, April, May, June, July, August, until the next crop? That's not possible. As we already knew that, we wouldn't have "transit stock" right, in 2011, in 2010, we started to work with the government to settle the importation liberation issues. We had one window, Nigeria, that was closed, and we needed the other windows. (Mproc3s2)[7] | ➢ Efforts to change Government's importation issues<br>➢ Identification of other suppliers (supply base) |
| **Workers strike** | Last year... We had another aluminum supplier, "CBA", a metal manufacturer. And, last year, they had a strike and it closed the plant. And they have a production plant in Brazil and we have a plant that takes this aluminum. All of the rest of the aluminum that we use comes from Germany. But we only produce a cover that we make using only their aluminum and the plant stopped for 2 weeks. And we have stock for basically one week. With them and with our cover, we supply to Ituiutaba, but there was no aluminum, there was no way to get a truck from the plant, the doors closed and so then simply, at the end of the week, on the day they re-opened the plant, our truck was there waiting to receive. And we have stopped, for like nearly two weeks due to this (Bmet3) [8] | But the immediate action in this case, it's not even immediate, because it's not short-term. Though it was useful to reinforce an action that we've been trying to take for a while and, now it has been reinforced by requirement, which is to substitute the cover. Today, we work [on this product] with a cover that you use a knife to open, to cut the aluminum on the inside. [This cover has existed] for 40 years. The others that you have are the ones where you pull the aluminum. To replace the aluminum cover that you pull with the one that you open with the knife, it takes investment, all of that. Oh the other hand, if we replace it, we have someone that produces the cover in the market, we have more aluminum suppliers, the steel itself, and we recover the investment very quickly. So in fact, this incident, and everything that happened, served to reinforce the project of replacing the cover, which started to pick up speed (Bmet3) [9] | ➢ Substitutable item - new product development<br>➢ Supplier development<br>➢ Risk management |

**Table 37.** Real examples of supply disruptions in Case 3 (continue)

| Examples | What happened and consequences | Actions taken to mitigate and/or cope with the disruption | Main points regarding actions and/or strategies to overcome the disruption |
|---|---|---|---|
| **Supplier vacation** | The main point is at the end of the year. At the end of the year, the suppliers go on collective vacation. Last year, we had a problem, in that the coffee was rejected. The supplier was on vacation, and we didn't have another supplier. And then we had a manufacturing problem in the plant. I don't know what actions were taken, because I wasn't here, but according to the records there was no action. There really was a loss. Then you have to deal.. deal with the consequences… (Bcof3) [4] | So, we need to align in some way the delivery of raw material stock with the need for virgin coffee at the plant. So, we talk to the plant, we say that the supplier in theory will be on collective vacation, that the coffee, instead of 15 days before, will be ordered 30 days before. 30 days prior so that, in case of rejection, we have time to talk to the supplier early enough, before they go on vacation (Bcof3) [5] | ➢ Supplier relationship (external communication)<br>➢ Redundancy of critical items<br>➢ Early order placement |
| **Drop of crops productivity due to extreme meteorological changes** | So, to get a crop to do well, we need: the rain at the right moment, the heat at the right time, yeah, there can't be any, any plague; if there is plague, it affects. And these are things that, even if there are studies that evaluate: oh, what the weather is like, oh, it will rain, it won't rain, this year the trend is that it will be a drier moment or not. And how it will have an impact in quantity and then in costs… But we have a problem now that we have been facing with the peach flesh. There were some frosts in September, in October in Chile and it has broken the crop of peach and I have been telling my clients since September: It will break, you will lack, and we will bring samples from other countries. Now, in February, there are people that stated to act, you know? (Bnut3)[10]<br>So, even IBGE and Conab, they follow the evolution of many agricultural products, including nuts, and the in November, like so us, the IBGE forecasted a crop of 200 to 250 thousand tons in Brazil this year. And then at the end, when the thing had to happen, we have got problems of dry weather or rain out of season. Yeah, and it brought our crop expectation to 136 thousand tons, that is, we had like a reduction of 50% from a month to the other, the harvest expectation. In 2011, the crop was a total disaster. And then several plants has been closed and manpower dismissed.(Msales2)[11] | It's talking to the supplier to anticipate and talk about the business. Look, we tend to have price increases, there are volume risks, and we'll develop other suppliers, yes or no. And maybe it's even necessary to authenticate another supplier, because the volume may not be available, So, the way we manage this, that, this it is exactly this, always anticipating, talking to the chain, that, in our case, is the suppliers. I don't deal with the producer (Bnut3) [12]<br><br>Because, usually, we say 2010/2011? 2010, if you look at the coffee importation data, we had to take these nuts from West Africa, we imported from Ghana, the Ivory Coast, Guinea-Bissau. We had to do it, because otherwise we would have totally collapsed (Mproc3s2) [13] | ➢ Identification of other suppliers (supply base)<br>➢ Supplier relationship<br>➢ Supplier development<br>➢ Importation from other countries<br>➢ Risk management |

**Table 37.** Real examples of supply disruptions in Case 3 (continue)

| Examples | What happened and consequences | Actions taken to mitigate and/or cope with the disruption | Main points regarding actions and/or strategies to overcome the disruption |
|---|---|---|---|
| **Flood** | An issue that arose recently was the flood in Espírito Santo, which greatly complicated our transportation. It was a specific case that, in theory, affected our chain. And so then there's this question of what to do (Bcof3) [14] | What to do to be able to overcome this possible loss, that, in this case, that… one of the things that we have agreed with the plant… we had to, in theory, postpone… yeah, not postpone, but tell them, alert them: look, we may face a problem and there may be a delay of 2 or 3 days. The coffee delivery, because it will have to make a change of route and, moreover, we aligned with the quality of the plant: any coffee that comes not out of standards, but a little bit out, they, uh, would take a fresh look, of course that… that wouldn't damage… the amount, though they…. Though it needn't be deep in… in criteria, because any problem we may have… really, any refusal problem, so then, we would have many problems to make up this coffee. We did this… this emergency partnership with planning as well as with quality, to make an agreement due to the problems we were facing of… of transportation in Espírito Santo due to the rains that occurred in December (Bcof3) [15] | ➢ Supplier relationship (external communication)<br>➢ Business function alignment and agreements (internal communication) |
| **Conflicts and Civil war in Africa** | In 2002, yeah, part of our team was in the Ivory Coast and there was a coup. Yeah, and then all the ports were closed, yeah, and the militias took power, our staff saw people walking around with guns in the streets, this kept the harbors closed for a while and it messed up our schedule for receiving shipment, right (Msales2s2) [16]<br><br>Africa has climatic problems like us, and Africa faces other problems such as civil wars, so, yeah, yeah, I remember that, I think at the end of 2012, we were okay to import and then war broke out in the Ivory Coast and we weren't able, for 25 days, we weren't able to board a ship, because the Ivory Coast war had broken out. One more of the many issues that Ivory Coast faces (Mproc3s2) [17] | There are things where can't do anything, you must wait for the guerrillas to re-open the port. It didn't have a large impact, because we had a little stock, at least, in FOOD-FC's case, it didn't; but it delayed us, it delayed production, it caused delays for sure at the plant in the day to day routine. It didn't impact the business with FOOD-FC, because we never work together. We always keep a stock, because we know that they may need to anticipate and so on (Msales3s1) [18]<br><br>So, if any of them are closed, if there's a problem, you evacuate from the other border, right? If you have a problem in Guinea-Bissau, you go to Senegal. If you are in Senegal, you go to Gambia, you see? So, there are local matters that may help you, all of them have good points, so you can get this produce out of the country. (Mproc3s2)[19] | ➢ Supply chain configuration<br>➢ Redundancy of critical item |

Therefore, taking into account these examples, the key actions and strategies to mitigate disruptions reported by the interviewees from these three companies are: approval of new suppliers (supply base), importation, internal communication, supplier relationship, supplier development, supply chain configuration, product flexibility (new/similar product development), and daily uncertainty management and risk mitigation.

In addition to these actions and strategies, suggestions were also proposed by the interviewees so as to create resiliency in the supply chain. Internally, interviewees have suggested that additional efforts and actions focused on risk mitigation should be often made rather than over thinking about cost in times of disruption. Another point is that managers should better explore and understand the internal resources to reconfigure and adapt as needed. Table 38 and 39 portrays these affirmations.

**Table 38.** Points of improvements regarding internal resources

| Internal suggestions | Statements of the interviewees |
|---|---|
| **Efforts and actions focused on risk mitigation** | All departments, they look at their end, right? So their ultimate goals are that, the plant doesn't want the plant to stop, costs require the smallest cost possible, but people don't understand, like, this is it, uh, everyone is working towards the same goal, but the problem in a crisis is that it seems everyone keeps working towards the same goal. But, in a crisis, it doesn't work, this goal won't exist, this goal doesn't exist. So maybe what I believe is that would be better to get people understanding and working harder on risk management and how to act when managing risks. So, when I am in a crisis, forget it, what's the priority? Is it supply or is it cost? You see? It's defining it, because you can't achieve everything at the same time. So, better defining this priority (Bnut3) [20]<br>If we had a, a structure, yeah... a risk management structure. Analyzing, looking at the possibilities, it's like a project, right? A project, there are all the stages there and one of them is risk analysis, where you make brainstorm everything that might go wrong. And for everything that is feasible, after a while, you make an action plan. If we had a department focusing on that, right? What are the risks, where do we need an action plan? Yeah... What, what is the plan to... what is the plan and how shouold this plan be followed to reduce and mitigate risks? I think it would really help (Blog3) [21] |
| **Better explore and understand the internal resources** | Yeah... I think, like, I think that improving this is not just, like I said, it's not just observing the supply basis itself, that we have outside FOOD-FC, within FOOD-FC, we've got options too. There may be items being made in Mexico or Chile that could serve FOOD-FC and we are starting to explore this. Exploring what we have inside so that we get to know what we have need from outside, but we still have to monitor inside, yeah…, the options we've got… To use them better, to use them as a way of, not just in cost, but to bring benefits to the group. (Bmet3)[22] |

Externally, interviewees proposed many other suggestions, such as earlier order placements, creation of groups to discuss possible risks and solutions to a particular supply chain, extra plant abroad to cope with environmental changes, collaboration along the supply chain, and substitutable product that holds advantage in comparison with the original one.

**Table 39.** Points of improvements regarding external resources

| External suggestions | Statements of the interviewees |
|---|---|
| **Earlier orders placements** | So I think the way they organize the procurement policy by buying one annual bid instead of buying monthly or bimonthly, I don't know, it helps, this, that way of buying helps industries to plan in advance, in order to avoid structure problems, price variation problems. So, based on their annual policy, we can, as we say, we can make our operation flat, you know, especially because the volume they consume is very high (Msales3s2) [23] |
| **Creation of groups to discuss possible risks and solutions to a particular supply chain** | All industries should be there, there should be a technical group: either from within the company or an employee or a contractor so that we would have this union, and then, in this nucleus, what would the nucleus be? Would it be Embrapa? Would it be the Fundação Cearense de Meteorologia? Would it be IBBA? Would it be the nucleus? Would it be for the scientific division to say: look, the tools that you're going to use are these, ok? And coming to this information, we will look at the data and pass on to you the big picture of how to achieve it… From this set of information, working on what we really need… There must be a set (of information) to exactly mitigate the risks that matter in our chain (Mproc3s2) [24]<br>If there were more in Brazil, for example, like [the] sugar [industry]. In sugar we have Única, an organization that monitors producers. So, if we had more organizations, more cooperatives, maybe it would be easier for a big company get in contact with one or two producers (Bnut3) [25] |
| **Extra plant abroad to cope with environmental changes** | Yeah, I think that, yeah, it's been very tough on the cashew industry, because of the susceptible crop failures, ok? So, like I told you, on average it's one in four years, but we're in the third, fourth straight year. So, if this keeps going for a long time, this crop problem, yeah, this is a serious problem, because the market won't bear the importation, it won't bear the price because it's imported from Africa, right, I mean, not even us, we couldn't keep this up forever. Unless we build a processing plant in Africa, ok? Which must be analyzed carefully, because, sometimes, you're fine, the next day there's a civil war, the president is deposed, and there's a military coup… anyway… (Msales3s2)[26] |
| **Collaboration along the supply chain** | No, I think there must be a field study carried out and it should be a study undertaken by the industry together with the producer, ok? The agricultural part has to be improved, in the specific case of the cashew nut, ok? On the other hand, there must be a better price equilibrium, ok? I mean, when there are plenty of nuts, the producer can't get paid so little (Bnut3)[27] |
| **Substitutable product** | So, I think that if the State steps in, yeah, encouraging small producers, in how they should prune the cashew tree, or even, uh, distributing the dwarf cashew sapling, which is a cashew that's easier to grow (Msales3s2)[28] |

As a consequence of those points highlighted above (sources of risk and uncertainty, examples, actions and suggestions), barriers and enablers to creating supply chain resilience were additionally cited by the interviewees. Table 40 illustrates the key barriers and enablers (internal and external) pointed out during the interviews. The other two cases, barriers and enablers are still recognised in this study as opposites on some points (for example: enabler - government assistance; barrier - government issues about importation and policy issues). Furthermore, some of the barriers and enablers stressed that this case goes beyond Procurement, in the sense that it is not under Procurement or even the companies's actions. Therefore it is not included in the discussion. On the other hand, an internal barrier mentioned by interviewees was about the bureaucracy and long process for internal approvals

that impede quick actions. In this regard, Procurement might not be responsible for solving this kind of problem since some authorisations come from heads of the companies, but companies should work on it. Nevertheless it should be interesting if any future study focuses on this particular point to complement the literature involved in supply chain resiliency.

**Table 40.** Barriers and enablers to help create resilience in supply chains

| Barriers | Enablers |
|---|---|
| *Internal* | |
| Lack of product flexibility<br>Lack of information sharing<br>Bureaucracy<br>Long process of internal approvals | Product flexibility<br>Information sharing<br>Internal integration |
| *External* | |
| Government issues about importation<br>Policy issues<br>Buyer-supplier dependence<br>Culture of the organisation<br>High national costs<br>Impossibility to control and predict climate changes<br>Lack of competitive suppliers<br>Lack of capable suppliers in market<br>Long process of internal approvals<br>Mistrustfulness<br>No concerns to take preventive actions<br>Small companies with weak financial condition<br>Delay in sharing information<br>Crops vulnerability<br>Bargain power | Supplier flexibility<br>Government assistance in terms of cost importation<br>Auditing<br>Increase velocity of information sharing by establishing specific time agreements in contracts<br>Extra capacity of suppliers<br>Strong and wide communication |

Following the same rationale of the previous cases, the next paragraphs present the issues found in this third case study. The intra- and inter-organisational issues found in this case are therefore focused on Procurement, which is the function responsible for preparing the company for unexpected and uncommon events so as to respond to disruptions, and recover from them. "*Look, all the common disruptions that we have encountered, we have developed plans to solve them and solved them quickly." (Blog3)*[29]. Table 41 summarises all identifiable issues and classify them into intra- and inter-organisational issues. Moreover, it exposes where those issues were found throughout the data collection.

**Table 41.** Intra- and inter-organisational issues from Case 3

| Type | Issues | What is it included into it? | Sources of risk | Example | Points of improvements | Barriers | Enablers | Discussion |
|---|---|---|---|---|---|---|---|---|
| INTRA-ORGANISATIONAL | **Knowledge acquired and backup** | experiences in how to deal with those risk; better explore and understand resources | √ | | √ | | | √ |
| | **Internal communication** | function alignment and agreements; information sharing and integration | | √ | | √ | √ | √ |
| | **Technological methods to discover, recover and redesign the supply chain** | not exactly a technology, but a group acting in the same propose | | | √ | | | √ |
| | **Communication tools** | online system to purchase orders, plus commom tools (e-mail, telephone and Skype) | | | | | | √ |
| | **Redundancy of critical items** | safety stock | | √ | | | | √ |
| | **Product flexibility** | substitutable item/product | | √ | √ | √ | √ | √ |
| | **Risk management** | assessment of the supplier financial weakness; risk forecasting and development of contingency plans; effort and actions on risk mitigation; groups to discuss risk and solutions; develop preventive acitons; audits | √ | √ | √ | √ | √ | √ |
| | **Procurement structure** | long processes approvals; bureaucracy, culture | | √ | | √ | | √ |
| INTER-ORGANISATIONAL | **Supply base** | identification of additional suppliers (dual sourcing, multiple sourcing, imporation); supplier flexibility | | √ | | | √ | √ |
| | **Supplier development** | develop new suppliers in order to avoid the lack of competitive and capable suppliers | | √ | | √ | | √ |
| | **Criteria for supplier selection** | supplier capacity | | | | | √ | √ |
| | **Supplier relationship** | external communication (strong and wide); increase collaboration and trust; increase velocity to sharing information between buyer and supplier | | √ | √ | √ | √ | √ |
| | **Supply chain configuration** | transportation issues; extra plant abroad to cope with environmental changes | √ | √ | √ | | | √ |
| | **Transportation modes** | roads and airplanes | | | | | | √ |

**Knowledge acquired and backup.** Interviewees in this case were very positive in affirming the importance of managers' experience as well as their knowledge acquired to manage risk and to deal with disruptions. In this regard, interviewees from the three companies in this case have affirmed that the more knowledge is acquired in how to manage and control internal and external resources, the more capable managers become to cope with disruptions. It was possible to observe through the above examples that managers from FOOD-FC, FOOD-S1 and FOOD-S2 have reported a wide range of real examples from which they could improve their knowledge, and then develop new actions to mitigate future risks. Nevertheless knowledge acquired is normally restricted to those who made part of a critical situation. In this case, none of the three companies presented a way to register lessons learned from a critical event in order to pass it further to new future employees. Furthermore, this intangible resource is found to be relevant in attending one of the internal points of improvement suggested by two interviewees from FOOD-FC (better explore and understand the internal resources).

> The knowledge acquired is not necessarily internal, right? So, like, if I've worked on other cases of supply disruption in other companies... because often you follow the standard behaviour that the company is used to. But in a time of crisis, if you have any other external experiences from a different work culture, perhaps you'll have a different view of how to handle it. So knowledge acquired: it makes a difference, yes. (Bnut3) [30]

**Internal communication.** This factor is another relevant issue, assuming the importance of this action to effectively share information in order to establish agreements especially in critical times. This is affirmed by Bnut3 who said that "*in times of crises, conversation is needed. In times of crises, communication has to flow - internally and externally*"[31]. In this context, Procurement receives great benefits by improving internal communication, knowing that this function has to attend internal needs through purchasing external resources. Therefore, it has to keep sharing information continuously between suppliers and internal customers (business functions), such as Production, Quality and Finance, in order to get ready to respond to and recover from unusual situations.

> Even if you take some action, if you don't know the what, where, when of the impacts, or whether people are willing to collaborate or not, you can't carry on. So I think the communication is paramount. (Bnut3) [32]

**Redundancy of critical items**. Strategies to manage stock are a key point to mitigate the impact of a disruption in the first place. However, as it has been highlighted before, redundancy just gives additional time to companies to find another long term action to cope

with disruptions. This kind of decision sought to be part of the Procurement activities in FOOD-FC, but it was also reported by its suppliers (FOOD-S1 and FOOD-S2) as an important way to overcome supply drawbacks in a short time. On the other hand, inventory has to be very well managed in this particular supply chain, considering that food has a short shelf life. Therefore, keeping high volumes of stock is a risk to companies, in case market does not go so well as expected. In consequence, millions of dollars might be lost in stocking products for a long period. In the past, FOOD-S2 used to hold a high volume of inventory to deal with the off-season. Currently, this practice has changed due to the short time in getting products from Africa (only seven days). However, this supplier still keeps 60 days stock of non-processed raw material. The raw material in stock is kept unprocessed due to different specifications of many customers, and therefore it is rather complicated to hold high volumes of a particular raw material.

> No, it has a shelf life of more than six months, if I'm not wrong. So it's clear that a big inventory doesn't make your crisis disappear. It gives you more time, but depending on the size of the crisis, just having stock doesn't help you, you know? (Bnut3) [33]

**Product flexibility**. This is an interesting point to be observed in this third case, especially because two of the alternative actions to deal with critical disruptions in the above examples were to reconfigure or to develop a new product. Thus, the development of new products was highlighted by interviewees from FOOD-S1 and FOOD-FC as an important issue to come with extreme situations. In doing so, FOOD-S1 and FOOD-FC were able to mitigate problems in supplying Production with specific raw material. This strategy has involved not only Procurement that had to find specific and alternative suppliers, but other business functions, such as Product Research and Development, which is responsible for effectively developing new products. In terms of product flexibility, FOOD-S2 cannot support this strategy due to the wide range of product's particularities for different customers. In this sense, this supplier (FOOD-S2) must use another way of effectively supplying its customer (FOOD-FC) in order to achieve resiliency (*e.g.* redundancy of critical items)

> But I think that some of these large companies could work a bit on prevention; what can we do? Approve a new supplier? Change our formulation? This year we don't have peaches, which is the case I'm thinking of right now. Let's make a product and get ready for another formulation with apricot, understand? Working like this... because there are times, when the harvest is over, there's no product. Zero. So there's no way you'll get a peach nectar for your line. In some cases, you'll even have cancel the line I've seen it happen. (Msales3s1) [34]

**Communication tools**. Regarding tools to improve buyer-supplier communication**,** only Msales3s1 has reported the use of technology to exchange information between buyer and supplier. He affirms that FOOD-S2 has an online system to place purchasing orders - "*But FOOD-S2 has a system. Every purchase order I make here, I add to the system and they can see it in Fortaleza, you know" (Msales3s1)*[35]. Nevertheless, it is not a system that shares real time information between companies. Moreover, interviewees from FOOD-FC have not reported any system that is used to place orders to FOOD-S1 or FOOD-S2. Otherwise, they do often contact by e-mail, Skype and telephone. In addition to the online system, interviewees from FOOD-S1 have reported the use of an internal system to improve internal communication (*e.g.* ERP). Through this system, heads and managers are invited to join, so that they are always updated about important subjects and projects, besides having a chat system of daily communication.

**Technological ways to discover, recover and redesign the supply chain.** To identify possible risk and disruptions, the only tool mentioned was the reports from government institutions that provide the medium term forecast about weather and crops' development. However, as illustrated in the above examples, the reports provided by them are not accurate and trustful enough for companies to rely on them. Although no technology focused on identifying risk was identified, interviewees from FOOD-FC, FOOD-S1 and FOOD-S2 have suggested the possibility of creating a group to act in this cause, and thus help all companies embedded in the agribusiness sector be more preventive and consequently be able to develop resilient actions.

> So, it's similar to what I was telling you about the weather forecast; if we had any institute to help us with this, it would be good. I'm not certain, but I believe that it could make a difference. (Bnut3) [36]

> And in this case, all the indicators, if you look on the CONAB or the IBGE websites, the numbers say that the crop has been ok. There is also an English publication, Food News, that reports about the nut crops in Brazil; everything seemed to be good. (Msales3s1)[37]

**Risk management.** How to identify source of risk and mitigate them is an important action that competitive companies are aware about. However, no formal procedure was reported by the interviewees. Interviewees have affirmed that risk management is normally embedded into daily activities, and there is no exclusive function or team to take care of this particular subject. However, Procurement people from FOOD-FC make use of contingency plan to manage possible risk, and they have developed different contingency plans to fulfil particularities of risk disruptions from each group of the raw material like nuts, metal or

coffee. But in the case of FOOD-FC, contingency plans are specially drawn for items that are considered critical. In addition, they assert that the contingency plan is a costly strategy, however they are aware that it is safer for the business than maintaining the low price strategy in extreme risk occasions.

> Yes, we did a project last year (in 2013) on key materials that are a risk. For example, cardboard; we have six, seven, eight approved suppliers, so if we have a problem with this material at Araras, then another supplier can start working on the same line tomorrow, for example. This is different from metal, because metal has a different lead time, so if tomorrow an SCN catches fire here, there's no coil to deliver, no one can give me that the next day. I'll have to bring it from Germany, Japan, Korea or China or France and it will be here in seven, eight, nine weeks. So those are the imminent risks with which we have to be more careful. (Bmet3)[38]

In line with this, no "concerns to take preventive actions" was reported as a barrier. In this regard, suggestions were made about focusing on efforts and actions to risk mitigation. Also, the interviewee from FOOD-S1 has reported the presence of a particular person responsible for studying the market and its changes to avoid any type of trouble. In this sense, Msales3s1 states *"I have a person in FOOD-S1, who is 100% dedicated to studying the market in order to prevent shortages. If there are any changes, we try to detect them as soon as possible. We call Marketing, Business Intelligence ... ok."* [39].

**Supplier base.** It is definitely the most discussed and stressed issue by the interviewees as a great Procurement practice and strategy to being more resilient. All the three companies showed to be aware of the risk in depending on a single supplier, especially when the supplier is not a large company and is responsible for a critical item of the final product. In this sense, they have this strategy well developed, in terms of holding at least three approved suppliers for any critical items. They also affirm that having a big supplier base is not the solution to mitigate risk and possible disruptions. There is a need to have qualified suppliers to attend FOOD-FC requirements.

> In relation to these three or four specific orders, we had delay problems; so they [FOOD-FC] sat down and talked to us, and they were aware it was a problem, but they have other suppliers, you know? FOOD-FC, as a large company, will never, ever buy a huge volume of product from a single supplier. Of course, did it impact us? It did. Did it cause problems? It did. I'm fully aware of the size of the problem we caused them, but they had the choice of another supplier, they were able to overcome the issue and did not stop their production line. (Msales3s1) [40]

**Criteria for supplier selection**. As the amount of suppliers in market is not an effective way to overcome disruptions, the approved suppliers must have good quality, besides being well-aligned with the FOOD-FC. Interviewees from FOOD-FC pointed out two interesting strategies that are included in this issue - extra capacity of the suppliers and

priority to work with large suppliers. These results in FOOD-FC avoiding problems related to the lack of supplier capacity or poor financial health.

> So how do you prepare yourself for a truck strike, or whatever. You can work with several companies. Today, our strategy is to stick with large companies that can guarantee a level of service. We used to work with smaller companies, but they crashed very easily. (Blog3)[41]

It is a traditional role of Procurement to search for low price suppliers. However in order to mitigate risk, the price is further negotiated and agreed with the head of Procurement department. *"[...] we establish two points: there is the cost and there is the technical assessment of suppliers. Once the suppliers are technically approved, we'll make an internal agreement about the cost" (Bmet3)*[42]. It is also important to check the financial condition of the supplier. The same interviewee from FOOD-FC has affirmed that "*The criterion for supplier selection goes through a few steps. Not just technical stages, but also financial steps and any other assessments to understand if the suppliers are able to meet FOOD-FC demands" (Bmet3)*[43].

**Supplier development.** If there is no supplier in the market for a specific item, or if suppliers seem to be a risk for the buyer, interviewees agreed that developing suppliers is a safe way to keep the company operating in the event of a supplier problem. For this reason Bmet3 alleges that "*So, the challenge is external, but it's also internal. Externally we face a challenge to find a supplier who fits. Internally, we also face a challenge to ensure that we have a second or third option developed*"[44]. Also, this strategy can be a way not to depend on a large supplier (when this is single sourcing) that might, in some moment, take advantage of the situation by increasing the price or restricting the supply. Thus, FOOD-FC has an audit process to help develop supplier under its needs and requirements.

> We have the company XW that can absorb a large volume ... everything we need, we just didn't give them 100% of the volume. We gave part of our volume to the company ZZ, which is a new company; it doesn't have any structure. There was a risk management audit carried out to understand everything that this company needs ... ZZ needs to invest in machinery, in structure ... to reach the quality of XW. (Blog3) [45]

> Actually, if you're audited by FOOD-FC, it gives me the handbook. Got it? What you need to have in your factory. The manual is already an apprenticeship. If you achieve it, you are ready to supply FOOD-FC, and any other company in the market. (Msales3s1) [46]

**Supplier relationship.** As important as having a good supply base is, the focal company holds a close relationship with the suppliers. Therefore, supplier relationship is another issue cited by the interviewees. Interviewees from FOOD-FC have affirmed that the

continuous communication with supplier is a key way to keep updated and to develop a trustful and committed relationship. So that if any risk is about to arise or something just happened, suppliers automatically contact the buyer (in this case, Procurement managers), in order to discuss the problem and come up with good solutions to both. This affirmation is also reported by FOOD-S1 and FOOD-S2. The companies in this case have clearly showed the importance of this relationship to develop resilience through communication, commitment and collaboration between internal and external part of the company.

> [The relationship with the supplier makes] the difference, because if you have close contact, and friendly contact, they often anticipate it for us. I don't need to worry, you know? So, I've come across some suppliers that call me: Look, we're facing a very hard time this Winter, this will causes issues in the future. And I didn't even need to call the vendor. It's a vendor with which I have close contact, more or less weekly, through the size of FOOD-FC's suppliers. So, it's having a conversation with suppliers to anticipate issues, and then passing the information to the business (Bnut3) [47]

> Yeah, you know why? Does it help to prevent shortages? Yes, because normally the supplier knows before things are published. So normally the buyer is warned about a problem by the supplier. And really, it should be like that, right? Always. (Msales3s1)[48]

An additional point cited in this case as an enabler was about changes in contracts regarding time response. Similar to Case 2, interviewees have suggested that the establishment of fees in contracts related to increase velocity in sharing information when a possible risk is forecast should be an alternative to avoid supply disruptions. But it is argued here that increasing the velocity of information sharing can be obtained through a strong buyer-supplier relationship, which is defined as an issue in this study.

**Transportation modes.** If any route has failed due to strike or problems in the roads, there are alternatives to maintaining the normal operation of the company as better as possible. A well-known Brazilian problem has been identified from the data analysis - the transportation by road. Although it is the predominant way of Brazilian transportation, it is the most expensive and danger at the moment due to the bad infrastructure conditions of the roads and motorways, which has been the cause of many supply disruptions. Unfortunately, although Brazil has abundant rivers and space to build rails, it is not well-explored as it should be. Because of that, in this particular case, no evidence of using rails was found. In this case, companies use ship for imported items and road to make the majority of the deliveries. Only one interviewee has mentioned the airplane mode to deliver an urgent parcel in other country. However this modal is very restrict to the type of product. For some of

FOOD-FC's raw material, for instance nuts, there would not be possible use airplane mode for the transportation.

> Modes of transportation depend... but, taking my category, road, [but there are cases in which we use] air freight for urgent cases. So if I consider my category, 70% of it goes by road, but I have some items that are imported, and then we work with shipping. But in the case of domestic products, I've never had to use air transport. It's more when it's imported and a problem comes up that we have to use air transport. (Bnut3)[49]

In this situation, the alternative to become resilient is to make changes in routes. To illustrate that, Mproc3s2 has reported an interesting way to show this idea.

> So, for example, when I was in Guinea Bissau, Ivory Coast, a problem erupted. The president did not want to leave office. So, as it is a French colony, France applied pressure, right, and sent a group there; the military were there and forcibly took control and gave it to the guy that had been elected. The border was closed with Ghana, okay? So the guys in Ghana were like: how do we do this? Well, if a border closes, if you have a problem, you flow through another boundary, right? If you have a problem in Guinea Bissau, you go through Senagal. If you have a problem in Senegal, you go through Gambia, understand? So, there you have the issue of which place supports you best, they all have good points, which let production flow. (Mproc3s2)[50]

To sum up, Table 41 illustrates all of the issues found in this case, besides classifying them into intra- and inter-organisational issues and representing from where they emerged. Equally from the other cases, it was reaffirmed that Procurement function plays an important role in managing and controlling the identified intra- and inter-organisational issues to creating supply chain resilience. To do so, Procurement managers have shown to be capable of adapting, integrating and reconfiguring the FOOD-FC's resources (which are information, knowledge, raw materials, final products and suppliers) through practices and routines (*e.g.* price and volume negotiation as well as purchasing items in the supplier relationship, redundancy of critical items, and intense communication in order to attend internal requirements) so as to overcome the supply disruptions. In the same vein as the other cases, Procurement managers become increasing experience in considering the knowledge acquired from lessons learned of past critical disruptions. As a result, the Procurement manager as well as the commodity buyers in this case are responsible for strategically managing and controlling intra- and inter-organisational issues by rearranging company's resources (internal and external) through knowledge acquired. This procedure matches to the rationale of the dynamic capability theory as explain in the last cases. Moreover, this rationale can be justified by means of interviewees' statements from FOOD-FC as well as FOOD-S1 and FOOD-S2. Furthermore, it also matches the dynamic capability theory.

## 5.4 Data analysis and general results from Case 4 (AGRO)

The fourth, and last case, is composed by a dyadic (focal company and two of its first tier suppliers) embedded in agribusiness supply chain. The focal company is a multinational company that operates in more than 90 countries, and holds around 15 plants in Brazil with more than 1800 employees along a complex and diverse supply chain, which has suppliers with different profiles - from chemical industry to independent producers and farmers. In Brazil, this company works with two business divisions - seeds and crop protection. Regarding crop protection, it produces chemicals for the health care of the seed crops. Both suppliers are responsible for supplying the focal company's chemical industry with a specific pigment. In order to keep them anonymous, they were titled in this case as: AGRO-FC for the focal company, AGRO-S1 for one of the supplier, and AGRO-S2 for the second supplier.

AGRO-S1 and AGRO-S2 operates in the chemical sector, and for this reason, they considered each other as competitors. They are both as largest as AGRO-FC. Therefore, AGRO-S1 is also a multinational company formed through the joint of some international enterprises in 1995. It comprises seven business units in which pigments division is one of them. In this segment, AGRO-S1 holds two industry plants in Brazil. On the other hand, AGRO-S2 is a Brazilian chemical company that operates worldwide - nine countries in the Americas, Europe and Asia. It is a leader in manufacturing surfactants and specialty chemicals, and has other 12 industrial units in Brazil, United States, Mexico, Uruguay and Venezuela.

As this study is focused on identifying particular Procurement actions to cope with critical supply disruptions so as to create supply chain resilience, six people were interviewed from the three companies contacted in this case. Table 42 illustrates companies, roles and codes that represent each of the nine interviewees in this first case analysis.

**Table 42.** Interviewed people in Case 4

| Company | Role | Codes |
|---|---|---|
| AGRO-FC | Procurement Manager | Mproc4 |
| AGRO-FC | Commodity Manager | Mcom4 |
| AGRO-FC | Materials Analyst | Amat4 |
| AGRO-S1 | Supply Chain Manager - Latin America | Mscm4s1 |
| AGRO-S1 | Sales Person | Psale4s1 |
| AGRO-S2 | Sales Manager | Msale4s2 |

Likewise the other cases, this relationship between buyer and supplier in this last case follows the bow-tie or basic buyer-supplier relationship as well. Figure 35 shows therefore the general structure of the relationship between focal company (AGRO-FC) and its suppliers (AGRO-S1 and AGRO-S2).

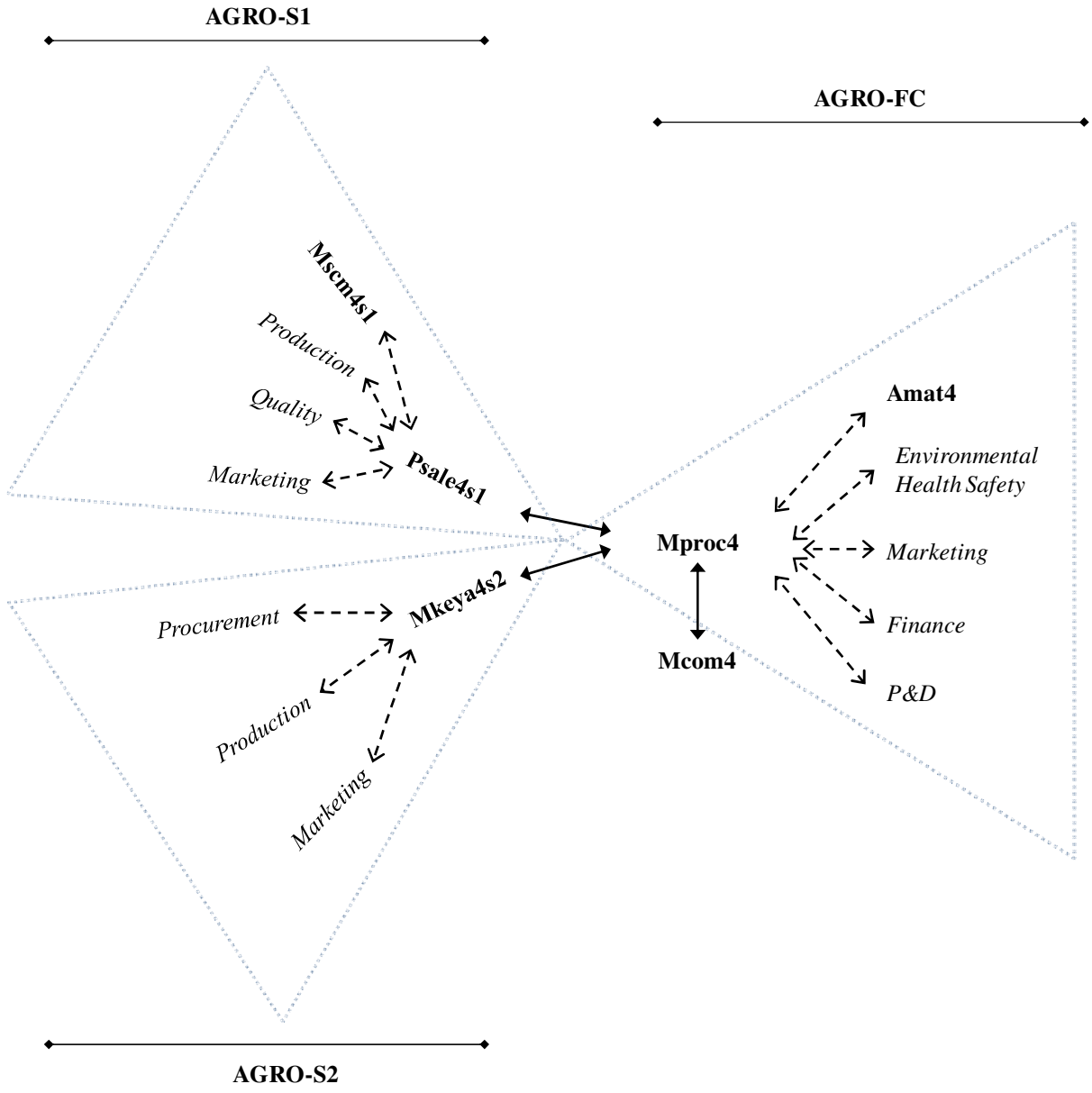


**Figure 35.** General structure of the double dyadic in Case 4

As can be observed in Figure 35, any kind of information between AGRO-FC and AGRO-S1 or AGRO-S2 passes normally through Psale4s1 and Mproc4, or Mkeya4s2 and Mproc4 in this particular segment (chemicals), where Psale4s1 and Mkeya4s2 are the responsible people for this particular customer (AGRO-FC). Psale4s1 clearly justifies this

relationship by stating: *"Now, all contact with AGRO-FC is with me, anything from sales to technical issues"* [1]. Nevertheless, there are occasions in which particular information have to be gathered by one of the sales person from the suppliers; thus, direct communication exists beyond these functions, for instance information about volume demanded from Planning and Production Control (AGRO-FC) to Sales (AGRO-S1 and AGRO-S2). However, Procurement knowledge and decisions always prevail between these companies. Figure 35 therefore represents the standard way to exchange information between these dyadics, whilst Sales and Procurement functions from each side of the dyadic are responsible for sharing the information internally in order to orchestrate and align the activities from internal business functions.

Aiming to keep the business functions aligned and updated with any changes in daily activities, Procurement was found to be a key function to manage the internal resources, however it has not the power to make things work by themselves. For this reason, Mproc4 has reported the importance of Procurement relationship to other business functions.

> yeah, we interact with all functional areas, for example, we get the demand, forecast and everything related from planning; finance supports us for all of our costs, expenditures, income. The development area, the technology side, they are 100% connected with us. Regulatory, everything we do here has to go through them; MAPA, ANVISA and IBAMA, all the rules are 100% followed (Mproc4). [2]

Therefore, according to the Procurement interviewees from AGRO-FC, they play a strategic role by being responsible for managing the flows of raw materials between internal company and suppliers in order to attend the plant demands. In this context, the activities reported by them are: identification and classification of suppliers that are capable of providing a specific raw materials in accordance with AGRO-FC needs; supplier relationship management; negotiation process of a specific purchasing item; development of contracts; and verification of the delivery' situations.

Regarding supply chain resilience, only two of the six interviewees declared to have heard about it but they did not know exactly what it is for. Similarly to the other cases, interviewees reported many resilient strategies and actions in their current practices; however, they use to name it as risk management activities or simply strategic actions to avoid supply problems. Procurement function from AGRO-FC seemed to have well-established and well-known procedures to manage risk in their activities through reconfiguring resources (internal or external) and manage them differently to particular situations. Conversely, interviewees from AGRO-S1 have affirmed not to have any procedure to deal with risk or to manage it,

whilst interviewees from AGRO-S2 mentioned contracts and forecast as tools to cope with disruptions. Subsequent to introduce them the concept of supply chain resilience, all interviewees recognised the great importance of this approach in their business, and hence reported corresponding activities responsible for coping with risk and uncertainties they have faced.

In this case, interviewees have pointed out sources of risk and uncertainties in their supply chain which cause supply disruptions. Figure 36 presents internal, external and environmental sources of risk reported by the interviewees. Regarding those risk sources, two of them are worthy to be emphasized. First, one of the internal risk source stressed (internal forecast) is a risk that comes from external or environmental changes (for example, internal forecast is difficult to accurate due to unexpected changes in seasons), while the other two sources (product quality problems and lack of production capacity) are issues that must be managed by other business functions (for instance, quality and production) and not exclusively by Procurement - which is the main focus of this study. Second, it is notable to stress how vulnerable this particular supply chain (agribusiness) is to environmental risks, such as extreme temperature or/and drought, which can highly impact company's operations and performance; recognising that there is no possibility to reverse these situations. Nevertheless, on this matter, it was interesting to infer by Psale4s1 statement that in case of natural disaster or a very critical situation, customer reacts in a comprehensive way, understanding the reason of the disruption and hence working intensively together to solve the problem. "*It was an interesting thing, because when you tell your customer that there was a problem, a natural disaster, they generally don't break the flow, they understand the problem and [look for] joint actions"* (Psale4s1)[3].

Following this rationale of risk source and uncertainties, interviewees were asked to give some examples of critical supply disruptions they have faced and have consequently impacted the performance of the company. The examples given by them covered a wide range of problems that mostly emerged at upside of the supply chain, and normally from external and environmental causes. Table 43 portrays the examples, the actions taken to reverse the situation, and the main points of the decisions.

Interestingly, a well-known example from the literature was reported by one of the interviewees - the Ireland ash cloud. In this regard, it is remarkable to stress how impactful this event was for many large companies embedded in a global supply chains. Additionally, observing the examples in Table 43, not only strategies found in the literature were pointed out as actions to overcome untoward events, but also new strategies showed up such as

"temporary loan from customer stocks" and"alternative proposal development for customers". These actions probably emerged from knowledge and experience of the participants; for this reason, AGRO-S1 seemed to be proud of this strategy to face challenges and deal with them.

> In most cases ... it [the disruption] might cause harm in terms of cost, but not in terms of the company's image; because customers often say: well, you gave me a problem, but you also provided the solution. (Psale4s1)[4]

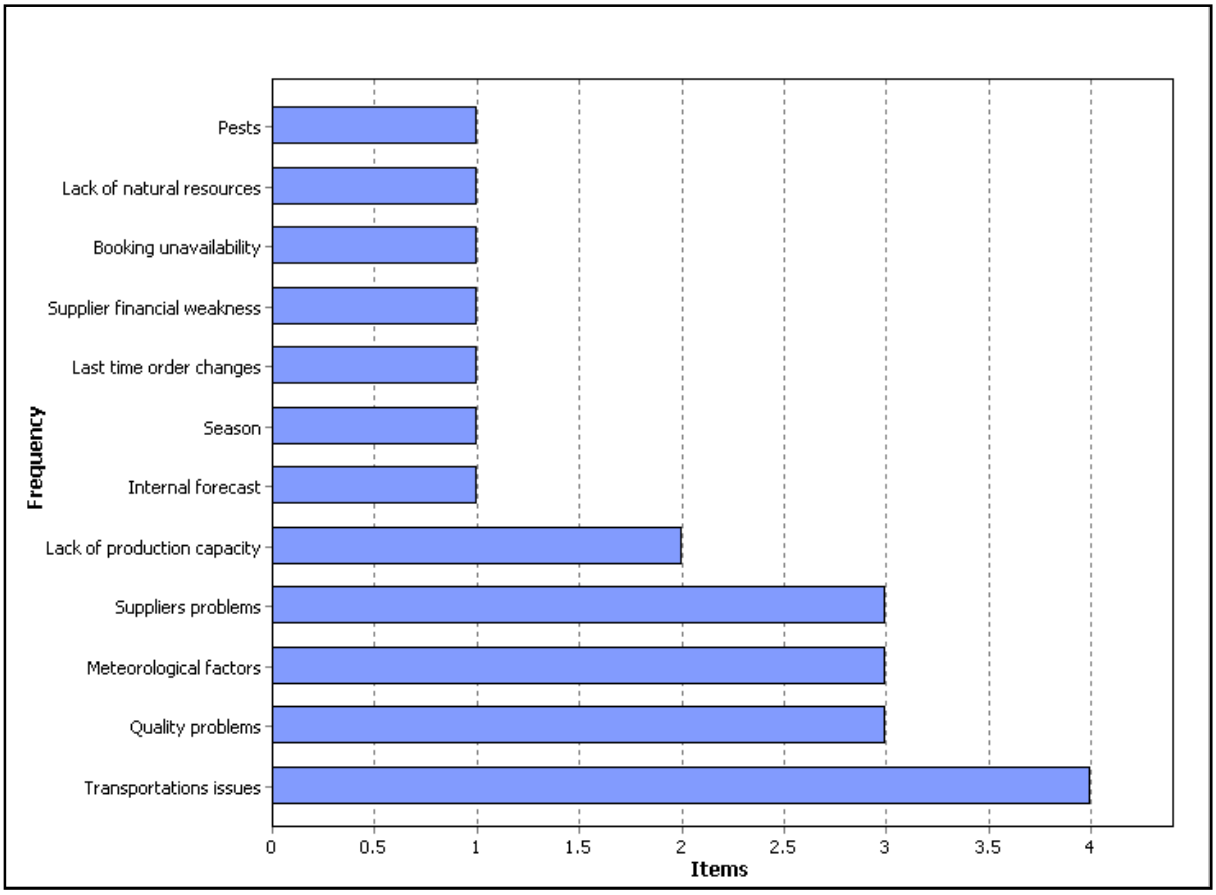


**Figure 36.** Sources of risk and uncertainties cited by interviewees in Case 4

Therefore, taking into account those examples, the key actions and strategies to mitigate disruptions reported by the interviewees from both sides of this dyadic are: supply chain configuration, transportation modes, knowledge acquired, supplier relationship, product flexibility, redundancy of critical items; and supply base.

Interviewees from AGRO-FC, AGRO-S1 and AGRO-S2 have reported common problems in the flows of goods, such as very short delays in deliveries that could be reversed through changing the production scheduling. Thus, these types of problems are not considered in depth in this study, recognising that this activity is more related to Production decisions rather than Procurement. In this regard, Wright (2013, p.31) affirms that flexible manufacturing is "the ability to respond quickly to currency fluctuations, supply disruptions, and sudden demand shifts by altering manufacturing volumes, mixes, and venues".

**Table 43.** Real examples of supply disruptions in Case 4

| Examples | What happened and consequences | Actions taken to mitigate and/or cope with the disruption | Main points regarding actions and/or strategies to overcome the disruption |
|---|---|---|---|
| **Drought due to extreme meteorological changes** | ...one of the requirements to plant corn seed is that the producer must have an irrigation field. Anyway, if it's a summer like we had here in Brazil, very atypical, with a lack of rain, then this producer sometimes will not get the right amount of water to irrigate, this consequently affects the seed quality, in germination as well as in productivity. However if we have a rainy period close to the harvest time, then that is harmful too because the grain decays inside the ear (of corn) (Mproc4) [5] | Against this bad weather - when we lack rain, for example - the solution is to bring water or water resources from another place. When it rains too much, there's no action we can take to prevent that (Mproc4) [6] | ➢ Supply chain configuration<br>➢ Transportation mode |
| **Lack of supplier capacity** | Last year (2013), we had a big problem with raw material for a herbicide of ours, that's our biggest product volume… it's this material, they didn't have product, and they couldn't supply us. And we had a huge volume, that we had to import quickly and we paid a high price to import it in a hurry (Amat4) [7] | We had to redistribute some production for a few months, change the monthly volumes in order to have no disruption during production. This year, we decided to work differently in order to not to have the same problem. We hold a planning meeting where the São Paulo staff that are more related to the commercial department, where our demand comes from, the plant planning department, and us. And if we have a problem with material supply here, where we're not going to be able to serve production, or we're going to delay production, we align the planning departments to analyse this disruption and decide what can be done (Amat4) [8] | ➢ Changes in production planning and scheduling<br>➢ Planning meeting<br>➢ Alignment along the business functions (internal communication) |
| **Problems with a critical supplier** | We have had many disruptions in production because of 20L barrels. This is a complex item to work with, because there must be a high volume of stock to supply production during the harvest. One million barrels are used a month, and 20L barrel production is very slow. So our suppliers, they faced some problems like this for a few months and some of them couldn't supply us. Then we had a lot of problems. During 2012, we even lost sales because we didn't have barrels, because we couldn't pack products. There was a demand of 300 hundreds litres of product, but we could supply only 200, 250 (Amat4) [9] | In 2013, we worked differently. A safety stock was organized based on the requirements and we carried out a study on how many we would have in stock to supply during the harvest period. In fact, there were simple actions to prevent this issue with lack of material (Amat4) [10] | ➢ Redundancy of critical items |

**Table 43.** Real examples of supply disruptions in Case 4 (continue)

| Examples | What happened and consequences | Actions taken to mitigate and/or cope with the disruption | Main points regarding actions and/or strategies to overcome the disruption |
|---|---|---|---|
| **Product quality problems from suppliers** | We have faced recently some quality problems that created a bigger disruption. It was related to a third-party supplier of ours. He couldn't supply our needs and we had owed material to the supplier for 15 to 20 days (Mcsm4s1) [11] | [...] we were able to switch one material for a client that had extra in stock, to this other client. And in the meantime we anticipated other suppliers' orders. We have some background suppliers, and so if there's a problem, I can still fulfil our needs (Mscm4s1) [12] | ➢ Temporary loan of customer stocks* (supply chain configuration)<br>➢ Dual sourcing |
| **Changes in plant location - time response and transportation mode** | We had a client, client too. They scheduled, more or less, a ton of pigment, 500 for December, 500 for January. However, the location of the plant which produced this kind of pigment changed. It was transferred to another place and in this move, the stock made to fulfil this company's orders wasn't enough. Their order, let's say, there were 10 tons requested and they produced 8 tons. So then they gave priority to the client, right? The marketing staff sat and defined this product and that product (Psale4s1) [13] | [...] then I had to get in contact with this client and say: hey, instead of receiving one thousand, you are going to receive half of it. And what happened? This half didn't exist, it wasn't defined, and it wouldn't be possible to ship. So, what did we do? We opted to deliver by airplane for the first order, and at the second order we could start the new production. What happened? New production never started. So we had another situation!! We presented some alternatives to the client and they accepted, because the story was very similar, and they accepted it just for that order. And when new production started, we had the other 500 kg of pigment from the first order, so we delivered. We found the solution to the problem, which was, firstly, bring by plane and secondly, present alternatives [to the customer] until the arrival of the other 500kg (Psale4s1) [14] | ➢ External communication and negotiation (supplier relationship)<br>➢ Transportation mode<br>➢ Alternative proposal development to customers (knowledge acquired)<br>➢ Product flexibility |
| **Ireland ash cloud in Europe, and Snowstorm in US** | You remember the volcano in Iceland in 2010? The one that spread smoke over the whole of Europe? It blocked a lot of airports and we were stuck for 20 days without a plan. You would receive something, but just a bit, right; then the whole system stopped and it's even funny, because, when something like this happens, the client that with overdue products, he understands. You mentioned something that make me think, because when something happens, the tsunami in Japan too... recently there has been a snowstorm in the US, it delayed some of our importations via plane. And it was an interesting thing, because when you justify to your client that there has been a problem, a natural disaster, they generally understand (Psale4s1)[15] | ... There are joint actions, but they don't get... uh, like, angry… Oh, you've screwed up? No, they don't get like that, they understand. Our average is usually 20-30 days to deliver to the client. It was delayed 45 days and the guy didn't complain, and their production went on. Either they have got safety stock there or, (and we were exclusive in this case), or he simply transferred production, or the other raw materials never arrived. (Psale4s1) [16] | ➢ Better comprehension of the disruptions (knowledge acquired)<br>➢ Joint actions (internal communication)<br>➢ Redundancy of critical items<br>➢ Changes in production scheduling<br>➢ Single sourcing (barriers) |

In addition to the actions or strategies reported to deal with a more severe supply disruptions, interviewees have suggested points of improvements that should be applied to their routines by aiming to achieve supply chain resilience. On this matter, most of the suggestions were made to improve internally rather than externally. Thus, internal suggestions were: efforts and actions focused on risk mitigation, product study and technological development, identification of critical items and development of supplier strategies, and critical analysis of the events (Table 44).

**Table 44.** Points of improvements regarding internal resources

| Internal suggestions | Statements of the interviewees |
|---|---|
| **Efforts and actions focused on risk mitigation** | So I think we lack focus. I think we do a lot of daily stuff without focus, without pausing to think, like, let's talk about risks. I guess if there was a process like this where we pause and analyze each product risk and each function risk, maybe we would get more results and more targeted managerial actions. We do this today, but it's part of the routine; so sometimes it's difficult to separate which action I took to prevent risks and which ones I took to guarantee the product here. It's all on the same scale and it's not possible to separate. So it may be necessary to have some focused actions, like, risk mitigation (Mproc4) [17] |
| **Product study and technological development** | Our chain is too big... [And because of this] there is a lot of interference. So it's difficult to point out a single point. I think that the more AGRO-FC studies it's materials and develops technologies, it's the only way we can minimize delivery disruptions (Mproc4) [18] |
| **Identification of critical items and development of supplier strategies** | Today we've been doing a work in planning the reestablishment of every item's parameters. We take each material, each item, and we analyze whether it's product A, B, or C; the lead time; the best strategy for covering this material… and today we've been surveying 100% of the items, evaluating the supplier options, where the supplier is based, whether this is a strategic place for AGRO-FC or not, whether other suppliers with shorter lead times need to be developed, with further agility in terms of delivery, as it gives us further flexibility in production, because if the lead time is long, we get stuck and I don't have the flexibility to change product. We are carrying out a study this year of reestablishing the parameters of all these items now, in the first semester before harvest, in order to work in a different manner during the harvest. An ABC curve looking at volume and analyzing everything, to the core of the product, verifying the supplier, where they're located, it's a very critical analysis (Amat4) [19] |
| **Critical analysis of the events** | Afterwards you must critically analyze, where have we failed? What have we missed? What haven't we predicted? Could we have predicted that? Do we lack any procedures? Is there a lack of information? What have we skipped? Following these steps, we will surely find a way to avoid the same problem, the same things, you know. It would be an analysis after any disruption, after any problem. And so it's not hidden, right, it shows that you want to solve it, to look for a multidisciplinary team to treat the issue (Msale4s2) [20] |

On the other hand, Table 45 exposes external points of improvements such as earlier orders and increasing partnership with supplier.

**Table 45.** Points of improvements regarding external resources

| External suggestions | Statements of the interviewees |
|---|---|
| **Earlier orders** | Look, it's like I said; we took part in these studies last year and it's being implemented now. And one of the things we have been implementing is that when someone orders, the client that orders first has a higher chance of receiving the product, so, in our chain here, what do I say as a vendor? To my clients, I say order as early you can, and the earlier the order will come. It'll be in the system, and so the better the perception of guaranteeing results will be (Psales4s1) [21] |
| **Increasing partnership with supplier** | We work with the idea of having many suppliers serving us, right? So that we don't lack products; and the suppliers we work with today, we try to be close to them in order to prepare our scheduling, to avoid any disruptions, mainly during production time. […] and we have a plan to have at least two suppliers per item, then we don't lack products, we don't take the risk of not having supply during the harvest, something like this (Amat4) [22]<br>If I have got a supplier that I define as a strategic one, I will work with him like a partner. I will tell him about innovation projects, I will focus all efforts to expand this supplier. We will work together each month to find opportunities, the volume I will need… This is strategic partnership (Amat4) [23] |

Following the presentation of the results in the last case, barriers and enablers to creating supply chain resilience were additionally emphasized by the interviewees. Table 46 illustrates internal as well as external barriers and enablers related to this case. Equally to the other cases, interviewees have mentioned some barriers that go beyond the the role of Procurement (*e.g.* company's policy and knowledge, rigid hierarchy, and importation issues). Additionally, the rationale of opposite ideas between barriers and enablers is still kept for this case.

**Table 46.** Barriers and enablers to help create resilience in supply chains

| Barriers | Enablers |
|---|---|
| *Internal* | |
| Rigid hierarchy<br>Delay in internal approvals due to bureaucracy<br>Company's policy<br>Single-sourcing<br>Lack of internal communication | Flexibility<br>Financial strength<br>Company's knowledge<br>Information sharing<br>Internal integration |
| *External* | |
| Supplier Financial weakness<br>Lack of collaboration<br>Complexity of the supply chain<br>Long lead times<br>Lack of supplier capacity<br>Lack of substitutable supplier<br>Delay in communication<br>Lack of commitment<br>Importation issues | Financial strength<br>Information sharing<br>External integration<br>Collaboration<br>Early communication<br>Alignment of members along the supply chain<br>Commitment |

The further paragraphs present the issues found in this fourth case study. It is emphasized that it is totally focused on Procurement intra- and inter-organisational issues responsible for preparing for unexpected and non-common events, responding to disruptions, and recovering from them. Table 47 summarises all of them by classifying into intra- and inter-organisational issues and how they were found throughout the data collection.

**Table 47.** Intra- and inter-organisational issues from Case 4

| Type | Issues | What is it included into it? | Sources of risk | Example | Points of improvements | Barriers | Enablers | Discussion |
|---|---|---|---|---|---|---|---|---|
| INTRA-ORGANISATIONAL | **Knowledge acquired and backup** | knowledge to manage the risks, meeting to discuss the situation; give solutions to customers; better comprehension of the disruptions; company's knowledge | √ | √ | | | √ | √ |
| | **Internal communication** | alignment along the business function; joint actions; avoid the lack of internal communication and collaboration; internal integration | | √ | | √ | √ | √ |
| | **Communication tools** | tecnhological developments | | | √ | | | √ |
| | **Redundancy of critical items** | safety stock | | √ | | | | √ |
| | **Risk management** | assessment of supplier financial situation and capacity; efforts and actions focused on risk mitigation; critical analysis of the events | √ | | √ | √ | √ | √ |
| | **Procurement structure** | higid hierarchy; simplicity of internal processes regarding approvals; bureaucracy; company's policy | | | | √ | √ | √ |
| | **Supply base** | dual sourcing vs. single sourcing; substitutable suppliers | | √ | | √ | | √ |
| | **Supplier development** | only for special occasions | | | | | | √ |
| INTER-ORGANISATIONAL | **Criteria for supplier selection** | strategic suppliers | | | | | | √ |
| | **Supplier relationship** | intensive external communication; negotication; increasing partnership; commitment; external integration; alignment with members of the supply chain | √ | √ | √ | √ | √ | √ |
| | **External inventory** | external stock within its supplier's plants | | | | | | √ |
| | **Supply chain configuration** | temporary loan of customer stocks; help to reduce the supply chain complexity and lead times | | √ | | √ | | √ |
| | **Transportation modes** | problems in transport; reconfiguration of routes | √ | √ | | | | √ |

**Knowledge acquired and backup.** As recognised in the last cases, manager's knowledge from daily experience and lessons learned is also recognised to be an issue in this case. To increase the knowledge of Procurement employees, they become more capable of dealing with further disruptions in a better way; even though these disruptions might come out from different causes. All interviewees from the dyadic have affirmed the importance of this issue to creating resilience in the company, and consequently along the supply chain. In spite of this positive affirmation, only AGRO-S1 records the problems and actions taken to overcome them. Thus, much information can be lost over the time, and new members might have not the opportunity to learn from other's experience.

> Yeah, this is really important. Each season is different, but a material may behave the same for different seasons. So really, knowledge is a facilitator (Mcom4) [24]

> Yeah, the right thing is to record what happened, and leave a record of the problem and the solution. I've already done that. Here, we have a window in the system to put and update this information, however, personal experience is the most valuable thing. I've already been through it, so I have the solutions. I believe in it (Msale4s1) [25]

**Internal communication.** In line with knowledge acquired, internal communication can also be considered an issue due to its importance to align activities through effective information sharing within the company. Thus, Procurement (as a spanning function) is able to execute its role by passing information through both sides (AGRO-FC to AGRO-S1 or AGRO-S2, or the other way round) in a most rapid way, by preparing the company to any possible critical changes in the plan.

> Yes, I think it's an essential factor. [...] Sometimes we get a lot of information at the last minute and this makes it very difficult for people to be able to act before a deadline, got it? Today, communication, as I said, is sometimes flawed. It's what creates major damage, because we don't have enough time to work and we have to work to meet the needs of suppliers and customers (Mscm4s1) [26]

**Redundancy of critical items.** As well as emphasized to create supply chain resilience, redundancy of critical components is another issues well-discussed and well-applied to Procurement activities to cope with supply risk. Internal safety stock showed to be a common business strategy of these dyadic to avoid production breaks and supply disruptions along this supply chain, especially when the raw material comes from a single sourcing. Moreover, AGRO-FC makes widely use of this issue to cover another possible issue - product flexibility. Neither AGRO-FC nor AGRO-S1 or AGRO-S2 have product flexibility due to the product's specification. It can happen but it is not well-accepted by the companies, as can be seen in one of the examples above.

> [...] let's say that the most critical case is the product that is single sourcing, highest volume. If this product has any shortage, the gross profit that I'm going to lose is high. [In this case] it's just the stock; Even if we make an agreement with the supplier to keep stock as well, AGRO-FC also keep a safety stock, ok? (Mproc4) [27]

Nevertheless, this agribusiness supply chain has a particularity to deal with safety stock. Some raw materials/products have a short shelf life; thus, there is a limitation regarding the size of the internal safety stock. The higher is the stock, the lower is quality of the product along the time. Therefore, redundancy of critical components is just a partial Procurement strategy to creating supply chain resilience.

> Today what happens to our stock. It's live stock. Every day that passes, it loses it's quality So if it's been a month and we did not sell, we're losing the quality of it and therefore we have to reduce the sale price. This, at the end of the day, ends up as cost of production, right. Stock that we have to discard. (Mcom4) [28]

**Communication tools.** Having technology that supports internal and external information sharing seems to be a good tool to Procurement in order to keep updated members along the business, and hence getting to know as fast as possible about possible changes that may end up into disruptions. Thus, technology to improve communication is other issue mentioned by the interviewees in this case. It has shown to be valuable to creating resilience by sharing information with important members within the focal company (AGRO-FC) or along the supply chain (AGRO-S1 and AGRO-S2 in this case). However, no technology that shares real time information was found between AGRO-FC and its supplier (AGRO-S1 and AGRO-S2). Apart from telephone, e-mails and Skype, interviewees from AGRO-FC and AGRO-S1 have mentioned SAP (System Application Products) and Team Space as technologies. Nonetheless, according to their statement both systems seem to be internal focused.

> The communication system that AGRO-FC uses is Team Space, where a functional area records the ongoing activities, the steps of each process and then shares this with the other stakeholders. This is a tool that we have. (Mcom4) [29]

**Risk management.** Lastly, it is another Procurement activity which can be considered an essential practice to prevent companies against disruptions. Interviewees from AGRO-FC mentioned the existence of a department responsible for identifying and analysing risk that might affect different types of commodities. Thus, information provided from this department is rather important to Procurement manager make decisions and guarantee preparedness and response to rapid onset events that might come from AGRO-S1, AGRO-S2 or any other suppliers.

Procurement interviewees from AGRO-FC showed to have well-developed risk management practices in which they observe possible risks from its suppliers and hence managing and reconfiguring internal and external resources to avoid them. These resources can be related to internal communication, safety stock, location of the inventories (internal or external), size and number of suppliers or still supplier relationship. Mproc4 explains it in the statement below. Furthermore, the risk analysis and management is executed in daily activities; so that, it is not a rare practice.

> Raw materials management is done in three or four ways. You concentrate on product in hand from a strategic supplier where you can, for example, use a partnership strategy; you can put a portion of these products into the hands of common suppliers which you manage based on competitiveness, or you also have suppliers that are specific to products that have no alternative, or because of the company's decision, or because there's no other alternative product on the market. And then, for each line, for each trading strategy, there's a risk management plan. (Mproc4)[30]

**Supplier base.** This is one of the main issues discussed in the interviews by Procurement members. As Procurement is predominantly focused at upstream of the dyadic, it seeks to identify capable and trustful suppliers (more than one) in a strategic location. In this sense, Procurement from AGRO-FC seemed to be prepared to unexpected events in order to increase the response of the recovery. However, interviewees from AGRO-FC reported the complex situation of having more than one supplier approved to every component. The reason given was the lack of substitutable supplier in market, the lack of product quality from other suppliers, the long distance between buyer and supplier, or even because the company could not approve any extra supplier due to excessive bureaucracy.

> The situation is this: I have several products that are single sourced, there are no alternatives. Some cases of single sourcing are because of AGRO-FC, because AGRO-FC didn't try to approve another supplier, but there are many cases that are single sourced because of the market. It's a special product developed by AGRO-FC and the market can't keep up. (Mproc4)[31]

**Criteria for supplier selection**. In line with the last issues, the criteria applied to select and approve suppliers in this case is related to the size of the suppliers. Thus, AGRO-FC seeks to work with global companies, so that it does not become vulnerable to supplier regarding financial health or lack of commitment. Additionally, the location of the supplier is relevant to reduce lead time. In this sense, Mproc4 affirms "*AGRO-FC has few contracts or purchases from small suppliers. Most of the suppliers are global. The reason is to mitigate risk*" [32].

**Supplier development.** In terms of supplier development, as AGRO-FC prefers working with global supplier, it does not seek for developing new suppliers, however for special occasions the company is trying to develop new ones so as not to depend on a critical supplier.

> There is a national [supplier] with which we're also working, but we don't have dual sourcing. The largest volume is a mineral that we take from Petrobras, but this is very complicated, because it's in Petrobras' hands, which is a very complicated institution. So we're working to have more than one option for this material. (Amat4) [33]

**Supplier relationship**. Although the interviewees have positively affirmed the need of good supplier relationship, AGRO-FC works closely with strategic suppliers only, and not with all of them. This strategic relationship can be observed in these dyadic through the following statements from both sides.

> If I have a supplier that I define as strategic, I will work in partnership with them. I'll talk to them about innovation projects, I will focus all my efforts to improve the supplier, I will work with them every month to see what the opportunities are, what the volume is that I'll need... this is strategic partnership. "(Mproc4)[34]

> Once a month I visit on location, yeah ... and every 15 days we talk on the phone, especially with Mproc4 and Amat4, via phone and email. (Psale4s1)[35]

**Supply chain configuration** and **transportation modes** were also considered relevant issues in this case due to actions taken by members from AGRO-FC as well as AGRO-S1 and AGRO-S2 to reconfigure routes and/or to change modes in order to reach the goal, and not fall into breaks. It is observed through the following assessments as well as through the aforementioned examples.

> Products can't be more than 300 Km from my processing plant. It's a perishable material, so as soon as I take it from the field, I have to take it for processing. (Mcom4)[36]

> There was a case, for example, where the customer ordered 40 days prior, and because of a logistics problem, or some problem with the product, the product would only be ready in 50 days. We warned the client, and then if we have to send it by air freight, we send it by air freight - anything to avoid this delay. (Psale4s1)[37]

**External inventory.** Taking into account the last statement, external inventory is therefore recognised here as an issue to creating supply chain resilience. In this sense, AGRO-FC has extra time to implement other strategies to cope with supply disruptions, knowing that additional stock is kept externally - in their suppliers - which are strategic located nearby.

> If our product is in production, we work to not have to stop the production for any reason. So for items that we consider important, there are external storage tanks, so AGRO-FC hires these tanks. So we have a high volume of this product there, in very large quantities. The supplier is responsible for supplying these tanks. (Amat4)[38]

> Yes.. AGRO-FC also keeps safety stock for some products, within the company or outsourced. So a couple of times, for a few products, we rented a place to keep the safety stock in order to ensure that there won't be a shortage of this product. (Mproc4)[39]

From the above examples, points of improvements, barriers and enablers, additional topics have showed up from the analysis of this case. Temporary loan of customers stocks was an interesting alternative given by Procurement employees from AGRO-FC, however this strategy can be considered into the supply chain configuration issue, as well as joint actions fits into the supplier relationship.

Table 47 summarises all of the issues found in this last case. It also classifies them into intra- and inter-organisational issues and portrays from where they have showed up throughout the data collection. As well as the other cases, Procurement has proven to play an important role in managing and controlling intra- and inter-organisational issues to creating supply chain resilience. To do so, Procurement managers make use of the internal and external resources (which are information, knowledge, raw materials, final products, technologies, and suppliers) through adapting, integrating and reconfiguring them according to Procurement practices and routines (*e.g.* identification and classification of suppliers that are capable of providing a specific raw materials in accordance with FOOD-FC needs; supplier relationship management; negotiation process of a specific purchasing item; development of contracts; and verification of the delivery' situations). So that, they become able to deal with supply disruptions, besides increasing the managers' knowledge and experience by means of lessons learned. As a result, the Procurement manager as well as the commodity buyers in this case are responsible for strategically managing and controlling intra- and inter-organisational issues by rearranging company's resources (internal and external) through knowledge acquired. This rationale was build through the analysis of this fourth case in which statements from AGRO-FC, AGRO-S1 and AGRO-S2 were considered. Furthermore, it also matches the rationale of the dynamic capability theory as explained in the previous cases.

## 5.5 General results from cross-case analysis

In this section, a comparative analysis is presented by considering the intra- and inter-organisational issues found in the early cases. To do so, a discussion about the differences and similarities of each case is exposed below. At the end, Table 48 e 49 summarizes differences and similarites about the intra- and inter-organisational highlighted in each of the four cases (BEV, KAPPL, FOOD and AGRO), whislt Table 50 summarizes each of the discussed in these cases.

### 5.5.1 Intra-organisational issues

**Knowledge acquired** from lessons learned of past critical events is a key point to increasing the manager's experience to deal with future disruptions. In this respect, it is valuable to remind the Mppc2's statement - "*internal, external, any knowledge available*" [1]. Therefore, it is through knowledge acquired that Procurement managers or employees become capable of managing the available resources in order to prepare, respond and recover their business from any critical breaks, and consequently building resilience. It therefore corresponds to Ponomarov and Holcomb (2009, p.137) affirmation: "the capacity to learn from past disruptions to develop better preparedness for future events is a principal property of resilience". Furthermore, it means that they are able to deal with a wide range of disruptions through wisely managing and controlling other issues (intra- or inter-organisational issues), and hence creating a supply chain resilience. It can be noticed through the examples in each of the four cases. As a short justification, Mmint1s1 in Case 1 asserts that they have learned how to mitigate certain disruptions by changes their supply base (inter-organisational issue). Therefore, although companies from the four cases are embedded in different supply chains, this issue was strongly highlighted by all of them as an important point to improve their abilities to cope with future untoward events. One characteristic that differentiated this issue from one case to another was the routine of recording problem situations (**backup**). Only BEV-S1 (Case 1) and AGRO-S1 (Case 4) record the problems and the subsequent actions taken to overcome them. Nevertheless, this practice was found in any of the focal companies, where Procurement activities have been explored. As a result, knowledge acquired seems not to be well-spread among Procurement employees, which makes this kind of knowledge remains limited to those who made part of the critical moment (any disruptive event). This is therefore a critical finding of this analysis considering that

Sheffi (2001, p.4) has stated that "companies cannot afford to maintain redundant employees around “just in case”; companies should insure that their knowledge is backed up". Thus, much information can be lost over time, and new members might not have the opportunity to learn from other's experience. It can undermine the resilient capability of companies along their supply chain, reminding that knowledge management is part of the planning process to build supply chain resilience, and constant information exchange and learning from horizontal and vertical supply chain partners to keep skill levels up is therefore essential in a company (Scholten et al., 2014).

**Internal communication.** This is another highly cited issue in all cases (Case 1, Case 2, Case 3 and Case 4), especially considering the importance of Procurement in rapid passing information through internal customer and suppliers to found efficient solutions in times of turbulence and to align the decisions. This great interconnection that Procurement plays between internal and external of the company is clearly stated by Mpurc1 in Case 1. Thus, the better the communication is, the faster the problem might be solved (Chiang et al., 2012).

> In fact, we have a strong connection with all of our internal customers. The whole company, let's say, works in Procurement, right. Because everyone has a particular need. So we are an area that looks after the company as a whole - there are functions with higher or smaller demand, but my area supplies all of them. (Mpurc1)[2]

It was noticed in Case 1 and Case 3 that not only internal communication is relevant in critical times, but external communication is also essential. It is therefore one of the element that improves the supplier relationship (inter-organisational issues further discussed) even stronger (Christopher and Peck, 2004; Blackhurst et al., 2011; Scholten et al., 2014). "*In the time of crisis, what’s needed is communication. A meeting in person - communication has to flow. Internal, external, any knowledge available*" (Bnut3) [3]. In line with this statement, one of the interviewees from Case 4 has highlighted that it is difficult to creating resilience if the information sharing is timing consuming. Otherwise, the size of the company has been highlighted in Case 2 as an enabler to achieve a better internal communication and, consequently, improving the resilience. By and large, results from this issue match Zsidisin et al. (2005) and Chiang et al. (2012) affirmation when they state that by improving the communication between Procurement and other functions, the organisation may reduce cost and lead-time, while enhance flexibility, quality, and its overall competitiveness.

**Redundancy of critical items.** As one of the well-discussed characteristic in the literature to create supply chain resilience, redundancy of critical components was predominantly found in all cases of this study (Case 1, Case 2, Case 3 and Case 4). Although stock may be considered a good strategy to mitigate disruptive impacts in the first place and create responsiveness through redundancy, it only affords the company with extra time to find other effective actions to cope with the consequences (Zsidisin et al., 2000). Strategies to manage internal inventory is normally more related to Logistics or Production (depending on the company' structure) than Procurement; however, how much stock the company has to hold as safety stock is a Procurement decision as well (Gadde and Hakansson, 2001; Trent and Monczka, 2004; Sobhani et al., 2014). Although all companies within the cases are alert of the high cost to maintain inventory, especially KAPPL-FC whose works with the kanban system, all of them hold a minimal safety stocks of raw materials. Notwithstanding, they do make it in a strategic way. BEV-FC, for instance, holds additional stock in times of high demand, whereas KAPPL-FC holds higher volume of stock to import items which demand long lead times. As well as KAPPL-FC, FOOD-S2 used to hold high volumes of stock for imported items, however it has changed due to importations from Africa has now take only seven days to arrived at the coast of Brazil. Even though, FOOD-S2 still holds 60 days of stock to cover any unpredictable events that could impede it to attend its customer (FOOD-FC for instance). Therefore, it seems that all companies hold different volumes of stock according to their needs. In Cases 3 and 4, for examples, companies do not use to hold high stock in virtue of the short shelf life of their products - The higher is the stock, the lower is quality of the product along the time. One particular point about volume of stock was observed in all cases - focal companies always hold less stock than their suppliers. In order to make up this difference that might occasionally cause trouble to them, they have external inventory (inter-organisational issues further discussed). Lastly, interviewees from the dyadic in Case 4 have stated to hold inventories as a way to compensate the lack of product flexibility. Therefore a "slack" in the inventory is considered a fundamental way to delivery of material on time (Carvalho et al., 2012a) and consequently create supply chain resilience in the current unstable environment (Christopher and Peck, 2004; Zsidisin and Wagner, 2010; Scholten et al., 2014).

**Product flexibility.** Although product flexibility seems to be closely linked to Production decisions, it involves Procurement opinion and support to find specific as well as

alternative suppliers capable of providing the required items (Foerstl et al., 2010; Sobhani et al., 2014). Thus, substitutable items is therefore a powerful alternative to companies mitigate a possible lack of specific items due to a disaster in supplier's plant, for instance (Sheffi and Rice, 2005; Tang, 2006b). Despite this action is considered a great strategy to creating supply chain resilience, only in BEV and FOOD cases this factor has showed up. However, BEV-FC has this ability for only items B and C. For this reason, interviewees from BEV-S1 and BEV-S2 have stated that they cannot provide any substitutable item to BEV-FC considering the particularity of its products. It might happen for BEV-S2 in rare occasions, as they have the specialist department; nevertheless it will be costly to them. In Case 2, FOOD-FC and FOOD-S1 presented great examples of being resilience in their examples through product flexibility, whilst FOOD-S2 was not flexible at all. One of the KAPPL-FC managers has affirmed that this lack of flexibility is a limitation of the company; on the other hand, KAPPL-S1 has shown to be flexible in this regard. Lastly, no evidence of this issue was found in Case 4. The more complex the products' configuration becomes, the more difficult is the recovery from any supply chain disruption (Blackhurst et al., 2011); it therefore implies on creating resilience in the supply chains.

**Communication tools.** Technology is considered a powerful tool to share and spread information from horizontal and vertical supply chain partners nowadays (Christopher and Lee, 2004; Tachizawa and Gimenez, 2010). So that, it can be much useful for Procurement to manage the increasing number of activities within and beyond the company, and thus getting to know as fast as possible about possible changes that may end up into disruptions. Regarding this issue, only KAPPL-FC has presented the Electronic Data Interchange (EDI) in order to exchange information between focal company (KAPPL-FC) and its suppliers (KAPPL-S1 and KAPPL-S2). Through this system, information is sharing in real time, and suppliers are able to visualise any changes made in the company's inventory (Tachizawa and Gimenez, 2010). It improves the visibility along the supply chain as well as the response capacity if any unexpected event occurs (Christopher et al., 2011). Therefore, it consequently helps increasing the creation of supply chain resilience. In case 3, FOOD-S1 and FOOD-S2 made use of a system online to place order as a communication tool. The use of e-mail, telephone, and Skype were found in the Cases 1, 3 and 4, however they are not as efficient as EDI in terms of real time exchanging information. Internally, all of them have ERP/SAP systems or any other similar one.

**Technological ways to discover, recover and redesign the supply chain**. This particular issue points out technologies related to risk identification, actions and solutions development, and supply chain rearrangements. Thus, in receiving useful information about likely risk at upstream of the supply chain, Procurement employees are able to put additional resilient action into practice; in other words, rearranging internal and external resources by paying attention to important issues highlighted in this study. No evidence of this kind of technology was found in the four cases as it presented in the literature (Sheffi, 2001; Sheffi and Rice, 2003; Blackhurst et al., 2005; Tang, 2006b; Christopher and Holweg, 2011; Carvalho et al., 2012b; Azevedo et al. 2013b); however this kind of tool was suggested as improvements to creating resilience in Case 4. Only BEV-FC and BEV-S1 from Case 1 presented a system that integrates all information about the results and consequences of a problem and then helps to develop an action plan to cope with that problem. But it was also stated that this system is not commonly used in BEV-S1. Furthermore, although no similar system was found in Case 3, an interesting situation was identified, differently from the other cases. Interviewees from FOOD case have complained about the lack of a specialist group or institutions responsible for study and forecast commodities (*e.g.* nuts and peaches). According to them, there are government institutions and private sites that provide forecasting from statistical models to commodities; however, the inaccuracy of the information is a weak point. They complement saying that when there are tools to gather information and provide trustful results, it is not put forward. In this respect, there is a real example about UPS in the literature, in which they develop a better system to manage risk in comparison with the government (Sheffi and Rice, 2005). Other examples related to this kind of technology has been reported in the literature recently (Sáenz and Revilla, 2014); it therefore revels the great importance of this kind of tools to creating supply chain resilience.

**Risk management.** According to Colicchia et al. (2010) "a better understanding of the risk sources for specific supply chain settings can enable the design of a more resilient supply chain". Thus, recognising that resilience is a result of some company' strategic actions and decisions, which aims to prepare the supply chain to effectively respond and recover from disruption, risk management is therefore an essential issues in this study. By observing the business environment and supplier's behaviour, Procurement managers usually apply their knowledge to achieve resilience. Therefore, practices related to this issue were found in all companies (focal companies and their suppliers) of the four cases. Like so, similar practices

of risk management were: strategic safety stock, supply audits, internal communication, supplier relationship (external communication), verification of supplier's capacity and financial health, dual or multiple sourcing for critical items, contingency plans, and location of the inventories (internal or external). These practices are part of the four processes to prevent discontinuities mentioned by Zsidisin et al. (2005) - risk identification, risk assessment, risk treatment and risk monitoring. Furthermore, Scholten et al. (2014) allege that mitigation processes incorporate horizontal and vertical collaboration, risk awareness, supply chain configuration and knowledge management capabilities. It is therefore noticed that these practices correspond to the issues highlighted in this study, which which emphasizes the relevance of these points. A conclusion about the relationship of these issues is made in the next chapter (Research Findings).

Now, differences among cases are also likely to be found, considering they are embedded in different supply chains. In Case 1, BEV-FC also makes use of strategic purchasing matrix (spending vs. product complexity) to purchase items and they have a corporation's group of incidents management to report serious cases. Regarding their suppliers (BEV-S1 and BEV-S2), it is observed that although they do have risk mitigation actions, they do not acknowledge them as formal procedures. Similarly, AGRO-FC (Case 4) also has a department responsible for identifying and analysing risks. Differently from Case 1 and 4, Case 2 and 3 do not have any group or department responsible for monitoring and identifying risks. In Case 2, although location of the inventories is exposed as common practices, they pay much attention to it, and have robust risk management to daily operations and small disruptions. One particular point in this case is that they are developing a new practice to record the problem and exploits it afterwards in order to find the cause. In Case 3, no formal procedure to identify and monitor risk was found, but they do apply practices to mitigate likely ones, such as contingency plans. On this matter, suggestions were made to focus on efforts and actions to risk mitigation, as well as in Case 4. Therefore, those risk management practices executed by companies in the four supply chains in this study are seen to be strategic established and well-performed so as to help leverage supply chain resilience. As a support to this affirmation, Golgeci and Ponomarov (2013) affirm that through an effective risk management and mitigation is possible to build supply chain resilience; so that, the utility of the supply chain resilience reaches beyond the purposes of risk management.

**Procurement structure.** As new issues came up from the field study, Procurement structure is therefore considered one of them. In all cases (Case 1, 2, 3 and 4), interviewees

have pointed out the hierarchical structure as a barrier to creating supply chain resilience, such as vertical hierarchy, rigid hierarchy, and delay in internal approvals or long processes of internal approvals. Thus, although all dyadics (Case 2 and 4) or triadics (Case 1 and 3) follow the bow-tie or basic buyer-supplier relationship, they have different characteristics and at some extend different internal structures. In Case 1, the multinational BEV has many plants (BEV-FC is one of them) and one BEV-corporation to set purchasing rules to items A. The corporation has a negotiating committee of key inputs in which Procurement and Plant managers make part of this group in order to develop strategies to overcome severe and risk situations that plant are forced to follow them. It is considered an enabler to develop supply chain resilience because they take care of any critical event by setting up an urgent meeting and discussing possible solutions. Furthermore, they have a list of suppliers approved. In this respect, if any plant has a problem with a particular supplier, they have another two or three options to supply them instead. A striking point in this case is that authority to make decisions was suggested as a point of improvement in order to create supply chain resilience (Zsidisin and Wagner, 2010).

In Case 2, the hierarchical structure of KAPPL-FC is totally different from the other cases, so that Production and Logistics holds a closer relationship with supplier rather than Procurement. In this regard, the former two functions perform the operational supply role within this company whilst the latter (Procurement) is strongly focused on supply strategies. Therefore, although Procurement does not have an often relationship with the suppliers, it is responsible for the supply strategies and if any uncommon problem arrives, it takes over the situation. In this case, interviewees have suggested simplification of the internal processes and increasing level of information sharing (even though some of them have stated that the internal communication was good) (Sheffi, 2001; Christopher and Peck, 2004; Carvalho et al., 2012b; Scholten et al., 2014). Case 3 has an interesting structure; it is characterised as a triadic. So that FOOD-S1 is responsible for managing and orchestrating the flow of goods, information and capital between FOOD-FC and FOOD-S2. This structure can extend the supply chain, because FOOD-FC does not keep an often contact with FOOD-S2, nevertheless it can be an useful situation to achieving resilience admitting that FOOD-S1 may cover a weakness point of FOOD-S2 (better negotiation and administration of the flow) (McDonald and Woodburn, 2007). It is currently seen at the fourth-party logistics service (4PL). The last case has a normal bow-tie structure, where Procurement managers have direct contact with sales or key account managers from suppliers. Internally, they share information with the business areas that support it to manage and control the resources.

It is known that if the company has a very rigid organisational structure where functions do not communicate among each other, it can limit the flow of information and hence become a barrier to visibility and resilience as well (Christopher and Peck, 2004). So that, "the ability of different organisations or internal business departments to work together to develop a collective strategy often determines the success or failure of managing a disaster and/ or supply chain disruption" (Scholten et al., 2014, p.219). Overall, they all consider structure as a barrier to supply chain resilience. As a result, the bow-tie relationship might not be a good structure to efficiently deal with disruptions and consequently developing a resilient supply chain.

### 5.5.2 Inter-organisational issues

**Supply base.** It is definitely the most discussed and stressed issue from all the four cases. Where do supplies come from, and from how many suppliers? These are two key points discussed by the interviewees. On this matter, all companies (focal companies and their suppliers) are aware of the risk to rely on a single supplier (Zsidisin et al., 2000; Pochard, 2003, Sheffi and Rice, 2005). However, interviewes from AGRO-FC have emphasized the complexity of having dual sourcing for each critical item due to the lack of substitutable supplier in market - Svahn and Westerlund and Pettit et al. (2010) highlights a similar example of this case. AGRO-FC complements by pointing out the lack of product quality from other suppliers, the long distance between buyer and supplier, or even because the company could not approve any extra supplier due to excessive bureaucracy. Commodity buyers from FOOD-FC however point out that they seek for approving large suppliers in which they feel safer than rely on small suppliers that most likely to end up in a financial crash. Nonetheless, they prioritize qualified suppliers regardless of their size. By and large, all four cases have emphasized the use of dual sourcing or multiple sourcing for each of the item (or at least for critical items) as a way to avoid crashes, and consequently becoming resilient (Zeng, 2000; Sheffi, 2001; Sheffi and Rice, 2005; Simangunsong et al., 2012; Azevedo et al., 2013). An additional alternative that came out from the data collection was the aid of franchises. It was exclusively highlighted by BEV-FC and BEV-S2. Thus, when there is a problem (internally or with their suppliers) to deliver the order on time, they can borrow from other franchises as an urgent action. It is because these franchises hold an relationship based on multilateral agreements that "must guarantee quality, provide visibility of services and/or goods, and implement the capacity to monitor users who have strong

incentives to free ride" (Menard, 2004, p.349) which may impact on the creation of supply chain resilience. Additionally, another alternative they make use to cope with critical incidents was the importation from the global producers. This decision can both be considered in supply base or supply chain configuration. In supply base, it relates to the increase number of suppliers and therefore not to depend on a single supplier, while in supply chain configuration can be an alternative to hold suppliers in different locations which reduces the risk to lose them all if a disaster occurs in a particular place (Christopher and Peck, 2004; Christopher et al., 2011).

**Criteria for supplier selection.** According to the literature, different criteria are applied to supplier selection, such as: supplier locations (e.g. Sheffi, 2001; Christopher et al., 2011); processes, practices and culture (Sheffi, 2001); common platforms for products (Zsidisin et al., 2000; Stecke and Kumar, 2009); capacity constraints (Christopher et al., 2011); financial stability (Zsidisin et al., 2000); and effectiveness of the supplier's management team (Zsidisin and Wagner, 2010). Although Case 1 has not mentioned anything about supplier selection as a way to create resilience; however it is observed through the data that they choose large suppliers to provide items A, and they observe capacity and location for items B and C. As well as Case 1, Case 3 have reported capacity and supplier size, and Case 4 supplier' size and location. Therefore, they all fit into the criteria found in the literature, knowing that large companies are considered by them as companies under financial stability. Differently from those, competitiveness was highlighted by KAPPL-FC from Case 2 as criteria for their supplier selection recognising that they also focus on capacity and location, but they do not prioritize size of the suppliers.

**Supplier relationship.** As important as having a good supply base, supplier relationship is another highly cited issue by the interviewees. According to the literature, close relationship is normally kept for few suppliers, whereas less closer relationship is made for a number of different suppliers in order to spread risks (Svahn and Westerlund, 2009; Zsidisin and Wagner, 2010; Christopher et al., 2011). This process was particularly noticed in Case 4 in which AGRO-FC works closely with strategic suppliers only, and not with all of them. The rest of the cases (Case 1, 2 and 3), they do not specify any difference of supplier relationship; in fact, they have strongly highlighted the close relationship with their suppliers. Partnership built through communication, information sharing, collaboration, trust, commitment, workshops and coaching were found in Case 1, 2 and 3 (Svahn and Westerlund,

2009; Zsidisin and Wagner, 2010; Yang and Yang, 2010; Christopher et al., 2011). It has shown to be rather helpful, because if any threat is about to happen, suppliers automatically contact focal company in order to find a solution together as effective as possible. In this vein, Case 1 has presented in interesting occurrence; BEV-S1 has an employee who stays in BEV-FC plant in order to increase the supply response.

**Supplier development.** As exposed in the literature, developing members of the supply chain in order to be as responsive as possible in times of disturbance can also be an issue to Procurement. If the company helps its suppliers to develop their processes, they become aligned and more responsive to changes (Zsidisin et al., 2000), besides improving information sharing, integration and flexibility as well (Lee et al., 2009; Yi et al., 2011). Observing the above issue, all focal companies seek for having large suppliers in order to mitigate risk, however it was noticed that they all have developed a supplier (at least once) after a severe incident they have faced. Therefore, they considered this point just in a very critical situation. In Case 2, for instance, it is reported the situation in which KAPPL-FC have helped KAPPL-S1 to develop a specific item which was imported before. Furthermore, it may also be a strategy to avoid power bargain from large and single suppliers, as exemplified in Case 3.

**External inventory.** This is another issue that came out from the empirical data analysis. Focal companies have made use of external inventory to reassure its supply. Only Case 2 and Case 4 have presented this issue. To do so, they hold additional stock (raw material) in warehouses or even supplier's plants; both located nearby the focal company. The level of inventory in the warehouse is under suppliers' responsibility. In Case 2, there is a system that connects KAPPL-FC and its suppliers by means of Electronic Data Interchange (EDI), so that they operate the vendor-managed inventory (VMI) strategy. Similarly to Case 2, Case 4 does the same process of storage but they do not work with any type of EDI to connect to its suppliers. Regarding this issue, Procurement managers in these two cases are involved in the management of these buffers, which is therefore a way of being resilient in case of a problem with supplier's deliveries. In order to justify this rationale, Chopra and Sodhi (2014, p.79) has affirmed that "segmenting the supply chain based on product volume, variety and demand uncertainty not only increases profits; it also improves the ability of the supply chain to contain the impact of a disruption".

**Supply chain configuration**. Strategies related to network configuration can definitely help develop alternatives to be resilient. Thus, how to design the supply chain is also pointed out as an issue, considering that rearrangements on the network may enable a quick response (Christopher et al., 2011). In this context, the distance between focal company and supplier was well-highlighted in Cases 1, 2 and 3 as an important factor. It is clearly visualized this issue in Case 2 where the warehouse was strategic located only 12km far from the focal company, and others suppliers are set nearby. No evidence of this issue was found in Case 4 admitting they work with global suppliers and they can use other alternatives to deal with it. In Case 1, the location of the franchises from BEV-FC and BEV-S2 are also strategic, and they make fully use of it to avoid great disruptions. Additionally, Sales person from BEV-S2 have stated that they also borrowed stock from a customer to rapid response from a problem in their deliveries. This action therefore makes them bouncing back from a likely disruption. Furthermore, they also import items from offshore suppliers due to the lack of national substitutable supplier. It could be considered a supply chain configuration strategy if they opt to have a supplier in other location, so that if a natural disaster occurs in that particular location, they have another supplier in a different location to supply them. Therefore, the alternative to reconfigure supply chains may be a positive way of handling disruptions, assuming any effects on cost efficiency (Chopra and Sodhi, 2014).

**Transportation modes.** Although transportation can be the main responsibility of Logistics, deciding how raw materials and resources will arrive at the company can also be a Procurement business. So that, additional options to make the delivery (in terms of routes or modes) will help companies to mitigate disruptions, as stated by Tang (2006b). From the three strategies proposed by Tang (2006b) to improve the transportation flexibility - multi-modal transportation, multiple routes and multi-carrier transportation - only the first two were identified in the four cases. Thus, if any route was damaged due to strike or problems in the roads, there are alternatives to maintaining the normal operation of the company. Regarding transportation modes, transportation by road was predominantly mentioned by interviewees in all cases. Additionally to that, shipping was reported for imported item, and the airplane can be an alternative only for severe situations. Thus, Cases 2 and 3 have therefore this flexibility, except Case 4 in which they can make use of air mode but they normally make their deliveries only by road. On the other hand, Case 1 seems to have no alternative option but road transportation. Moreover, in Case 3 they have a restriction for airplane

transportation, which depends on the type of the product. For FOOD-S2, for instance, there is no way to make an airplane transportation for tons of nuts. Related to routes, examples of this strategy were found in Case 1 and 3, and interestingly, Case 1 reported an example about the consequences and actions taken to deal with the impacts in transportation due to the Brazilian protests against the government decisions. In all these occasions, Procurement normally participates of the decision in changes routes or transportation modes so as to cope with the situation in a more resilient way.

In order to represent how Procurement function can manage and control the intra- and inter-organisational issues identified in this study, through the lens of dynamic capability, Figure 37 illustrates how those issues fit into the three main elements of the theory (Positions, Processes and Path). Assuming that organisations are embedded into today's uncertain and volatile environments (as explained in chapter 2), each organisation holds tangible and intangible resources in different positions. So that, resources reported from the four cases (BEV, KAPPL, FOOD and AGRO) were classified and included in Figure 37. Over time, managers increase their competences through lessons learned and past experiences (path) from daily routines and practices (processes). In this vein, knowledge acquired and backup of this knowledge (intra-organisational issue) are build through organisational practices or routines, such as risk management and internal communication. According to Eisenhardt and Martin (2000), dynamic capabilities exhibit commonalities across organisations and these features can be classified as "best practice". Thus there are some occasions in which good practices such as multiple sourcing for critical items may become the "best practice" to more than one company within a supply chain. Furthermore, it was noticed that companies from the four cases are aware of the likely risk from the unstable environment and dynamic market; so that, the process of risk management was highly discussed and pointed out as an important procedure.

**Table 48.** Differences and similarities about intra-organisational issues

| INTRA-ORGANISATIONAL ISSUES | BEV | KAPPL | FOOD | AGRO |
|---|---|---|---|---|
| **Knowledge acquired and backup** | Information or lessons learned backup (BEV-S1) | | | Information or lessons learned backup (AGRO-S2) |
| **Internal communication** | | The size of the company influences in the efficient information sharing | | Problems to creating resilience when the information sharing is not efficient |
| **Redundancy of critical items** | Additional stocks when the demand is high | Additional stock to importated items - long lead time | Reduction of additional stock to importated items due to lead time decreasing (FOOD-S2) | It is a way to compensate the lack of product flexibility (justification) |
| **Product Flexibility** | Only to items B and C of the focal company | Only KAPPL-S1 showed to have flexible manufacture | Good examples of product flexibility (FOOD-FC and FOOD-S1) | |
| **Communication tools** | | EDI to share internal and external information | Online system to place orders (FOOD-S1 and FOOD-S2) | |
| **Technological ways to discover, recover and redesign the supply chain** | System that integrates information about consequences and results of any critical event, which helps in the action plan development (not often used) | | Institutions or groups to make forecast, however the reports are not so accurated. They highlight improvements at this issue | Help to develop supply chain resilience (point of improvement) |
| **Risk management** | Strategic Purchasing Matrix (spendings x product complexity) and group of incidents management (corporation) | Special attention to invetories location (external or suppliers). Development of new practice to record problems for future analysis | Contingency plans. Focus on actions and efforts to mitigate risk (point of improvements) | Group/department responsible for risk identification and analysis. Focus on actions and efforts to mitigate risk (point of improvements) |
| **Procurement structure** | Hierarchical structure (barrier). Negotiating committee of key inputs. Increasing the authority to make decisions (point of improvements) | Hierarchical structure (barrier). Procurement hold a more stratigic role than operational. | Hierarchical structure (barrier). FOOD-S1 makes a link between FOOD-FC and FOOD-S2. | Hierarchical structure (barrier). |

**Table 49.** Differences and similarities about inter-organisational issues

| INTER-ORGANISATIONAL ISSUES | BEV | KAPPL | FOOD | AGRO |
|---|---|---|---|---|
| **Supply base** | Franchises instead of additional inventory in suppliers (BEV-FC and BEV-S2). Importation from global suppliers | | Large suppliers, considering that they are less likely to crash financially | Lack of substitutable suppliers (in terms of quality) in market. Suppliers' distance. Bureaucracy to homologate suppliers |
| **Criteria for supplier selection** | Large suppliers to items A, and observe capacity and location to those responsible for items B and C | Competitiveness, capacity and location | Capacity and suppliers' size | Suppliers' size and location |
| **Supplier relationship** | BEV-FC holds a workers in BEV-S1 plant in order to increase the response | | | Close relationship with strategic suppliers only |
| **Supplier development** | Only for critical cases | Only for critical cases | Only for critical cases. It is helpful to avoid bargain power from large companies (Justification) | Only for critical cases |
| **External inventory** | | Warehouse nearby focal company - VMI | | Warehouse or in suppliers' plant |
| **Supply chain configuration** | Suppliers from other location (countries or continents). Strategic location of Franchises. In case of urgency, BEV-S2 borrow from other customers to respond faster | Nearby suppliers/warehouses (prioritize when it is possible) | Nearby suppliers/warehouses (prioritize when it is possible) | Nearby suppliers/warehouses (prioritize when it is possible) |
| **Transportation modes** | Road and water | Road. Airplane only for critical cases | Road. Airplane for critical cases and depending on the type of the product | Road. Airplane only for critical cases |

**Table 50.** Intra- and inter-organisational issues from all cases

| Type | BEV | KAPPL | FOOD | AGRO |
|---|---|---|---|---|
| INTRA-ORGANISATIONAL ISSUES | Knowledge acquired and backup | Knowledge acquired and backup | Knowledge acquired and backup | Knowledge acquired and backup |
| | Internal communication | Internal communication | Internal communication | Internal communication |
| | Technological ways to discover, recover and redesign the supply chain | - | Technological ways to discover, recover and redesign the supply chain | - |
| | Communication tools | Communication tools | Communication tools | Communication tools |
| | Redundancy of critical items | Redundancy of critical items | Redundancy of critical items | Redundancy of critical items |
| | Product flexibility | - | Product flexibility | - |
| | Risk management | Risk management | Risk management | Risk management |
| | Procurement structure | Procurement structure | Procurement structure | Procurement structure |
| INTER-ORGANISATIONAL ISSUES | Supply base | Supply base | Supply base | Supply base |
| | Supplier development | Supplier development | Supplier development | Supplier development |
| | Criteria for supplier selection | Criteria for supplier selection | Criteria for supplier selection | Criteria for supplier selection |
| | Supplier relationship | Supplier relationship | Supplier relationship | Supplier relationship |
| | Supply chain configuration | Supply chain configuration | Supply chain configuration | Supply chain configuration |
| | Transportation modes | Transportation modes | Transportation modes | Transportation modes |
| | - | External inventory | - | External inventory |

Interestingly, it was also observed that some of the intra- and inter-organisational issues make part of this procedure. For instance, companies assess the capacity and financial health of the suppliers in order to manage risk; hence the criteria of supplier selection is within risk management. The same rationale happens to product flexibility (holding substitutable items cope with unpredictable events); redundancy of critical items or external inventory (safety stock to rapid respond in times of shortages); supply chain configuration (location of the plants and warehouses); transportation modes (alternative modal to be able to deliver the orders on time); supplier development (to avoid the risk of having no alternative supplier in market); supplier relationship (partnership means risk avoidance to AGRO-FC, for example); internal communication (support from other functions areas to deal with a disruption); and communication tools or technological ways to discover, recover and redesign the supply chain (technology to improve internal and external information sharing in order to avoid risk). Additionally, the process of risk management is constantly getting improvement due to the knowledge acquired and backup of the Procurement managers, in particular, and how they are structured into the organisation (Procurement structure).

Therefore, through integrating, adapting and reconfiguring internal and external resources by changing ordinary routines or practices through managers' competences as shown in Figure 37, Procurement managers are able to build value-changing strategies to achieve supply chain resilience. Supply chain resilience can therefore be characterised as dynamic capabilities as it is an output measure which is dependent on company's decisions (Brandon-Jones et al., 2014), so that it is continuously changing in order to adapt to the environment. In this vein, Golgeci and Ponomarov (2013) have stated that supply chain resilience can be viewed as a firm's dynamic capability of recovering from supply chain disruptions. As a result, it is possible to achieve competitive advantage by being able to bounce back to company's original operations performance or event to a better one.

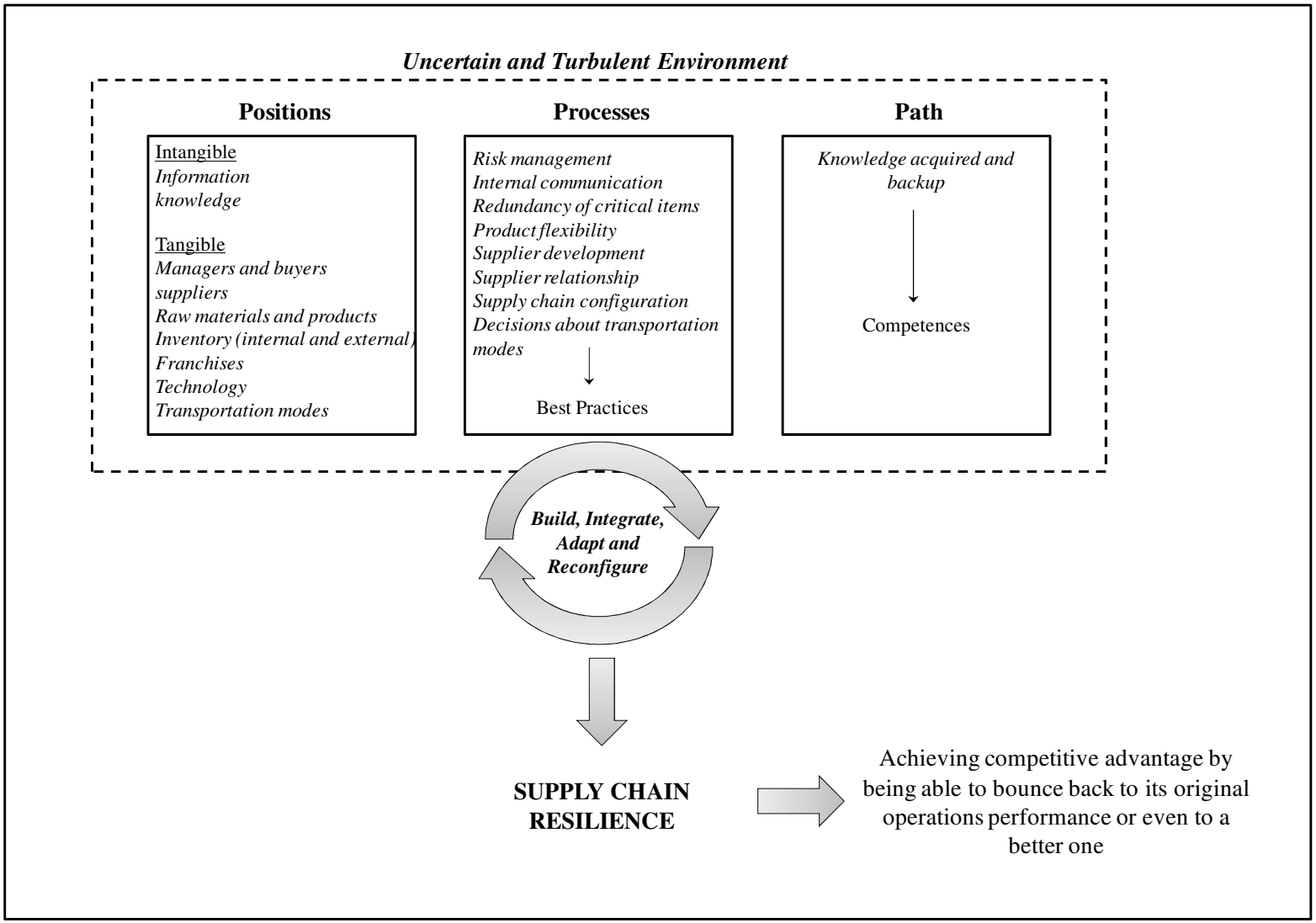


**Figure 37.** Supply chain resilience viewed through the lenses of dynamic capability theory

## 6. RESEARCH FINDINGS AND PROPOSITIONS

The aim of this chapter is to present the general findings of this research by directly answering the research questions proposed, after validating the empirical and theoretical data. Empirically, 30 interviewees from 12 different companies (four focal companies and two suppliers from each one) participated in this research. Most of the participants have more than ten years of experience. Because of this, they were able to present different and interesting risks and examples of supply disruptions, which were fundamental to identify intra- and inter-organisational issues.

Regarding data analysis, most of the risk sources cited by the interviewees emerge from external or environmental sources. Also, companies from the four case are more prepared to deal with disruptions of high probability and low impact rather than low probability and high impact disruptions. This is the reason why some interviewees have affirmed that companies have only taken preventive actions after they have faced a critical disruption.

> So, [this critical event] has happened and the actions were only taken after that, ok? There are cases in which they only take arrangements after the event, unfortunately (Psale1s2) [4]

This research focuses on the role of Procurement, hence interviewees were asked about the importance of this function in daily actions and, consequently, in creating supply chain resilience. Interestingly, interviewees from the focal company as well as from their suppliers have stated that Procurement has an important role in strategic and daily activities; however, as per standard conversation, price negotiations and contract execution are the primary Procurement activities. Notwithstanding, these participants also emphasized the important role of this function in mitigating risk.

According to Sobhani et al. (2014, p.252), "the Procurement function is not limited to purchase raw materials, parts and services, however, it should handle much broader functions of supply". Thus, recognising that this function has considerably broadened its scope in recent years, this study has confirmed the trend to an ever-widening scope of the Procurement role. In line with this, it has currently been named as Purchasing and Supply Management in recent studies (*e.g.* Foerstl et al., 2010; Chicksand et al., 2013; Sobhani et al., 2014) as well as in acknowledged Institutes of this area - CIPS (Chartered Institute of Purchasing & Supply) and IPSCMI (International Purchasing and Supply Management Institute).

Bearing in mind the results from the within-case and cross-case analysis, the summary answers for the research question are:

*RQ1) What are the intra-organisational issues that must be addressed to Procurement in dealing with unexpected supply chain disruptions in practice?*

The following points are therefore intra-organisational issues that Procurement should address to help create supply chain resilience. They were firstly identified in literature and then confirmed through the empirical data; except Procurement structure which emerged from the empirical data only. Additionally, risk management (which was previously pointed out as an inter-organisational issue in the theoretical findings), is now classified as an intra-organisational issue, considering that Procurement is an internal business function responsible for managing likely risks as much internal as external.

- Knowledge acquired and backup;
- Internal communication;
- Communication tools;
- Technological ways to discover, recover and redesign the supply chain;
- Redundancy of critical items;
- Product flexibility;
- Risk management;
- Procurement structure.

*RQ2) What are the inter-organisational issues that must be addressed to Procurement in dealing with unexpected supply chain disruptions in practice?*

The following points are therefore inter-organisational issues that Procurement should address in order to create supply chain resilience. They were firstly identified in literature and then confirmed through the empirical data.

- Supply base;
- Supplier development;
- Criteria for supplier selection;
- Supplier relationship;
- External inventory;
- Supply chain configuration;

- Transportation modes.

There are also two exceptions in this topic: 1) external inventory has emerged from the empirical data only; 2) no evidence of emergent stock (as found in the literature) was identified within the four cases.

*RQ3) How can Procurement manage these intra- and inter-organisational issues in order to help create supply chain resilience, through the lens of dynamic capability theory?*

Knowing that companies have to strategically purchase materials and services in order to serve customer's needs and consequently the market share, Procurement is recognised as the process of planning, evaluating, implementing, and controlling routines of sourcing decisions (Sobhani et al., 2014). Thus, this study has shown that Procurement does play a significant role in creating supply chain resilience through the within-cases and cross-case analysis. In this vein, intra- and inter-organisational issues with regards to supply chain resilience from a Procurement perspective, in particular, were identified by crossing theoretical and empirical data. Nonetheless, Harrison et al. (2013, p.265) has asserted that "while resiliency resources, capabilities, and strategies could be powerful allies to mitigate disruptions, the question arises of how to effectively utilize them". Thus, it is imperative to know how Procurement can manage them so as to create a resilient supply chain. To answer this question, the dynamic capability theory was used to help explain it, as well as to ground the results under theoretical basis.

Following the explanation given in the cross-case analysis, in which the elements of the dynamic capabilities were used to build Figure 37, it has been found that it is possible to creating supply chain resilience through managing and controlling specific asset positions (resources), some organisational processes (practices and routines), and managing path dependence (competences). Bearing this in mind, propositions were built in order to answer this last question, based on the results of this study.

**Assets Positions**

As stated earlier, Teece et al. (1997) affirm that companies can achieve competitive advantage through dynamic capabilities. These capabilities are therefore composed of distinctive processes, shaped by the company's specific *asset positions,*

and the evolution paths it has adopted or inherited. So that, asset position corresponds to the company's resource base that is classified in this study as tangible and intangible resources (Figure 37). In this sense, how these resources are arranged and positioned within the company may result in different strategies, which in turn result in particular dynamic capabilities (Helfat et al., 2007).

Taking this idea, and now considering the aim of this study, Wieland (2013) states that a supply chain might become resilient if it uses resources that enable it to cope with changes. Declaring that these resources cannot only be raw materials, but also suppliers as well as managers, for instance (see Figure 37), Procurement managers or commodity buyers are considered in this discussion as company's resources (asset). Thus, synchronising materials and information between internal and external parts of the company, and efficiently taking actions to minimize the impact of any supply disruption are normally seen as the role of Procurement.

> My job, among other things, is to coordinate things between suppliers' approval and the franchises. To support the needs of the manufacturers as well as the inputs, and ensure that the desired suppliers are up to our standards [...] (Mproc1) [1]
>
> In fact, we have a strong connection with all our internal customers. So you could say that the whole company works in purchasing, right? This is because everyone has a particular need. We are a function that attends to the company as a whole. There are functions with higher demand, others with lower, but all of them need something from us. (Mpurc1) [35]
>
> The Procurement function is the main element in monitoring risk and avoid supply disruptions. (Mmint1s1) [3]
>
> So I see it this way; our supply chain is focused on purchasing (Procurement); that's how I understand it. This is the main strategy to mitigate anything. (Mplan1) [44].

Considering the results of the empirical data, the role of Procurement in dealing with supply disruption will depend on how Procurement is structured within the company and for which kinds of activities it is responsible - "*the structure of all this assures me that I mitigate the disruptions; it is more or less because of this that we see a supply chain, or a procurement process, that is able to create resilience in a supply chain*." (Mplan1)[45]. In this regard, it was seen through data analysis that the company' structure and the rigid hierarchy were pointed out by interviewees from the four cases (BEV, KAPPL, FOOD and AGRO) as barriers to build supply chain resilience. Furthermore, Menard (2004) claims that how companies are structured can define the

relationship with other companies in the market. As a result, the bow-tie relationship was identified in all cases, and it has limited, to some extent, the flow of information that has to pass through Procurement managers.

On the other hand, interviewees from FOOD and AGRO have affirmed that when there is a critical disruption, they overcome this barrier by directly contacting people without following the normal path of exchanging information (as represented in Figure 33). Moreover, it is also observed in KAPPL that Procurement managers are more responsible for strategic decisions (suppliers identification and selection, and decisions making to solve critical problems) instead of a more daily routines (supplier relationship, for example). It therefore helps the flow of information, which makes the resilience process more effectively.

> So we act like this, but the first sign from suppliers is given by inbound logistics and PCM. They tell me: look, we're having sourcing issues with this supplier. Then, we make contact with the supplier in order to check what's going on, if there is problem, I'll go to the supplier plant. (Mpurc2)[1]

Therefore, although Procurement has proven to be an important function to manage and control the company's resources through organisational processes in all cases of this study, how managers are positioned might impact on what kinds of activities they are responsible for (strategic [KAPPL-FC; BEV-Corporation], operational or both [BEV-FC, FOOD-FC, AGRO-FC]). In this sense, the first proposition addressed to this research is:

***P1.*** *The way Procurement function is positioned within the company can influence the creation of supply chain resilience.*

**Organisational and Managerial Processes**

Dynamic capabilities are not only determined through the organisation's tangible and intangible resource base at a given point in time, but are built over time through managers decisions (Eisenhardt and Martin 2000; Blome et al., 2013). In this sense, it is vital to know what organisations do and how they do it (Helfat et al., 2007). It is therefore perceived through their practices or routines that appropriately alter the resources so as to achieve value-creating strategies (Eisenhardt and Martin, 2000; Nielsen, 2006; Easterby-Smith and Prieto, 2008; Beske, 2012).

Procurement practices and routines were identified through the multiple case studies presented above (BEV, KAPPL, FOOD and AGRO). Figure 37 portrays main practices or routines which are also considered intra- and inter-organisational issues. Among these processes, it is interestingly observed that risk management may involve decisions related to the rest of the processes. As explained at the end of the chapter 5, risk management procedures can be: assessing capacity and financial health of the suppliers to manage risk (criteria of supplier selection); holding substitutable items to cope with unpredictable events (product flexibility); holding safety stock to achieve rapid response in times of shortages (redundancy of critical items or external inventory); determining the location of the plants and warehouses (supply chain configuration); altering transportation modals to be able to deliver the orders on time (transportation modes); avoiding the risk of having no alternative supplier in market (supplier development); developing partnership to mitigate risk (supplier relationship); information support from other business functions to deal with a disruption (internal communication); and applying technology to improve internal and external information sharing so as to avoid risk (communication tools or technological ways to discover, recover and redesign the supply chain).

> KAPPL-FC has already been through several stages, and I have experienced several of these. For example, there was a time when KAPPL- FC existed as a global company which followed the Swedish train of thought that said: it is much better have few suppliers and consolidate volumes and get a better cost. You consolidated volume - theoretically if I buy 10 I have one price but if I buy 20 I'll get another price. But we are in Brazil; it's a bit tricky to do that, and fortunately the company realised that after a while. So now, for example, you have to have at least three approved suppliers - two of them for daily supplying and one as a backup, a stand-by. (Mpurc2)[38]

> Raw materials management is done in three or four ways. You concentrate on product in hand from a strategic supplier where you can, for example, use a partnership strategy; you can put a portion of these products into the hands of common suppliers which you manage based on competitiveness, or you also have suppliers that are specific to products that have no alternative, or because of the company's decision, or because there's no other alternative product on the market. And then, for each line, for each trading strategy, there's a risk management plan. (Mproc4)[30]

Admitting such importance to the risk management process, it is worth highlighting that supply chain resilience is an output of risk management. In this sense, Golgeci and Ponomarov (2013) asserted that supply chain resilience emerges as a dynamic capability which can be leveraged by means of an effective risk management.

Additionally, these authors, in support to Ponomarov and Holcomb (2009), complement in affirming that the utility of supply chain resilience reaches beyond the purpose of risk management. Furthermore, Scholten et al. (2014, p.223) have concluded in their study that "mitigation processes are of paramount importance as they are the antecedents to building supply chain resilience capabilities which in turn enable the execution of the necessary processes during preparedness, response and recovery". Therefore, the second proposition addressed to this research is:

***P2.*** *Procurement is capable of managing the identified intra- and inter-organisational issues through the process of risk management.*

**Path dependence**

According to Cavusgil et al. (2007, p.162), "the concept of path dependency recognises that history matters". So that, past experiences and lessons learned from those are the two main points within this element, which consequently help increase competences. In this sense, the process of learning may be a central element in the creation and renewal of dynamic capabilities (Easterby-Smith and Prieto, 2008), since the repetition and experimentation enable tasks to be performed better and quicker (Teece et al., 1997).

> The knowledge acquired is not necessarily internal, right? So, like, if I've worked on other cases of supply disruption in other companies... because often you follow the standard behaviour that the company is used to. But in a time of crisis, if you have any other external experiences from a different work culture, perhaps you'll have a different view of how to handle it. So knowledge acquired: it makes a difference, yes. (Bnut3) [30]

> Yeah, the right thing is to record what happened, and leave a record of the problem and the solution. I've already done that. Here, we have a window in the system to put and update this information, however, personal experience is the most valuable thing. I've already been through it, so I have the solutions. I believe in it (Msale4s1) [25]

These characteristics leads to the third main issue highlighted in this study - knowledge acquired and backup. All the 30 interviewees from the 12 companies, with no exception, have pointed out the great importance of knowledge acquired from past experiences to improve their abilities in coping with future untoward events - "*Yeah, this is really important. Each season is different, but a material may behave the same for different seasons. So really, knowledge is a facilitator*" (Mcom4)[24]. Thus, it is through

knowledge acquired that Procurement managers become capable of managing the available resources (internal and external) in order to prepare, respond and recover their business from any critical disruption along the supply chain. As a result of the learning processes and knowledge accumulation, Procurement managers can come up with great solutions to overcome supply disruptions by knowing how to better build, integrate, adapt and reconfigure the organisational resources base through their routines and practices.

> Yes, the [Brazilian] protests [against the government] have greatly affected! We had to reroute the transport to other places, and so logistics is hardly impacted, because we have to verify, for example, I leave here to go to BH. Then, you leave from a direction and, there, it is stuck, so you have to come back and change for another route, you understand? Basically, this has a huge impact. As it has been happening now in RJ, eh, there had been demonstration against the World Cup, so then we don't know what might happen. It may cause impacts, you know? We're already seen others. Then you start to analyze other actions to overcome it, you see? It is unstable, though. (Msac1s2) [21]

Nevertheless, it is imperative to create backups of this knowledge, remembering that "companies cannot afford to maintain redundant employees "just in case"" (Sheffi, 2001, p.4). So that, Procurement managers can share experiences and hence improve their abilities to deal with unpredictable events through developing value-creating strategies so as to achieve supply chain resilience. Therefore, the third proposition addressed to this research is:

***P3.*** *Procurement can enhance the capacity of creating supply chain resilience through the path of knowledge acquired and backup information.*

**Supply chain resilience as a dynamic capability**

Following the rationale of the above discussion as well as Figure 37, it is possible to conclude that companies need to develop dynamic capabilities to survive in today's uncertain and turbulent environment. Thus, how Procurement can manage those previously identified intra- and inter-organisational issues is a matter of building, integrating, adapting and reconfiguring organization's specific positions through distinctive processes following the evolution paths (Teece et al., 1997). In other words, depending on how Procurement is structured within the company and also on manager's knowledge acquired from past experiences, Procurement can better prepare their

business to effectively respond and recovery from disruptions through the management of communication, inventory, product, supply network, transportation and suppliers. Nevertheless, all these points may be included into the risk management process. As a result of this process of building, integrating, adapting and reconfiguring, value-creating strategies will help companies create supply chain resilience (dynamic capability); consequently, it enables several temporary advantages which allow the company to stay ahead of competitors and hence maintain competitive advantage (Eisenhardt and Martin, 2000; Teece, 2007; Blome et al., 2013 ).

To sum up, three issues out of fifteen identified intra- and inter-organisational issues have been pointed out as essential issues to coordinate the rest of them. These three issues - Procurement structure, Risk management and Knowledge acquired - are therefore portrayed in Figure 38 that is an evolution of Figure 21 created from the result from a theoretical study only.

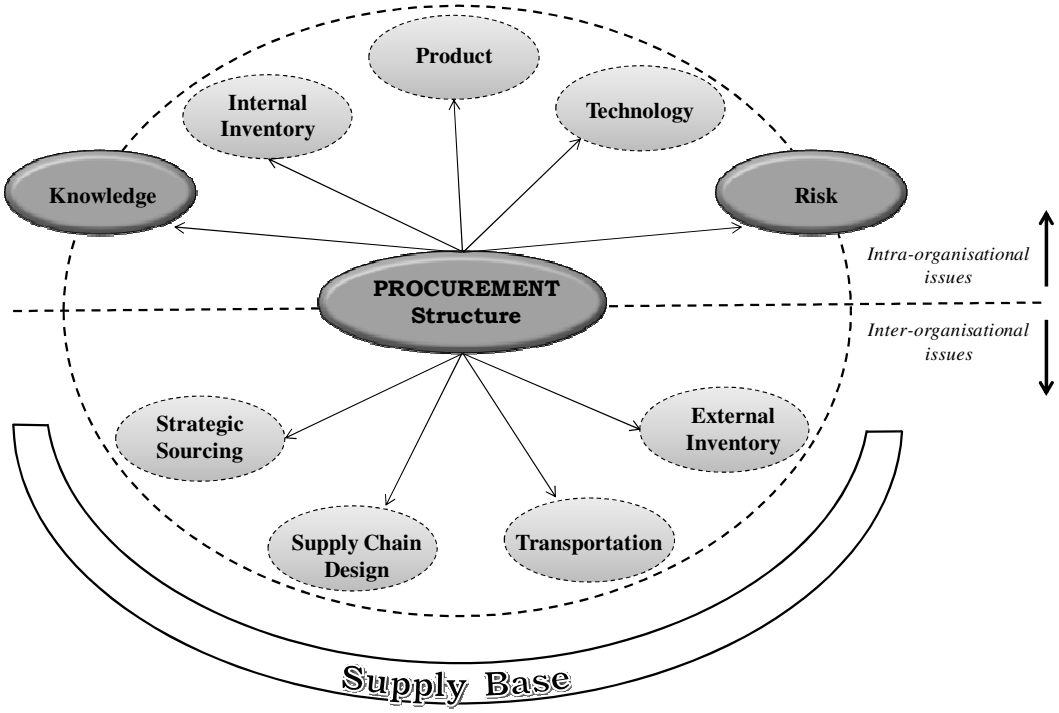


**Figure 38.** Research framework after the empirical study
Source: created by the author

Considering this final discussion, a fourth proposition is here addressed to finally answer the last research question:

***P4.*** *Procurement can help to create supply chain resilience by essentially managing and controlling three intra-organisational issues - Procurement structure, risk management, and knowledge acquired and backup.*

Recognising that dynamic capability is therefore created over time rather than bought in market (Blome et al., 2013), Figure 39 represents the final framework for achieving supply chain resilience through Procurement actions. This figure, which is also an evolution of the theoretical one, holds the same idea exposed earlier. Managers are decision makers, and they must collect information, analyze it, synthesize it, and act upon it inside the firm (Augier and Teece, 2009). In this vein, Procurement managers can achieve supply chain resilience by managing risk through intra- and inter-organisational issues within the company' structure. Furthermore, knowledge acquired from past events will always increase the competences of Procurement managers to improving the value-creating strategies, which in turn, improve the resilient capability of the supply chain.

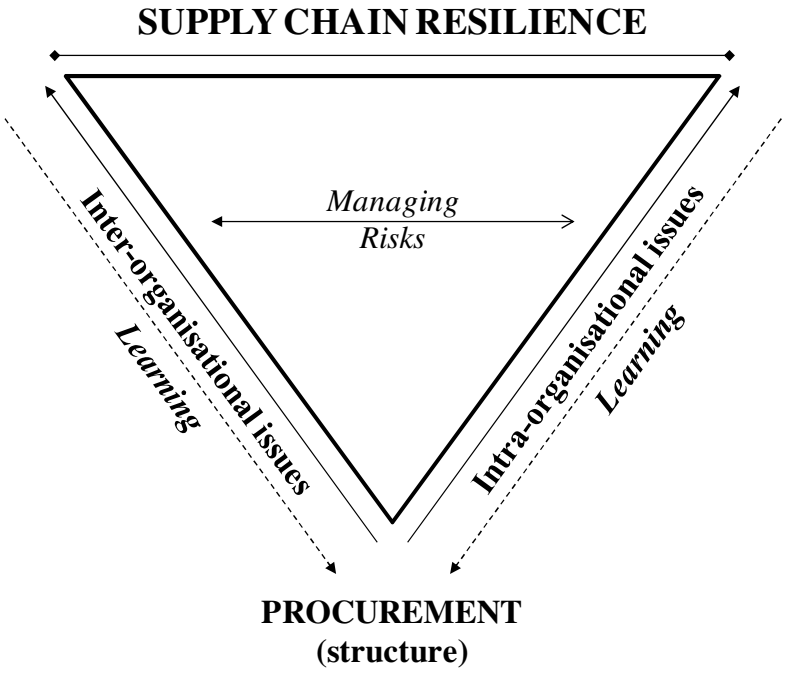


**Figure 39.** Final research framework
Source: created by the author

To conclude, it was observed that both sides of the dyadics or triadics from the cases have shown to be aware of the cost and the value of becoming resilient, even though it sometimes requires extra stock (redundancy), multiple sourcing, and efforts

focused on risk management, for instance. Nevertheless they have also affirmed that it is clear how important it is for their business nowadays, besides probably being cheaper to develop resilient actions than being incapable of serving demand.

> It highly increases the cost, of course, but it is exactly what I've said before. As I don't have any other alternative, I mean, I might have but I don't care because [creating resilience] will make my industry keeps working (Mmint1s1). [5]

# 7. CONCLUSION

Recognising the today's complexity and vulnerability of interconnected networks, the concept of supply chain resilience has excelled among other approaches of supply chain management as it enables an organisation to prepare for, respond to, and recover successfully from disruptions (Scholten et al., 2014). For this reason, understanding where a company's vulnerabilities lie and how to effectively act on them is therefore important to survive in the middle of political upheavals, increasing economic uncertainty, rapid changes in technology, higher customer expectations, capacity constraints, globalized market forces and natural disasters (Sáenz and Revilla, 2014). Thus, although supply chain resilience is pointed out by some scholars as a subject in its infancy (*e.g.* Christopher and Peck, 2004; Blackhurst et al., 2005; Blackhurst et al., 2011), a growing number of studies have been published on this topic, as can be seen in Figure 11 (chapter 2).

This exploratory study sought to understand the role of Procurement in managing the intra- and inter-organisational issues that help create supply chain resilience, through the lens of dynamic capability theory. To do so, three research questions were theoretically and empirically explored. As a result, fifteen organisational issues were found (eight intra-organisational and seven inter-organisational), which were grouped into ten general points related to Procurement, whose function links between internal and external parts of the company (Figure 38). A good management and control of both intra- and inter-organisational issues by Procurement managers (according to the discussion in the chapter 6) will help companies to achieve an effective supply chain resilience (Figure 39).

Overall, findings have highlighted that Procurement can help create supply chain resilience by essentially managing and controlling three intra-organisational issues - *Procurement structure, risk management, and knowledge acquired and backup* (Figure 40). These three intra-organisational issues have been shown to be essential in creating supply chain resilience from a Procurement perspective. Nevertheless, although these three issues have been excelled in comparison with the rest of the identified issues, the other twelve issues left are also important enough to be managed and controlled, even within the process of risk management. Each of them has substantial particularities that strengthens the resilience of the supply chain.

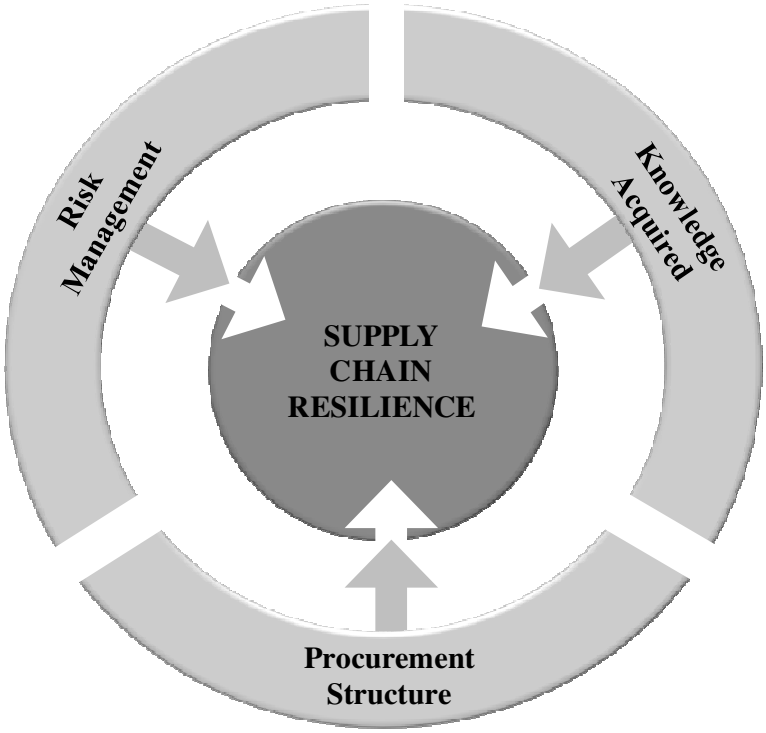


**Figure 40.** The three elements to achieve supply chain resilience
Source: created by the author

Intra-organisational issues: *Internal communication* is therefore meaningful to Procurement considering that the better the communication is, the faster the problem might be solved (Chiang et al., 2012). *Redundancy of critical items* is one of the main strategies applied by companies in the empirical study; the "slack" in the inventory is therefore considered a fundamental way to deliver material on time (Carvalho et al., 2012a). *Product flexibility* has shown an interesting strategy to overcome critical disruptions, observing that the more complex the product's configuration becomes, the more difficult recovery is from any supply chain disruption (Blackhurst et al., 2011). Although *communication tools* have been lacking in some companies (BEV, FOOD and AGRO), they have the ability to share information in real time along the supply chains (among buyers and suppliers) so as to improve the visibility as well as the response capacity in case of untoward events (Tachizawa and Gimenez, 2010; Christopher et al., 2011). *Technological ways to discover, recover and redesign the supply chain* help to identify risks, to develop actions and solutions, and to reconfigure supply chain arrangements, besides being intensely reported through examples in the literature (Sheffi, 2001; Sheffi and Rice, 2003; Blackhurst et al., 2005; Sheffi and Rice, 2005;

Tang, 2006b; Christopher and Holweg, 2011; Carvalho et al., 2012b; Azevedo et al. 2013; Sáenz and Revilla, 2014).

Inter-organisational issues: *Supply base* is a significant issue by holding the trade-off of single versus multiple sourcing, depending on the criticality of the item; however all four cases have emphasized the use of dual sourcing or multiple sourcing for each of the critical items (at least) as a way to avoid crashes and, consequently, becoming resilient (Zeng, 2000; Sheffi, 2001; Sheffi and Rice, 2005; Simangunsong et al., 2012; Azevedo et al., 2013). Still on this matter, franchises have emerged from empirical data as a source of alternative supply. *Criteria for supplier selection* is also critical to avoid future risk and disruptions, since it can be assessed by supplier locations (e.g. Sheffi, 2001; Christopher et al., 2011); processes, practices and culture (Sheffi, 2001); common platforms for products (Zsidisin et al., 2000; Stecke and Kumar, 2009); capacity constraints (Christopher et al., 2011); financial stability (Zsidisin et al., 2000); effectiveness of the supplier's management team (Zsidisin and Wagner, 2010); and size of the company (characteristics which came out from the empirical data). *Supplier relationship* is another highly cited issue that all focal companies have emphasized in order to increase communication, information sharing, collaboration, trust and commitment (Svahn and Westerlund, 2009; Zsidisin and Wagner, 2010; Yang and Yang, 2010; Christopher et al., 2011). *Supplier development* is therefore a strategy used by companies (in the KAPPL case) in which they help the suppliers to develop their processes, so that they become aligned and more responsive to changes (Zsidisin et al., 2000), besides improving information sharing, integration and flexibility as well (Lee et al., 2009; Yi et al., 2011). *External inventory* was an issue that emerged from the empirical data which can help the focal companies and their supplier to maintain normal operations. *Supply chain configuration* is related to network configuration which can definitely help to develop a resilient supply chain, considering that rearrangements on the network may be a positive way of handling disruptions (Christopher et al., 2011; Chopra and Sodhi, 2014). Finally, *Transportation modes* is thus helpful to Procurement by providing extra alternatives (rearrangements of routes and modes) to deliver the loads on time, and therefore helping to mitigate disruptions (Tang, 2006b).

All these findings are therefore a result of a theoretical and empirical study supported by an organisational theory - dynamic capability - to explain how the

phenomenon (creation of supply chain resilience by means of Procurement) occurs within these complex environments.

### 7.1 Theoretical implications

A number of theoretical implications can be listed as a result of this thesis. First, several enablers and barriers to creating supply chain resilience were identified in literature in order to detect their influences on Procurement activities. In doing so, it was found that barriers present opposite characteristics from enablers in general; because of that, the analysis and discussion about the implications of them on Procurement activities were mostly focused on the enablers. Second, it helped explore an unstudied point in the literature by expanding the knowledge built so far in operations management and supply chain management through identifying the connection between a mature business function (Procurement) to a recent area of the supply chain management (resilience). Additionally, it adds to knowledge in the supply chain strategy literature with regard to those organisational issues that may help Procurement managers to better orchestrate the flow of goods and information along the supply chains in order to cope with supply disruptions.

Third, this study also highlights the benefits of using proactive actions by focusing on key issues to create resilient capability within the companies or along their supply chains to overcome critical disruptions, as well as daily outages. On this matter, thirteen intra- and inter-organisational issues from a Procurement perspective were found in the literature and further expanded to fifteen with the empirical study. It therefore reaches beyond a gap highlighted by Brandon-Jones et al. (2014, p.69) who said "future research could examine other resources or capabilities which might enhance resilience[...]. For example, the impact of flexibility, adaptability, or intra-organizational management capabilities".

In line with this, a fourth implication can be highlighted - two organisational issues came out from the empirical data which are Procurement structure and external inventory. Not mentioning the great role of franchises and the negotiating committee of key inputs in helping to create resilient actions as highlighted in Case 1 (BEV). Fifth, three intra-organisational issues out of fifteen identified were pointed out as the main ones for helping to create supply chain resilience through a Procurement perspective - Procurement structure, risk management, and knowledge acquired and backup. As exposed in chapter 6 through the four propositions, it is proposed that how Procurement

is well-structured within the company, besides the presence of good procedures to risk management and knowledge backup, Procurement is therefore capable of creating or even improving supply chain resilience.

Sixth, particularities were found within the issues which have not been published regarding supply chain resilience, such as strategic purchasing matrix (spending vs. product complexity) and corporation's group of incidents management regarding risk management, negotiating committee of key inputs discussed in Procurement structure, the benefits of exchange goods among franchises in supply base, and the importance of company size as a criteria for supplier selection.

Seventh, the result of this study has confirmed the trend to an ever-widening scope of the role of Procurement, in the sense that it has currently been named as Purchasing and Supply Management in some studies (*e.g.* Foerstl et al., 2010; Chicksand et al., 2013; Sobhani et al., 2014) as well as in acknowledged Institutes in this area - CIPS (Chartered Institute of Purchasing & Supply) and IPSCMI (International Purchasing and Supply Management Institute). Eighth, the mechanism of how Procurement can manage intra- and inter-organisational issues were explained through the lens of dynamic capability theory, which consequently adds to theoretical knowledge, especially because few studies have been published under a theoretical basis (*e.g.* Blackhurst et al., 2011; Chiang et al., 2012; Simangunsong et al., 2012; Brandon-Jones et al., 2014; Kumar and Vlajic, 2014; Treiblmaier, 2014). By and large, the findings of this study help to expand the understanding of supply chain resilience on how it can be developed through internal actions (particularly Procurement actions) so as to face the challenges and impacts of the current global market, knowing that "if you don't manage and lead change, you are going to have to surrender to it" (statement of the Marsh's director in Sáenz and Revilla, 2014, p.6).

### 7.2 Managerial Implications

"The world is becoming turbulent faster than organisations are becoming resilient" (Hamel and Valikangas, 2003, p.2). Although this affirmation might be considered old, a recent study (July, 2014), from the Global Supply Chain Institute at the University of Tennessee - Knoxville, has found that 90% of the organisations surveyed (150 supply chain executives and interviews with executives from six companies) do not measure supply chain risk when outsourcing production, and none uses outside expertise to help

assess supply chain risks (http://utcbanews.wordpress.com/2014/07/17/ ut- risk-mitigation- study- shows- companies- lacking- in- assessments- strategies/). Thus, when market opportunities arise or when disruptions occur, dynamic operations can help companies respond to them effectively (Wright, 2013). Thinking about it, the light shed on the intra- and inter-organisational issues underpinning the development of a resilience capability from a Procurement perspective can also be considered a contribution. By managing them proactively, practitioners are able to deal with unplanned outages without taking the risk of making immediate and inefficient decisions which will impact the firm's performance. Furthermore, it will help Procurement to enlarge and reaffirm its internal and external relationship with internal customers and suppliers by fulfilling efficiently its responsibilities of boundary spanning function. In the sense of the great importance of the close relationship among internal business functions to support Procurement activities, studies such as Paiva, 2010, Pimenta, 2011; Silva, Lombard e Pimenta, 2013; Pimenta et al. 2014; Silva et al., 2014 have recognised the cross-functional interdependence.

As supply chain resilience is a recent approach to supply chain management, very few managers have demonstrated knowledge of this concept. In this regard, a new approach has been introduced to the participants of this research by inciting them to demonstrate how their current practices and strategies were efficient to cope with supply disruptions. Additionally, recognising that the role of Procurement has considerably broadened in recent years, other business functions can observe the identified organisational issues in order to boost the creation of resilient actions and strategies within their business. Lastly, despite that this research has no intention to generalise the findings, the findings are not limited to beverage, food, household appliance and agribusiness supply chains. Managers from other areas can make use of the fifteen organisational issues for preparing the company from unexpected events, and then effectively responding and recovering from critical supply disruptions. The reason is that those issues might be found in companies from different sectors.

### 7.3 Limitations and Research Opportunities

Despite the findings and implications highlighted above, this study also presents limitations. Firstly, it is purely exploratory based on the body of knowledge presented in three databases in the past 14 years, as it followed the systematic review process. Secondly, it was focused on Procurement activities, which although have a strategic and

important function that interfaces focal company and suppliers, is only one part of the organisation. Thirdly, and following the second limitation, it was restricted to the upstream of the supply chain and it might be interesting to explore the downstream side in further research.

Considering these limitations, a number of missing topics can be highlighted for further research. Empirical studies can delve into the role of Procurement in creating supply chain resilience considering that useful knowledge is achieved by interplaying with the reality (MacCarthy et al., 2013). In this context, qualitative as well as quantitative research can help to advance the knowledge by applying them suitably. Regarding qualitative methods, one opportunity for future research could be conducting multiple case studies in manufacturing companies from a single sector. For example, the technology or fashion sector which are embedded in a very uncertain and dynamic market. It would assist to verify whether the aforementioned issues are applicable, efficient and sufficient to create supply chain resilience. Comparing these issues in different sectors is also a good research opportunity to visualise different perspectives, common issues among them or even identify additional ones. As following research, a comparison study among different countries would be relevant to come up with possible issues related to culture, economy and environment. Furthermore, in order to narrow down the scope of the future studies, researchers could focus on specific products, suppliers or even distinct disruptions to investigate the creation of resilience capability for particular critical cases. Also, future research could develop a longitudinal study, so that researchers could identify the evolution of resilient strategies. This research opportunity was already referenced by Jüttner and Maklan (2011) and Pettit et al. (2013), however from a different context to the focus of this study.

Like those future propositions for qualitative research, quantitative methods can also be applied in order to explore the findings from different perspectives. In this case, a survey could be conducted to test and quantify the issues found in this study. Although the rate of response using method is normally low, it has the advantage of gathering data from a variety of companies in different countries owing to the global internet accessibility. Nevertheless, Pettit et al. (2013) highlight in their research, ways to increase the response rate, such as preliminary messages, follow-up reminders, personalization of requests and deadline dates. Furthermore, the development of a mixed method should also be a valuable research since it has increasingly been employed by raising the validity of the findings through examining the same

phenomenon qualitatively and quantitatively (Brannen, 1992). Moreover, MacCarthy et al. (2013) state that both methodological approaches are essential and inextricably linked for theory building and knowledge development.

Delving the knowledge into resilient enablers and barriers is also a good opportunity for further research, as they are the starting point to extract the organisational issues. Thus, a focus group method can help to come up with a variety of outcomes by creating a discussion among managers with different skills, experiences and motivation. It would be interesting during this session to apply the critical incident technique (Flanagan, 1954). This additional tool could help to collect data in a more systemic way in order to increase the soundness of the possible outcomes. Afterwards, methodologies such as ISM (Interpretive Structural Modelling) approached by Faisal et al. (2006) and FISM (Fuzzy Interpretative Structural Modelling) applied by Yenradee and Dangton (2000) could be relevant to understand the relationship among the enablers.

The phenomenon in analysis - creation of supply chain resilience - may be encompassed by not only Procurement's efforts but also by a set of business functions effort (logistics, sales and marketing for example) within the focal firm and along members of the supply chain. Accordingly, issues and actions from different function perspectives should be further explored in order to build a resilient supply chain. Furthermore, it is known that resilience is not a cheap strategy. Thus, other opportunities for research could focus on organisational performance by examining how costs to create resilience capability can be minimised. It will guide practitioners to systematically manage their general resources with the aim to be more effective in disruption recovery.

The involvement of this topic with other underpinning approaches or theories should also be considered for further research. Resource dependence theory (Pfeffer and Salancik, 1982), Strategic choice (Child, 1972; Miles and Snow, 2003) or Strategic contingency theory (Hickson et al., 1971) could be interesting theories to address the phenomenon since they all consider the environmental influence on the organisation's actions, performance and consequently business continuity. However, for each one of these, the phenomenon should be approached differently according to their particularities. Lastly, trade-off decisions of supply chain resilience and Procurement should be investigated in order to delve further into this study which could produce additional and meaningful results.

Taking into consideration the results from the case analysis, other future opportunities of research can be highlighted. Firstly, as the cases were conducted in Brazil, other researches using the same topic could explore intra- and inter-organisational issues from other countries, considering that culture can highly influence on the actions and strategies to creating supply chain resilience. Secondly, other sectors could be explored in order to check whether those intra- and inter-organisational issues highlighted in the conceptual framework are really important and sufficient to creating supply chain resilience. Thirdly, still in this line, different perspectives from the internal business function can be set as the object of the study. Fourthly, investigating how to develop resilience upstream of the supply chain is also in interesting topic which has not been explored so far. Fifthly, considering Procurement structure is one of the main issues for creating supply chain resilience, another future opportunity could be to explore what kinds of buyer-supplier relationships would be better to achieve better results in preparing, responding and recovering from critical supply disruptions. Furthermore, it is possible to extend such results to other links along the supply chain and not focus only on dyads. The forethoughts about such organisational issues will help managers to avoid mismatches in the long run.

Based on the findings and the recommendations for future research listed here, it is advocated that this topic is relevant to be studied considering its importance in dealing with the emergent, volatile and challenging market plus an unstable environment. It has also being closely linked to a boundary spanning function involved in one of the top recent topics studied at the moment: global sourcing risk. Indeed, moving away from traditional strategies and plans to manage risk in the supply chain is something that managers are already aware of in the current climate. Therefore, companies should take advantage of the current crisis arising from this era of turbulence in order to overcome not only disruptions, but also to become more competitive in a volatile market.

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## APPENDIX I: Case Study Protocol

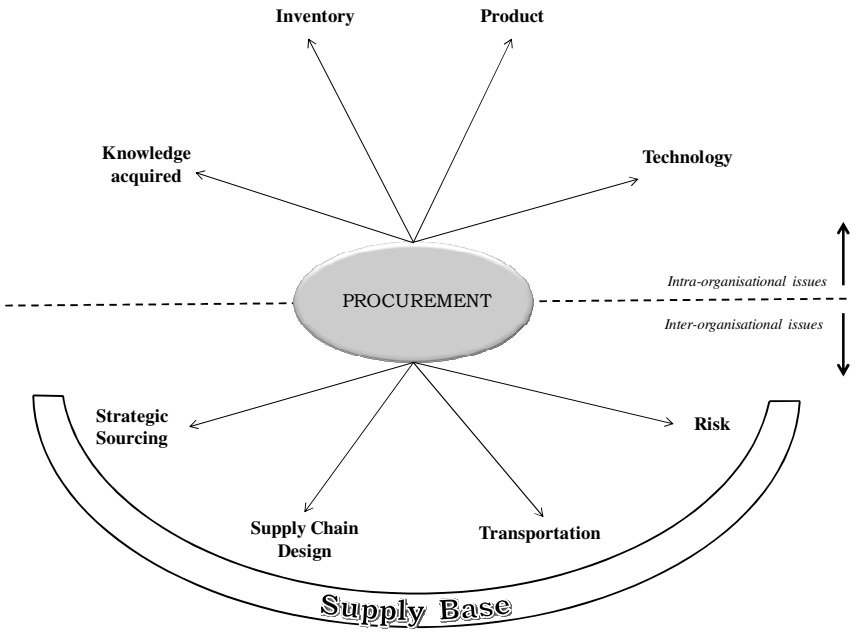
### 1) Purpose of the research

*The aim of this study is to understand the role of Procurement in managing the intra- and inter-organisational issues that helps create supply chain resilience, through the lens of dynamic capability theory.*

### 2) Research questions

*RQ1) What are the intra-organisational issues that must be addressed to Procurement in dealing with unexpected supply chain disruptions in practice?*
*RQ2) What are the inter-organisational issues that must be addressed to Procurement in dealing with unexpected supply chain disruptions in practice?*
*RQ3) How can Procurement manage these intra- and inter-organisational issues in order to help create supply chain resilience, through the lens of dynamic capability theory?*

### 3) Theoretical framework for the case study



**4) Case study selection**

Selection criteria for companies to be studied in this research:

- medium to large-size companies;
- focus on manufacturing companies;
- companies with well-developed Procurement function (or other functions responsible for the suppliers) which includes two or more employees (managers and leaders);
- suppliers which provide critical items to the focal companies;
- companies from different sectors;
- companies located in Brazil.

**4) Data collection**

a) Companies to collect data

- Case 1: one focal company and two of its critical suppliers embedded in a beverage supply chain;
- Case 2: one focal company and two of its critical suppliers embedded in a household appliance supply chain;
- Case 3: one focal company and two of its critical suppliers embedded in a food supply chain;
- Case 4: one focal company and two of its critical suppliers embedded in a agribusiness supply chain.

b) Sources of evidence

- Interviews
  - first contact within the company;
  - Procurement people from different levels;
  - any individuals from other functions if they are involved to supply chain disruptions;
  - sales or key account managers from the key suppliers;
  - any other individual from other functions within the suppliers if they have direct contact with Procurement from the focal company;

***NOTE:*** *the names of the functions/departments are supposed to change according to different companies' structure.*

- Additional data
    - internal documents from focal company or suppliers;
    - annual reports;
    - performance reports;
    - information from their home websites.

d) identify all the interviewees in the first personal contact;

e) schedule the interviews (date and time);

f) Procedures for data collection and analysis:

- Data collection
    - introduce the aim of the research and highlight the data confidentiality once again;
    - provide the interview script to each one of the interviewees (Appendix III);
    - record the interviews (around 45 minutes per interviewee);
    - make notes during the data collection;
    - add all notes, transcripts and documents in the case database.

**5) Data Analysis**

- codebook (Appendix IV);
- code the transcriptions based on the literature-derived codes;
- analyse the codes according to the aim of the research;
- conduct the cross case analyses and link the results with the findings of the literature review;
- link the results of the analysis to an organisational theory.

## APPENDIX II: Formal Letter sent to Brazilian Companies

UNIVERSIDADE FEDERAL DE SÃO CARLOS
Departamento de Engenharia de Produção
Centro de Ciências Exatas e de Tecnologia
Programa de Pós-Graduação – PPG – EP

**CARTA DE APRESENTAÇÃO DE PESQUISA**

Prezado(a),

Sou doutoranda do Programa de Engenharia de Produção da Universidade Federal de São Carlos (UFSCar) e estou desenvolvendo uma tese de doutorado sobre "**O papel da função Compras no desenvolvimento de uma Cadeia de Suprimentos Resiliente**", sob à orientação da Prof[a] Dr[a] Andrea Lago da Silva e co-orientação do Professor Dr. Martin Christopher, da Universidade de Cranfield - Inglaterra, onde realizei parte da minha formação.

O conceito de Cadeia de Suprimentos Resiliente busca auxiliar empresas a responderem de forma rápida e efetiva a casos de rupturas do fluxo de bens e/ou serviços causados por incidentes inesperados, tais como falhas na manufatura (falhas/riscos internos), falhas de transporte (falhas/riscos na cadeia) ou danos no sistema de suprimentos devido a incidentes externos (ambientais, sociais ou políticos) como chuvas torrenciais, enchentes ou mesmo protestos (falhas/riscos do ambiente), por exemplo. Nesse sentido, o objetivo desta pesquisa é **identificar pontos chaves que devem ser observados internamente e externamente pela função Compras de modo a desenvolver uma cadeia de suprimentos resiliente.** A função Compras foi escolhida como foco deste projeto devido a sua capacidade de gerenciar e coordenar as necessidades internas com seus respectivos fornecedores externos. No entanto, há casos de empresas em que outras funções, como por exemplo a Logística, atuam melhor neste processo do que Compras em si.

Sua empresa me despertou interesse, pois busco por empresas que trabalham no setor de manufatura, sejam de grande porte e que implementem ações para lidar com estes tipos de riscos e incidentes. Além disso, sua empresa possui elevada representatividade dentro do mercado em que atua e está inserida em um mercado altamente competitivo, no qual é possível que sejam solicitados a participarem de um mercado globalizado e de programas de gestão de riscos e eventos críticos.

Neste momento da pesquisa, necessito entrevistar gerentes e coordenadores da função Compras (ou função correlata) responsáveis pela compra de matéria-prima e componentes, além de dois a três fornecedores chave da empresa (se possível). No caso dos fornecedores, interessariam pessoas que fazem contato com os compradores de tais matérias-primas ou componentes. As entrevistas serão compostas por perguntas semi-estruturadas e terão uma duração média de 45 a 60 minutos. O questionário de entrevista é composto por 15 questões abertas e já foi validado por meio de algumas entrevistas piloto.

O presente projeto possui fins unicamente acadêmicos e não divulgará nenhum tipo de dados confidenciais ou mesmo o nome da empresa, se assim julgarem pertinente. Assim, gostaria de saber da possibilidade de ter uma primeira conversa com você (por telefone ou skype) para esclarecer pontos chaves da pesquisa, expor benefícios desta à empresa, e saber do interesse de vocês em participar desta pesquisa. Comprometo-me, ao fim do trabalho, enviar um sumário executivo com os principais resultados. Desde já agradeço a sua atenção e me disponho a esclarecer quaisquer dúvidas que venham a surgir.

Atenciosamente,
Carla Roberta Pereira

Doutoranda e pesquisadora da Universidade Federal de São Carlos (UFSCar)
Telefone:+55 016 98237-9406 - Skype: carlinhacrp
e-mails: pereiracrz@dep.ufscar.br ou pereiracrz@gmail.com

**APPENDIX III: Semi-structure Interview Protocol**

## QUESTIONÁRIO GERAL

*Objetivo: Este questionário é destinado a pessoa de contato ou gerente geral da empresa. Ele objetiva verificar se a empresa atende aos objetivos da pesquisa, além de identificar possíveis cargos a serem entrevistados (Compras e/ou funções relacionadas).*

**Início: Verificar o entendimento dos entrevistados sobre o conceito Gestão da Cadeia de Suprimentos Resiliente**

1) Você já ouviu falar sobre Cadeia de Suprimentos Resiliente?

1a) Se sim, como você a definiria?

1b) Se não, dar uma explicação sobre o que é este conceito e, em seguida, perguntar se há alguma atividade ou processo que estaria relacionada a isto.

2) Como você aplicaria este conceito em sua empresa?

**Parte 1: Informações gerais sobre a empresa**

3) Primeiramente, poderia me falar de forma geral sobre sua empresa e sua responsabilidade dentro dela?

- *Pontos de interesse:* natureza dos negócios, estrutura organizacional/hierarquia, principais produtos, mercado (demanda e fornecimento), volume de produção e receita.

4) Na sua opinião, quais são as principais causas/fontes de incerteza na cadeia de suprimentos da sua empresa?

5) Já houve casos de rupturas de fluxo de bens (produtos) causados pelo atual mercado dinâmico e mudanças ambientais?

a) Que tipos de rupturas? relatar algumas.

b) Qual é a mais frequente? por que?

c) Qual foi a mais severa/crítica? por que?

6) Como estas rupturas afetam as operações normais e o desempenho da empresa?

7) Quem são os envolvidos na identificação de riscos e ações em caso de rupturas de fluxo de bens (dentro da empresa e também em relação aos fornecedores)?

8) Qual é o papel de Compras (Suprimentos ou departamento correlato) em lidar com estes casos de rupturas?

9) Na sua opinião, quais os pontos (barreiras) mais difíceis de resolver/superar em caso de rupturas de fluxo?

10) Na sua opinião, quais processos ou atividades ajudam a empresa a recuperar seu desempenho mais rapidamente depois de sofrer qualquer tipo de ruptura de fluxo (desde as mais frequentes até a críticas)?

## QUESTIONÁRIO A SER APLICADO A EMPRESA FOCO

*Objetivo: Este questionário é destinado a gerentes, coordenadores ou pessoas envolvidas com a função Compras (Suprimentos ou correlata) da organização.*

**Início: Verificar o entendimento dos entrevistados sobre o conceito Gestão da Cadeia de Suprimentos Resiliente**

1) Você já ouviu falar sobre Cadeia de Suprimentos Resiliente?

1a) Se sim, como você a definiria?

1b) Se não, dar uma explicação sobre o que é este conceito e, em seguida, perguntar se há alguma atividade ou processo que estaria relacionada a isto.

2) Como você aplicaria este conceito em sua empresa?

**Parte 1: Entender sobre a função Compras e seu relacionamento interno com outras funções**

3) Poderia relatar de forma geral quais as responsabilidades de Compras e como ela é estruturada dentro da empresa?

4) Qual é o relacionamento entre Compras e outras funções internas? (*relacionamento forte ou fraco?se forte, com quais funções e por que?*)

5) Como é o relacionamento entre Compras e fornecedores responsáveis pela entrega de componentes críticos para a produção?

6) Quem são os seus fornecedores principais (aqueles que fornecem matéria-prima para os principais produtos da empresa)?

**Parte 2: Entender qual a importância da função Compras em lidar com riscos e rupturas**

7) Na sua opinião, quais são as principais causas/fontes de incerteza na cadeia de suprimentos da sua empresa?

8) Já houve casos de rupturas de fluxo de bens (produtos) causados pelo atual mercado dinâmico e mudanças ambientais?

a) Que tipos de rupturas? relatar algumas.

b) Qual é a mais frequente? por que?

c) Qual foi a mais severa/crítica? por que?

9) Como estas rupturas afetam as operações normais e o desempenho da sua empresa?

10) Qual é o papel de Compras em lidar com riscos e rupturas de fluxo?

a) Quais são os procedimentos de avaliação e identificação de riscos?

b) Como Compras monitora as vulnerabilidades de fornecedores e gerencia os riscos?

c) Como Compra lida com os riscos que não podem ser previstos? (quais as ações/soluções tomadas).

11) Além do pessoal de Compras, quem mais está envolvido neste processo de avaliação e identificação de riscos? (*pode ser pessoas dentro da empresa ou fora - fornecedores*)

12) Na sua opinião, quais são as barreiras que impedem/dificultam a empresa voltar rapidamente o seu desempenho normal após qualquer tipo de ruptura?

13) Considerando as barreiras pontuadas, quais seriam os possibilitadores (ações ou atividades) que auxiliaria a empresa a retornar ao seu desempenho normal o mais rápido possível?

(Pontos gerais que podem ser abordados na discussão sobre esta pergunta com o entrevistado).

| Pontos críticos (issues) | Necessita de atenção especial p/ criar resiliência? (S/N) | Interna/e? | Externa/e? | Por que? Vantagens? O que se ganha com isso? |
|---|---|---|---|---|
| *conhecimento interno adquirido* | | | | |
| *comunicação interna* | | | | |
| *forma de gerenciamento de estoque* | | | | |
| *redundância de componentes críticos* | | | | |
| *flexibilidade de produto - ex. modularidade* | | | | |
| *tecnologia (melhorar a comunicação)* | | | | |
| *tecnologia (auxilia na identificação de riscos e solução de problemas de rupturas)* | | | | |
| *Número de fornecedores* | | | | |
| *Critério seleção fornecedores* | | | | |
| *Desenvolvimento de fornecedores* | | | | |
| *Relacionamento com fornecedores* | | | | |
| *configuração da cadeia/rede de fornecimento* | | | | |
| *Formas de transporte* | | | | |
| *Gestão de riscos* | | | | |

14) Na sua opinião, quais mudanças organizacionais hoje poderiam auxiliar neste rápido retorno de desempenho?

15) De que forma você acha que a gestão de fornecedores e estratégia de suprimentos poderia ser melhorada para melhor auxiliar na redução de riscos e aumento da resiliência?

**Parte 3: Fechamento da entrevista**

16) Há algum outro ponto relevante que deveria ser pensado/aplicado na identificação e gestão de riscos e, consequentemente, para a criação da resiliência na cadeia de suprimentos? Se sim, justificar.

17) De forma geral, há algum outro ponto que gostaria de destacar? Algo sobre perguntas anteriores que você tenha lembrado de mais algum detalhe ou ponto relevante?

## QUESTIONÁRIO A SER APLICADO AOS FORNECEDORES

*Objetivo: Este questionário é destinado aos fornecedores chave da empresa entrevistada (empresa foco). Os entrevistados serão pontuados pelos responsáveis de Compras de acordo com sua disponibilidade e não envolverá a mesma quantidade de entrevistas feitas na empresa foco.*

**Início: Verificar o entendimento dos entrevistados sobre o conceito Gestão da Cadeia de Suprimentos Resiliente**

1) Você já ouviu falar sobre Cadeia de Suprimentos Resiliente?

1a) Se sim, como você a definiria?

1b) Se não, dar uma explicação sobre o que é este conceito e, em seguida, perguntar se há alguma atividade ou processo que estaria relacionada a isto.

2) Como você aplicaria este conceito em sua empresa?

**Parte 1: Entender o relacionamento dos fornecedores com a empresa foco**

3) Primeiramente, poderia me falar de forma geral sobre sua empresa e sua responsabilidade nela?

- *Pontos de interesse:* natureza dos negócios, estrutura organizacional/hierarquia, principais produtos, mercado (demanda e fornecimento), volume de produção e receita.

4) Quais são suas responsabilidades em relação a empresa foco?

5) Como é o relacionamento entre vocês e a empresa foco?

6) Há alguma outra pessoa ou departamento nesta empresa que tem contato direto com a empresa foco? qual e por que?

**Parte 2: Entender como fornecedores trabalham com a empresa foco com relação a gestão de riscos e rupturas**

7) Na sua opinião, quais são as principais causas/fontes de incerteza na cadeia de suprimentos da sua empresa?

8) Já houve casos de rupturas de fluxo de bens causados pelo atual mercado dinâmico e mudanças ambientais?

a) Que tipos de rupturas? relatar algumas.

b) Qual é a mais frequente? por que?

c) Qual foi a mais severa/crítica? por que?

9) Como estas rupturas afetam as operações normais e o desempenho da sua empresa?

10) Quando ocorre alguma ruptura no fluxo de bens, quais as ações/procedimentos tomados por vocês e também pela empresa foco de modo a voltarem o mais rapidamente ao desempenho normal das operações?

11) Poderia descrever um ou dois casos de rupturas de fluxo de bens o qual tenha causado grandes problemas a vocês e a empresa foco?

12) Quais as ações foram tomadas? Elas foram eficientes e efetivas?

13) Na sua opinião, quais são as barreiras que impedem uma rápida recuperação da empresa em seu desempenho após qualquer ruptura?

14) Considerando as barreiras pontuadas, quais seriam os possibilitadores (ações ou atividades) que auxiliaria a empresa a retornar ao seu desempenho normal o mais rápido possível?

(Pontos gerais que podem ser abordados na discussão sobre esta pergunta com o entrevistado).

| Pontos críticos (issues) | Necessita de atenção especial p/ criar resiliência? (S/N) | Interna/e? | Externa/e? | Por que? Vantagens? O que se ganha com isso? |
|---|---|---|---|---|
| *conhecimento interno adquirido* | | | | |
| *comunicação interna* | | | | |
| *forma de gerenciamento de estoque* | | | | |
| *redundância de componentes críticos* | | | | |
| *flexibilidade de produto - ex. modularidade* | | | | |
| *tecnologia (melhorar a comunicação* | | | | |
| *tecnologia (auxilia na identificação de riscos e solução de problemas de rupturas)* | | | | |
| *Número de fornecedores* | | | | |
| *Critério seleção fornecedores* | | | | |
| *Desenvolvimento de fornecedores* | | | | |
| *Relacionamento com fornecedores* | | | | |
| *configuração da cadeia/rede de fornecimento* | | | | |
| *Formas de transporte* | | | | |
| *Gestão de riscos* | | | | |

15) Na sua opinião, o que você mudaria ou adicionaria de modo a melhorar a responsividade (criar resiliência) nas empresas caso ocorra rupturas?

**Parte 3: Fechamento da entrevista**

16) Há algum outro ponto relevante que deveria ser pensado/aplicado na identificação e gestão de riscos e, consequentemente, para a criação da resiliência na cadeia de suprimentos? Se sim, justificar.

17) De forma geral, há algum outro ponto que gostaria de destacar? Algo sobre perguntas anteriores que você lembrou de mais algum detalhe ou ponto relevante?

## APPENDIX IV: Codebook

- **Companies' general information**
  - CASE 1
    - BEV
    - BEV-SUPPLIERS
    - interesting statements
    - structure C1
  - CASE 2
    - KAPPL
    - KAPPL-SUPPLIERS 2
    - interesting statements 2
    - structure C2
  - CASE 3
    - FOOD
    - FOOD-SUPPLIERS
    - interesting statements 3
    - Structure C3
  - CASE 4
    - AGRO
    - AGRO-SUPPLIERS
    - interesting statements 4
    - structure C4
  - PONTOS CONCLUSIVOS
- **Procurement**
  - importance to cope with risk and disruptions
  - other functions that help to cope with disruptions
  - Responsibilities
  - Share information with
    - Finance
    - Logistics
    - Supply Chain
    - Manufacturing/PCP
    - Marketing
    - Quality
    - Food Production
    - SAC
    - Sales
    - Research and Development
    - Environmental Health Safety
    - suppliers
- **SCResilience**
  - do not know the meaning
  - know the meaning
  - understanding and application of this approach
  - importance of the approach in the company
- **Disruptions**
  - Causes/sources of uncertainties
    - Internal
      - Lack of production capacity
      - Internal forecast
      - Quality problems
      - Manufacturing problems
    - External

- Last time order changes
- Booking unavailability
- Transportations issues
- Suppliers problems
- Supplier financial weakness
- Suppliers strikes
- Policy changes
- Lack of supplier capability
- Long distances
- Employees strike
- Lack of safety stock
- Demand vulnerability
- Poor supplier's administration
- Trucker strikes
- Lack of partnership with suppliers
- Supplier's broken machines
- The poor Brazilian infrastructure of the roads
- Problems in the supplier's production line
- Problems with the product specification
- Failures in orders requirements
- Problems in the second tier suppliers
- Robberies and strikes in ports

▪ Environmental
- Lack of natural resources
- Pests
- Meteorological factors
- Season
- Forest fire

➢ Examples - real cases
▪ lack of product quality
▪ delay in delivery
▪ problem with pests
▪ Lack of supplier capacity
▪ extreme meteorological changes
▪ problems with the suppliers
▪ natural disaster
▪ Blackout
▪ quality issues
▪ time response and transportation modes
▪ Island ash cloud
▪ supplier vacation
▪ Flood
▪ financial crash supplier
▪ crop problems
▪ walkout strike
▪ inaccurate information from Government Institutes' reports to crops
▪ Civil war in Africa
▪ Blizzard in USA
▪ problem in product specification
▪ problems with internet network
▪ traffic accident
▪ supplier financial crash of supplier's focal company
▪ warehouse fire
▪ supplier's broken machine
▪ low quality of raw materials duo to weather changes

- bottle cap blackout
- unexpected demand increasing
- supplier fire plant
- problem due to single sourcing
- shipping accident
- communication mistakes
- Brazilian protest against the government
- Energy blackout in supplier's plant

- Procedures/actions/strategies to mitigate them
  - uncertainty management and risk mitigation
  - meetings
  - good incomes from preparation
  - internal and external communication to make a deal
  - urgent meeting in case of unexpected disruptions
  - new/similar product launch - product flexibility
  - importation
  - holding stock
  - approvals of new suppliers
  - assessment by specialists
  - fees collection in case of delays to deliver
  - changes in production scheduling
  - financial analysis of suppliers
  - negotiating committee of key inputs
  - dual sourcing
  - contingency plans
  - Contract
  - KPI's
  - S and OP
  - strategic matrix

- **Intra-organisational issues**
  - Barriers - internal
    - Complexity
    - Financial weakness
    - Lack of capacity
    - Lack of collaboration
    - Lack of coordination and control
    - Lack of coordination
    - Lack of flexibility
    - Lack of information sharing
    - Lack of integration
    - Lack of knowledge
    - Lack of trust
    - Lack of visibility
    - Long distancess
    - Long lead times
    - risk location
    - Delay in internal approvals
    - lack of commitment
    - bureaucracy
    - product flexibility x specification or standardization
    - single-sourcing
    - delay in communication
    - company's policy
    - leadership profile
    - internal hierarchy
  - Enablers - internal
    - Adaptability
    - Agility

- Alignment
- Collaboration
- Company´s knowledge
- Control
- Coordination and control
- Financial strength
- Flexibility
- Information sharing
- Integration
- Redundancy
- Risk management
- Supply chain design
- Trust
- Velocity/acceleration
- Visibility
- internal supplier commitment
- contingency plan
- technology to improving visibility and decreasing inventory
- changes in scheduling
- SaOP
- close work environment

➢ Intra-org issues from literature
- Risk
  - risk management.
- Inventory (int)
  - Redundancy of critical items
- Knowledge
  - knowledge acquired and backup
  - internal communication
- Product
  - product flexibility
- Technology
  - Communication tools
  - Technological ways to discover, recover and redesign the supply chain
- Structure
  - Procurement structure

➢ Points of improvements to SCRes - int
- Critical analysis of the events
- identification of critical items and supplier strategies
- Study and technological development
- Efforts and actions focused on risk mitigation
- better exploring and understanding the internal resources
- low product variability due to high demand variability
- improvements in information system
- simplify internal process
- improvements in demand forecast in order to better align the upstream sup

❖ **Inter-organisational issues**

➢ Barriers - external
- Government issues about importation
- importation issues
- lack of substitutable supplier
- product quality
- low quality of workers
- packaging in poor condition
- high costs
- weak workforce

- delays in deliveries
- lack of substitutable suppliers ex
- buyer-supplier dependence
- Policy issues
- small companies and financial weakness
- lack of competitive supplier
- long run to internal approval
- velocity to share information
- vulnerability of the crops
- mistrustfulness
- no concerns to take preventive actions
- cultural
- lack of field planning
- bargaining power
- impossibility to control the weather
- decrease of the production volume due to old crops
- lack of general institution to monitor and assess risk
- lack of trustful reports from Government Institutions regarding crops
- lack of collaboration and communication
- lack of supplier capacity ex
- problems in structure of suppliers
- supplier financial problem
- long lead times because of the importation
- often unknown changes in demand
- cost negotiation
- Lack of external integration
- production planning mistakes
- external approvals
- lack of planning alignment in the dyadic
- poor road infrastructure
- Long distancessss
- high tax transportation
- states bureaucracy
- outsourcing transportation
- rare and poor service of outsourcing transportation at the north of Brazil

➢ Enablers - external
- Flexibility inter
- Government assistance in terms of cost importation
- auditing
- contracts
- Communication - ext
- extra capacity of suppliers
- Early Communication
- strong and wider communication
- alignment of the members along the SC
- team coaching
- empowerment
- dual-sourcing
- monitoring of supplier capacity
- collaboration ex
- visibility along the sc
- supplier changes in case of often problems
- supplier open minded
- better process control
- trustful relationship
- alignment along business planning

- inaccurate information in demand system
- contingency plan
- franchisess
- supplier's committee
- agility in communication
- quick reaction to supply customer
- Preventive Machine Maintenance
- acquisition of good quality raw materials
- critical contract analysis
- commitment and knowledge to find solutions

- Inter-org issues from literature
  - Strategic sourcing
    - supply base
    - criteria for supplier selection
    - supplier development
    - supplier relationship
  - Supply chain design 1
    - Supply chain configuration
  - Transportation
    - Transportation modes
  - Inventory (ext)
    - External inventory

- Points of improvements to SCRes - ext
  - Earlier orders
  - extra fees in case of current mistakes
  - managing body of the producer
  - joint work
  - extra plant abroad
  - product substitutable
  - creation of groups to discuss the possible risk within a particular supply chain and how to manage and cope with it
  - improvements in technology to share information in a more rapid and effective way
  - better supplier alignment with the focal company planning
  - high exchange in function roles
  - increasing the commitment and collaboration from large companies to suppliers
  - empowerment to make decisions
  - increasing commitment and collaboration from all members along the sc
  - improving preventive actions
  - minimal safety stock at focal company
  - improvements in communication
  - having its own transportation, and not outsourcing

## APPENDIX V: Original codes from the interviews (Case 1)

**[1]** A minha função, entre outras coisas, é fazer um meio de campo entre a autorização de fornecedores e as franquias. Suportar tanto as necessidades dos fabricantes quanto necessidade de insumos, e garantir que os fornecedores desejados estejam dentro das nossas normas [...] também claro ajudar o meus colegas de Compras a seguir (Mproc1).

**[2]** [...] neste caso, eu sou comercial; aí, por exemplo, eu tenho contato direto com Compras lá, né. Eles passam para mim a necessidade, mas quando é, por exemplo, problema no filme, eu corro mais atrás aqui de modo a não faltar filme para o cliente (Psale1s2).

**[3]** A área de compras é a principal componente no acompanhamento disso, só que ela só consegue trabalhar munida de informações a partir de outros setores da empresa (Mmint1s1).

**[4]** Eu não sei se eu já estou viciado no modelo. É que a gente não tem essa formalidade, né. Então talvez inconscientemente a gente realiza isso, mas não de uma forma estruturada (Mproc1).

**[5]** Cansei já de ouvir, o caminhão esta parado na barreira fiscal. Muitas vezes quando o caminhão esta com frete fracionado, ele esta trazendo o material de um monte de gente, ai deu problema em uma única rota, pronto, travou tudo, teve uma inundação em uma estrada, o caminhão teve que voltar, quantas vezes. Então assim, a gente tem essa fragilidade no país (Mmint1s1).

**[6]** [...] o feriado agora passado, por exemplo, houve um acúmulo de veículos e consequentemente atraso na entrega. Então por mais que a gente tenta evitar isso, isto pode acontecer.

**[7]** Tivemos um fornecedor que teve máquina quebrada. Era o grande fornecedor de preforma, de garrafa pet. A gente não compra garrafa, a gente compra pre-forma, que é um estágio anterior a garrafa. E ai, quebrou a máquina; teve 30 dias para consertar. Boa partes dos fabricantes dependia dele (Mproc1).

**[8]** Se usou a capacidade ociosa dos outros fornecedores para se atender essa demanda não atendida pelo outro fornecedor. É muito difícil ter uma parada de produção, assim grande por falta de insumo. A gente não tem assim... e são 40 fábricas no Brasil. Apesar que são grupos diferentes, são empresas diferentes, mas numa crise a gente consegue montar alguns planos que se não tem um insumo, produz em outra fábrica. Então tem uma série de alternativas que a gente vai criando para poder manter o mercado abastecido (Mproc1).

**[9]** Em 2012, a gente teve um apagão de tampa, porque? Como a gente entrou em campanhas promocionais que envolvia pincode na tampa. [...] só que não é só a tampa. Tem a tampa, o rótulo... e daí não adianta, por exemplo, sair com a tampa sem o pincode com rotulo. Você esta enganando o consumidor, né, porque esta lá comunicando a promoção e a tampa não tem o pincode, e também não adianta ter o pincode e não ter a comunicação porque ai você não tem efetividade. Daí o que aconteceu, a gente teve uma série de campanhas, vamos dizer assim, encavaladas, que o fornecedor acabou não suportando os estoques, de produto semiacabado com o de acabado, e acabou que teve um apagão, todo mundo ficou sem tampa. [...] Então em alguns momentos eu tinha demanda e estava com a linha parada, me gerou parada externas, me gerou alguns SKU´s mais segmentados, algumas rupturas, rupturas de venda, então gerou um impacto sim, gerou um impacto negativo (Mplan1).

**[10]** Quais são as soluções que tivemos: vamos trabalhar com a tampa *mainline* e tentar buscar o rótulo com outro fornecedor, né. Então a gente transferiu um pouco do ônus do fornecedor de tampa para o de rótulo, o de rótulo você precisa me fabricar aquilo tudo. E nesse ínterim a gente buscou outros players, né, já homologados pelo sistema BEV. Então assim, como a gente tratou esse apagão, primeiro, organização, né, já tem o cara, presidente do comitê que já olhou tudo, temos esses fornecedores com todas essas plantas, com esse consumo, o que a gente pode fazer, a gente pode redistribuir volumes entre plantas, que tem eventualmente alguma sobra, a gente pode distribuir melhor volumes entre os players, mesmo que ele não possa me atender, e porque não desenvolver, importar, a gente importou planta também, e retomamos o fornecedor que fornecia anteriormente pra gente, que não estava mais fornecendo. Então assim, como foi a resposta do sistema? foi rápida, de forma organizada, centralizada, todo mundo buscou ai alternativas, seja com novos fornecedores, importação, ou utilização de tampas sem promoção, e até abdicar de uma campanha (Mplan1).

**[11]** Aconteceu um incêndio na fábrica do fornecedor e a gente perder quase todo nosso pedido. Dai a gente parou a fábrica. [...] Do dia para a noite ele me ligou e falou: oh, todo o seu pedido do mês seguinte, eu não vou te entregar porque pegou fogo na minha fábrica (Mproc1).

**[12]** Então assim, a gente ficou bem... mas ai a gente recorreu ao comitê, né, a associação dos fabricantes, e eles pegaram todo esse nosso pedido e passaram para um outro fornecedor (Mproc1).

**[13]** Agora, já houve uma ocasião que o fabricante teve um problema grave no processo produtivo dele, tá? Neste caso especifico, não era um problema de logística, era um problema de falta de produto mesmo (Mmint1s1).

**[14]** E ai o que é que foi feito, a gente teve em que com o apoio deles, fazer importações emergenciais, tá? A gente importou da Argentina que é, seria o tempo mais rápido. Não adianta trazer isso da Ásia, não adianta trazer isso do México, tá? Que o tempo de trânsito ia ser muito dilatado. Trouxemos de navio também, mas o que aconteceu? O sinal acendeu com algum tempo de dias de estoque, deles também. Eles identificaram a falha com algum tempo de antecedência e foi possível tomar essas ações, tá Mas isso daí já tem um bom tempo que aconteceu, isso daí não é uma coisa que acontece com frequência. E o que a gente consegue fazer hoje, é manter um certo nível de estoque em um armazém externo, e a gente trabalha com grandes silos de resina (Mmint1s1).

**[15]** Existe uma resina que a BEV-FC está trabalhando que é a resina petbottle. É uma resina com um viés, não tem muita diferença, mas ela tem um viés de sustentabilidade e questão de natureza e etc. É uma resina que tem uma carga de poluente menor e essa resina é importada, não é produzida no Brasil; ela vem ou da China ou da Argentina. Teve a questão de um navio que tava trazendo da Argentina, afundou e a resina não chegou. A BEV-FC ia ficar sem.

**[16]** E a nossa ação foi informar que a gente poderia fornecer a pré-forma que ela queria com a resina normal. Pra isso a BEV-FC teve que, eu acho que já existia o rótulo desenvolvido sem as informações que a resina era para a petbottle, mas teve que pedir para produzir etc, e essa foi a ação. Informar com a maior brevidade possível para que a BEV-FC pudesse produzir o rótulo (Psale1s1).

**[17]** O que está acontecendo muito agora por termos de distância, está tendo muito problemas de transporte. Assim, por exemplo, eu tenho uma estimativa de tempo de Bahia a Sul de 7 dias, que é o normal. Mas as vezes ocorre de ser 10-12, por que? porque teve o feriado agora passado, por exemplo, então houve um acúmulo de veículos e consequentemente atraso na entrega. Então por mais que a gente tenta evitar isso, isto pode acontecer. A carga saiu da nossa unidade e infelizmente devido a excesso de cargas pela estrada, impactou e teve um atraso de 2 dias e impactou o cliente.

**[18]** Como a gente viu que não ia atender a tempo, a gente teve que retirar material de unidade deles e mandar para outra. Então, por exemplo, já aconteceu de Curitiba fornecer material para a unidade de Porto alegre. Isso a unidade do meu cliente, ai depois a gente tem que arcar com as despesas de transportes, entendeu? (Msac1s2).

**[19]** Sim, os protestos afetaram muito! (Msac1s2).

**[20]** Muito, muito, muito, muito, nossa! A gente teve muito problema com isso, muito mesmo. Assim, porque tinha, eles paravam sempre as principais rodovia, né. Então, assim, ficava três, quatro dias parado (Psale1s2)

**[21]** Tivemos que redirecionar o transporte para outros locais, e ai a logística fica bastante impactada, porque a gente tem que verificar, por exemplo, eu sai daqui destino BH. Então ai você sai por um lado, e lá ta parado; dai você tem que retornar e fazer um outro percurso, entendeu? Basicamente isso impacta bastante. Como está acontecendo no RJ agora né, está tendo manifestação por causa da Copa, então ai a gente não sabe o que pode acontecer. Pode ser que isso venha a impactar, entendeu? já estamos vendo outras.. ai vc começa estudar outras medidas para poder burlar isso, entendeu? mas é inconstante né. (Msac1s2)

**[22]** A gente tinha que mandar material de um lado para outro, pegava de um cliente para entregar em outro. Aqui a gente tem também muito distribuidor aqui né, então isso também está distribuído no Brasil inteiro. Então, acontecia: ah, o caminhão está parado, é lá no Rio de Janeiro, entrega no Paraná, o que a gente vai fazer? Aí, a gente pega um distribuidor perto e ele manda. Depois, a gente manda para o cliente. O bom nosso é que existem, como a gente tem três fábricas e tem muito distribuidor, espalhado pelo Brasil inteiro. Então, a gente consegue fazer isso. Mas se a gente não tivesse, nossa, não sei como. (Psale1s2)

**[23]** No final do ano passado, a gente tem uma fábrica aqui em Itamonte, que agora só faz filme impresso, mas a gente fazia o nosso filme lá também e, por conta das chuvas, caiu essas torres de transmissão, sabe? Caiu duas torres e a cidade inteira ficou apagada. E assim, não tinha nem previsão de voltar a rodar e era final de ano, quando os pedidos nossos aumentam. Nossa, um período, assim, muito difícil. A gente

falava com os clientes, eles não entendiam, tinham que mandar até reportagem que tinha caído lá, na cidade inteira. Então, ficamos alguns dias sem energia nenhuma. (Psale1s2)

**[24]** [A ação foi] socorrer pela Bahia, socorrer por Lorena, mas, assim, isso daí impactou muito também nas nossas vendas, até a gente chegou até a perder alguns clientes por conta disso. Porque a gente não tinha material na data. (Psale1s2)

**[25]** Eu digo pra você a empresa tem se preocupado sempre em fazer reuniões periódicas para discutir os principais problemas, tá? E a partir disso fazer um planejamento de ações para atacar esses problemas, e fazer o acompanhamento das ações periodicamente. Mas o que acontece, a gente é uma empresa bastante enxuta e muitas vezes a rotina se sobrepõe a estes assuntos estratégicos. Porque assim, ninguém nega a importância da estratégia, mas na prática você precisa fazer a coisa rodar. Se você ficar só na estratégia e a coisa não rodar, você para. Você precisa encontrar o equilíbrio entre o operacional e o estratégico. Mas na bola dividida, o operacional sempre acaba ganhando maior importância. Existe sim, uma grande atenção no sentido de diagnosticar os principais problemas, as principais dificuldades, os principais vícios e para que eles sejam tratados através de determinadas ações que são definidas. Inclusive temos ajuda de algumas consultorias externas, etc e tal. Mas é sempre um desafio. (Mmint1s1)

**[26]** Eu acho que uma das coisas principais que eu vejo é comprometimento das pessoas. Comprometimento na forma que cada um fazendo o seu serviço, mas principalmente olhando aonde impacta o que está fazendo. O que você pode fazer para que o outro também tenha sucesso. Colaboração. Eu acho que se cada um fizer sua parte bem feita, mas olhando onde o seu trabalho impacta no outro, o que você pode melhorar, acho que pode fluir muito mais fácil. (Msac1s2)

**[27]** Na verdade é o seguinte, aquilo que eu te falei, existe ainda uma questão que é muito fortemente baseada na diferença de porte das empresas. [...] Existem situações em que o porte do cliente acaba interferindo na pequena preocupação com relação aos fornecedores, que acaba interferindo na cadeia como um todo. [...] Então no final das contas, existe uma pequena preocupação com a eficiência da cadeia, de determinados players da cadeia que são muito grandes. (Mmint1s1)

**[28]** Às vezes o planejamento até existe, mas é um planejamento falho, que gera uma série de emergência que poderiam ser evitadas se o planejamento fosse mais bem feito. Então a minha sugestão é que se pensasse mais nisso. A minha sensação é que se pensa pouco a esse respeito, pelo menos no nosso segmento. (Mmint1s1)

**[29]** Acho interessante, inclusive, o desenvolvimento de estudos nesse sentido, porque a gente sofre muito aqui. E estamos no nordeste e grande parte do nosso mercado fornecedor esta no sudeste, então a gente sofre muito com as questões logísticas. [...] Nós tínhamos uma unidade em Manaus que não esta operando mais, que ai o pesadelo era muito maior, ah porque o rio subiu, pronto acabou. Então assim, eu acho interessante salientar ir para uma discussão a esse respeito, claro eu estou falando muito da parte de logística, mas a cadeia como um todo, precisa ser discutida, para estar a par de um monte de situações que acontecem.

**[30]** Talvez aquela sugestão que eu te disse de aumentar a autonomia, ou ter um comprador com autonomia maior ou mais próximo dos compradores deles lá, talvez alguma coisa nesse sentido pudesse ajudar sim. (Msale1s1)

**[31]** É muito superficial, eu acho. E assim, como a gente sempre tem solução para o problema deles, então meio que larga, relaxa, às vezes, sabe? Eu acho que tinha que ser mais preventivo. O pessoal de Compras tinha que trabalhar mais com o preventivo. E, assim, na questão de resolver problemas... eles, no caso, é só me cobrando, porque alguém está cobrando eles que vai parar a fábrica, entendeu? (Psale1s2)

**[32]** Então, é o que eu te falei: muitos clientes, eles deixam para ver que está faltando filme já em cima da hora, né. E eu acho que tem que ter um estoque mínimo, tem que ter um estoque de segurança, entendeu? Porque mesmo que a gente tenha filme pronto, a gente tem que contar com outras coisas também, que é o transporte, né, e contar que o transporte seja rápido e tudo mais. Então, assim, acho que ajudaria muito ter um estoque de segurança, entendeu? (Psale1s2)

**[33]** Ah sim, veja só. A gente no passado já teve problemas dessa natureza [fornecedores]. Então hoje, não só hoje como já algum tempo, a nossa ação é não ter nenhum tipo de exclusividade com algum determinados fornecedores. (Mmint1s1)

**[34]** Quanto melhor a comunicação, mais rápido se resolve o problema, tanto interna, quanta externa. Isso, aquelas barreiras que eu te falei, uma proximidade maior ajuda sim (Msale1s1)

**[35]** Na verdade, todos os nossos clientes internos, a gente tem uma ligação forte. Então a empresa inteira, vamos dizer, trabalha com compras né. É, porque na verdade, todos tem uma necessidade em particular. Então nós somos uma área que a gente atende a empresa no todo. Uma área com maior demanda, outra com menor, mas todas abastece o nosso setor. (Mpurc1)

**[36]** a gente tem um sistema de governança de gestão integrada, que a gente, se gerou uma parada externa a gente tem todo o movimento de, vamos fazer um plano de ação que, vamos rodar um PDCA, causa raiz, Ishikawa, vamos ver o que a gente pode fazer, criar um plano de ação. Plano de ação de uma forma bem formalizada, comunica, envolve os fornecedores, os envolvidos ai, comercial as vezes se deu uma ruptura, fica sem produto, precisa ser envolvido. (Mplan1)

**[37]** [...] a gente depende deles, o estoque deles tem que segurar este desvio de demanda para nos abastecer, senão não tem muito o que fazer. A restrição nossa é justamente isso.

**[38]** Acho interessante, inclusive, o desenvolvimento de estudos nesse sentido, porque a gente sofre muito aqui. E estamos no nordeste e grande parte do nosso mercado fornecedor esta no sudeste, então a gente sofre muito com as questões logísticas. Nesse sentido de problemas de estrada, custo de frete que é altíssimo, principalmente se estiver subindo burocracia em determinados estados, isso tudo faz com que eu seja obrigado a aumentar meu estoque. (Mmint1s1)

**[39]** O meu cliente pode alterar a especificação e isso vai impactar no meu estoque. Basicamente é dinheiro perdido" (Msac1s2).

**[40]** Eu acho que assim, não sei se é barreira ou impacto, mas o impacto a gente trabalha para evitar, quando acontece. A gente tenta trabalhar ou com produtos substitutos, seja ela produto acabado ou insumo, ou comunicação. Acho que esses são fatores críticos (Mpmp1)

**[41]** Não é assim que funciona, então eu tenho um problema de flexibilidade nesse sentido, mas ao mesmo tempo eu descomplico meu processo, porque eu não tenho uma série de matéria prima diferentes" (Mmint1s1).

**[42]** [...] neste caso, a flexibilidade de produto que tem objetivo de simplificar o processo, já está meio embutido, pois o processo de produção é simples.. não é complexo para tal. (Mmint1s1)

**[43]** Incidentes podem acontecer? Podem. Pode pegar fogo? Pode pegar fogo. Mas assim, esse comitê trata disso, desses incidentes que possam acontecer (Mplan1)

**[44]** Então assim, eu enxergo dessa forma, nossa cadeia de suprimentos voltado a compras (Procurement), eu entendo assim. Essa é a principal estratégia para mitigar qualquer coisa.

**[45]** Essa composição de tudo isso me garante que eu mitigaria minhas rupturas, é mais ou menos por ai que a gente enxerga ter uma cadeia, um processo de compras que consiga dar uma resiliência para a cadeia de suprimentos (Mplan1)

**[46]** E a gente tem o corpo técnico também, que até a BEV-S2 disponibiliza para os clientes gratuitamente. [...] Então, a gente tem mais ou menos, assim, 10 técnicos e cada um numa região para ficar mais próximo do cliente possível, né, porque daí a gente já liga e ele já vai na mesma hora no cliente (Msac1s2)

**[47]** ("Então, eu acho que tem sim [estes procedimentos de avaliação e identificação de riscos], mas eu não sei te dizer como é feito")

**[48]** Tampa, por exemplo, é um caso. Essa situação, a gente tinha 70% de tampa na mão de um fornecedor, a gente devagarzinho começou a diminuir essa participação, por quê? Porque assim você fica com todos os ovos na mesma cesta, o risco potencial é maior. (Mplan1)

**[49]** A gente no passado já teve problemas dessa natureza, então hoje, não só hoje como já algum tempo, a nossa ação é não ter nenhum tipo de exclusividade com determinados fornecedores. [...] Eu jamais deixo um pedido de compra somente com um fornecedor. Vou além com dois fornecedores, a gente trabalha hoje com 3 ou 4 fornecedores. [...] Aumento de estoque é a solução pouco desejada, mas indispensável para evitar esse tipo de problema quando a gente tem poucos fornecedores, poucas alternativas de fornecimento, tá? (Mmint1s1)

**[50]** Então assim, dentro do país hoje a gente tem apenas um fornecedor, e também a gente faz o processo de importação de resina com alguns fabricantes Asiáticos e com fabricante que fica na Argentina também (Mmint1s1)

**[51]** o que acontece? cada fabricante tem a sua resina, e os nossos principais clientes, que são os mais exigentes, eles dizem olha: Eu aceito preformas com resinas dos tipos, X, Y e Z, do fabricante A, B e C. (Mmint1s1)

**[52]** [...] a ruptura é uma coisa que a gente mitiga através dessa parceria

**[53]** Então, tudo que eu faço com o cliente é o comercial. Aí, no caso, eu sou comercial, a gente que faz. Aí, por exemplo, eu tenho contato direto com Compras lá. [...] tento trabalhar da forma mais transparente possível, assim eles confiam em mim, eu vou confiar neles também, entendeu? (Psale1s2)

**[54]** Como a gente tem outras franquias, as vezes a gente pode até fazer empréstimo de outras franquias, como a gente faz aqui.. como as outras franquias fazem.. as vezes não tem uma peça no mercado, eles ligam aqui, a gente vê se tem no estoque e a gente transfere, depois eles nos pagam.. entendeu? Então a gente tem esse qualificador quando a gente tem franquias que trabalham com as mesmas coisas.. então é mais fácil. Então é um facilitador ai que a gente tem. Diferente de algumas empresas que elas são únicas. (Mpurc1)

**[55]** Esse é um problema aqui no Brasil. Então assim, para evitar isso, a gente faz a compra de resina de duas maneiras, através de dois modais. O modal de cabotagem e o modal rodoviário. O modal de cabotagem ele permite um custo mais baixo, só que o tempo de trânsito é muito mais elevado e a gente tem o plano B com o rodoviário, por exemplo. Se a gente tem o problema de atraso do navio, ou o navio cancelou a escala no porto de salvador. A gente consegue em 2 dias trazer a resina de caminhão pra cá. (Mmint1s1)

**[56]** Não, não pode estar ok não. Nunca vai estar ok, acho que a gente tem sempre que buscar constante melhoria porque se está sossegado é porque as coisas não estão boas. Eu vejo que, a gente está sempre tendo reuniões para ver o que pode melhorar, vendo as possíveis sugestões das áreas, o volume das áreas em si, as interfaces umas em outras para que possa sempre estar bem mais lincadas, para que as coisas possam fluir mais fácil, entendeu? (Msac1s2)

## APPENDIX VI: Original codes from the interviews (Case 2)

**[1]** Então a gente age dessa forma, mas o primeiro sinal quem dá é a logística *inbound* e PCM. Eles dizem pra mim assim: olha, estamos com problema de abastecimento neste fornecedor. Ai a gente vai atrás para saber o que tá acontecendo, se é problema... vou lá o fornecedor. (Mpurc2)

**[2]** em casos de grandes rupturas, na verdade, todos os VP's, que são os vice presidentes da área de logística, engenharias, compras..., todos que tiverem um relacionamento com o problema, vão montar um grupo de trabalho [para discutir o problema] (Mpurc2).

**[3]** todos aqui, tanto o planejamento que a coordenadora seria Mppc2, a captação ou o recebimento que seria Minlog2 e o transportes, a gente tem o mesmo objetivo que é justamente evitar esta ruptura.

**[4]** A KAPPL-FC, em geral, se preocupa muito com isso e investe muito dinheiro nisso, com segurança, com treinamento, com um monte de coisa. Mas sinistros são passíveis de acontecer, mesmo você tomando todos os cuidados.

**[5]** [...] você tem um monte de variáveis que pode influenciar num "*go* ou não *go*" de uma ordem de fabricação. Por exemplo, ahhh uma quebra de uma máquina interna, um lote recebido rejeitado. Então a resiliência, ela não é só proveniente da ruptura da cadeia, mas de outros fatores que podem contribuir" (Minlog2).

**[6]** Nós tivemos um fornecedor que fornece um determinado item para a linha do produto X, que é fundamental e usa em todos eles. E de repente, a gente viu com algumas rupturas, um problema. Quando a gente foi avaliar este fornecedor, a gente fez a avaliação financeira, e viu-se que este fornecedor estava afundado. Por exemplo, com problemas financeiros seriíssimos, com problemas administrativos seriíssimos, e nós tivemos várias ações para conter. Hoje ele já tá melhor, mas ainda sob análise, né. A gente sabe que ele é um doente que ainda não está totalmente curado. (Mpurc2)

**[7]** A gente está fazendo um acompanhamento dele, principalmente na parte de programação (porque não tinha pessoas que programava a fábrica dele de acordo), então a gente deixou pessoas alocadas durante o dia todo por vários dias, dentro da fábrica desse fornecedor para que pudesse fazer a administração de estoque, a administração da produção para este fornecedor, porque ele começou a perder pessoas. Então ele começou a ficar em uma situação financeira ruim, onde as pessoas, principalmente do campo administrativo começaram a abandonar... A parte administrativa a gente resolveu dessa forma, colocando pessoas nossas que pudesse controlar e dizer para ele, olha essa matéria prima vai acabar, você vai precisar comprar porque o lead time dela é 10 dias e só tem 11... Dai nós tivemos que agir também no intuito de comprar matéria-prima para ele fazer a industrialização, porque ele tava sem crédito no mercado. Começou então a prestar o serviço de transformar aquela matéria-prima, mas deixou de comprar. E acompanhamentos que a gente fez na parte financeira, o que ele tava fazendo. Isso daí fez com que sanasse o problema entre aspas. Paralelo a isso, nós começamos um trabalho de desenvolvimento de outros fornecedores; só tínhamos ele daquele item. E a estratégia da commodity vai ser, pelo menos... não cortar este fornecedor porque a gente acredita q ele pode se recuperar. Mas nós não podemos mais ficar 100% dependendo dele. Então a gente já está desenvolvendo outros nacionais e internacionais que substituam e deixa a gente amparado em um caso de ruptura né. A gente já teve outros casos assim também. (Mpurc2)

**[8]** Recentemente num fornecedor que fica em Minas Gerais nós tivemos problemas, não exatamente no fornecedor, mas no sub-fornecedor. O fornecedor dele que estava em uma região que foi afetada pelas enchentes. (Mpurc2)

**[9]** ...ocasionou, talvez não a ruptura, porque nós tínhamos estratégias de... tínhamos itens similares importados que a gente acabou tendo que fazer algumas movimentações que não afetasse a nossa produção, mas foi uma enchente que aconteceu lá e acabou prejudicando. (Mpurc2)

**[10]** Nós também tivemos um problema de incêndio em um dos nossos depósitos em [outra localidade] que complicou um pouquinho o atendimento dos nossos clientes. E durou acho que uns 2 meses, mais ou menos, para este problema ser resolvido. É lógico que tem coisa que você não recupera - Demanda não atendida é demanda perdida, né. (Mpurc2)

**[11]** Bom, primeiro foi que a gente saiu do depósito e fomos alugar um outro depósito, né. As ações foram tentar... ali, por exemplo, tinha não só produtos como componentes de refrigeração, que foi o que complicou um pouco mais. Porque produto, você perdeu o produto, você perdeu.. você vai ter que fazer

outro. Só que a gente tinha componentes que pertenciam a outros produtos que ficavam estocados lá. Ações foram: importação imediata de alguns componentes para tentar atender os nossos clientes o mais rápido possível. Teve ações que demorou 10-15 dias e a gente conseguiu colocar os produtos de volta. E algumas ações foram mais demoradas para alguns produtos, para alguns equipamentos estragados. Mas você vê ai bastante coisa e bastante dinheiro que dependemos em função disso, mas tínhamos que atender os clientes.

**[12]** ...o comportamento do consumidor, isso é uma sazonalidade desconhecida. Isso faz com que a gente também tenha variações de mix de produtos muito rapidamente... mas é um ano atípico né, que na verdade ninguém sabe o quanto a copa do mundo vai influenciar nos volumes né, o quanto que as eleições vão influenciar no volume. Então é um ano difícil, de surpresas. (Mpurc2)

**[13]** A gente procura, de repente, estar no fornecedor, deixar ele preparado para um pico. Por exemplo, falar: olha, vc precisa estar preparado para este pico que pode acontecer. E pode acontecer a qualquer momento. (Mpurc2)

**[14]** Aconteceu que Minas veio a falar: quebrou o moinho e nós não vamos ter cimento durante quinze dias. (Hcomp2s1)

**[15]** Então o estoque que eu tinha aqui deu para suprir esses quinze dias. E a gente se virou com o segundo fornecedor e pronto. (Hcomp2s1)

**[16]** acidente, por exemplo, a pouco tempo teve uma carreta que se acidentou. Na verdade, não foi com ela o acidente. Houve um acidente na pista, atrapalhou o trânsito e a carreta chegou atrasada. (Mlog2)

**[17]** então, nesse caso específico, assim... como nós temos as janelas, e dentro das janelas a gente já sabe quais são os itens que chegam. Então, ah teve um acidente e o item que está nesta carreta vai atrasar. Então a gente já dispara esta informação e existe a possibilidade de uma inversão né, de uma alteração de sequência de produção. Tá, isso a gente consegue fazer. (Mlog2)

**[18]** Por exemplo, a gente tem um problema muito sério hoje na cadeia: a cadeia, a informação tem que estar clara, tem que ser clara para todo mundo. Se ela fluir bem, ela vai para todo mundo e não tem porque você ter problema. Eu não posso estar escondendo, ahn, do cara, o que eu vou fazer daqui três meses. Ele tem que ver, eu tenho que chamar ele, eu tenho que falar qual que é a estratégia da empresa: Olha, nós vamos ganhar *market* share. Para o cara estar preparado para crescer conosco, a informação tem que ser clara (Mppc2)

**[19]** Acho que o maior problema é não ter uma informação boa. Eu acho que, a maioria das vezes, as tomadas de decisões são feitas com informações úteis. Então, é buscar sistemas que facilitem e melhorem as informações. A informação, quanto melhor, quanto mais apurada, e no momento certo... porque não adianta eu ter uma informação no momento errado, eu vou tomar todas as decisões erradas. Então eu acho que trabalhar informação é uma das coisas mais importantes. Informação de uma maneira geral né. Se eu tirar uma boa demanda de um fornecedor, se eu tiver uma troca de dados adequados, estoque... eu vou melhorar meu suprimentos. Eu vou reduzir o risco né. Se eu tiver os meus fornecedores de transporte bem próximo, trabalhando junto, ia melhorar muito isso. Então, de uma maneira geral, eu acho que a informação é precisamente importante para que tenha uma relação duradoura com os fornecedores, e para que a gente possa também evitar riscos de rupturas. [...] Para que eu tenha uma melhor resposta, para isso eu preciso investir em sistemas. Porque senão, de novo, como eu não tenho um sistema bom, eu vou investir em estoque segurança, etc.. tal tal tal para compensar o risco da resiliência (Minlog2)

**[20]** [...] Quando a gente fala em melhorar a informação, não necessariamente tem que investir em tecnologia somente. Mas é mudar, simplificar o processo, os procedimentos de executar as tarefas. (Minlog2)

**[21]** Eu tenho que, hoje, eu posso fornecer ganhos com o que eu tenho, mas eu ainda tenho muito, muito fundo de quintal. Eu cheguei a apresentar VMI para um cara, e eu pergunto para ele assim: Qual que é teu sistema? Qual que é seu ERP? Tem que ter! Tem uma fábrica de vidro já falou para mim: eu não tenho ERP. É uma planilha excel. Então, eu acho que tem muita frente ainda, falta mesmo qualidade de informação nessas interfaces com o fornecedor. E hoje em dia, a velocidade que a gente quer, o custo que a gente quer e tudo essas coisas... rápidas, não dá tempo. Se você for ainda pensar em planilha de *excel*, não dá... então, essa inovação, tem muita gente lá trás. Então, eu acho que, assim, essa parte também de inovação do fornecedor. (Mppc2)

**[22]** Os grandes problemas que a gente tem hoje nos fornecedores também é essa mudança de mix né, mas quem não quer colocar aquele produto na linha? ah eu vou entregar só isso daqui hoje, outro dia eu vou entregar só aquele outro... quer dizer, essa dinâmica ele tem q ter de qualquer forma, parte tudo do

planejamento. Nós temos um mix, uma mudança de planejamento que nós sempre repassamos para os nosso fornecedores

**[23]** A sugestão que assim, a única coisa que eu percebo que acontece e dificulta um pouco é que tem muita troca de pessoal lá dentro da KAPPL-FC. Então, às vezes, você negocia com uma pessoa, passa dois, três meses, a hora que você vai tentar resolver aquele problema ou continuar a solução daquele problema, aquela pessoa já está em outra função, é outro que está responsável, então até chegar naquele ponto de novo, é um desgaste. Então, é essa troca de funções lá dentro que eu acho que complica um pouco. (Hcomp2s1)

**[24]** interno, externo, todo conhecimento que tiver (Mppc2)

**[25]** Não, não tem isso. É mais a rotina do dia a dia (Mtransp2).

**[26]** Conhecimento adquirido é importantíssimo. Por isso que às vezes a KAPPL-FC tem pessoas estratégicas e normalmente os departamentos são formados de pessoas jovens, com dinamismo, com garra, e também os velhinhos aqui né (risos) que tem conhecimento, experiência, né (Mpurc2).

**[27]** Por exemplo, a equipe do Mppc2 tem um item critico, por algum momento, por algum motivo, um item ficou crítico. Então essa informação tem que chegar rápido para a gente, para a gente ter um poder de resposta mais rápido. [...] Tanto para ela que chega para mim, quanto de mim, para a equipe do Minlog2 que faz o recebimento. Então esta informação é fundamental. (Mtransp2)

**[28]** A comunicação interna ajuda e ajuda muito. Aqui, como eu te falei, é uma empresa pequena. Então, a gente tem contato diretamente com a produção, com a qualidade, com planejamento, com tudo, tá? Está todo mundo junto. Então esse contato é contínuo. (Hcomp2s1)

**[29]** Eu tenho, bom, a garantia de fornecimento se dá de várias maneiras, mas eu me garanto aqui, no dia de hoje, você vai falar assim que manter estoque é um negócio errado né. Todo mundo trabalha aí no Just In Time. Eu aqui me garanto mantendo um estoque de produção de pelo menos um mês. Peça produzida e matéria-prima. Existem algumas matérias-primas que não precisam de um mês, mas é matéria-prima que eu tenho segurança que eu tenho ela. Mas, do contrário, a minha garantia é essa. (Hcomp2s1)

**[30]** O alumínio estava em crise, estava difícil achar alumínio no mercado. Enfim, foi que quando ele possui o estoque dele, eu estou lá, [o concorrente X] está lá, [o concorrente Y] está lá, está todo mundo lá. Então, quem autorizar mais puxada, vai ficar. Eu não vou chegar para esse fornecedor e falar: oh, só me entrega o que preciso hoje. Não! pode fazer 10 mil que eu puxo. Aí é da estratégia. (Mppc2)

**[31]** Com estes operadores, eles serão responsáveis pelos estoques deles. Não é um estoque da KAPPL-FC, é um estoque do fornecedor. Então isso é um dos projetos que eu diria que ajuda, que resolve muito este problema de resiliência. (Minlog2)

**[32]** Existe alguns fornecedores, por exemplo, eu tenho um em... em Araras, fornecedor e esse cara, ele não precisa ocupar o meu hub aqui com operador logístico, porque ele está muito perto do hub. Então, ele, dentro da fábrica dele, ele vai arrumar um local e vai disponibilizar nossos itens. E nós vamos determinar o estoque. (Mppc2)

**[33]** Num dá para viver sem [tecnologia] né. Então tecnologia é fundamental para a gente. A gente tem hoje todo o nosso warehouse que é controlado de um produto, de um WMS (warehouse management system), onde você tem as leituras em real time, os movimento em real time, né.. a gente tem algumas evoluções, alguns up grades para serem feitos no produto que vai nos conferir um pouco mais de confiabilidade.. de ponto a ponto do material dentro de casa. Isso facilita as tomadas de decisões né. (Minlog2)

**[34]** A KAPPL-FC é muito complicada. Esse é um trabalho que a gente está vendo, reclamando. A engenharia, ela não padroniza. Por exemplo, se você pegar a base de isopor, cada SKU aqui tem uma base. Pelo amor de Deus, faz uma base só para todas elas. Então, a KAPPL-FC tem esse problema muito sério. Cada uma tem seu parafuso, cada um tem isso. A gente perde muito. Então, eu acho que a padronização dos itens, que é uma coisa que reduz estoque, reduz trabalho, reduz risco. (Mppc2)

**[35]** É, no caso da KAPPL-FC, não tem como, porque aquilo ali é bem específico e não pode fugir do padrão. Então não tem como outros produtos que eu forneço servirem. (Hcomp2s1)

**[36]** É, internamente a empresa se vê obrigada a ter planos de contingência, né. Isso a gente tem que ter. A gente tem que pensar em mitigar. [...] Se acontecer isso.. o que você faz? se acontecer aquilo, o que você faz? tem que ter uma estratégia. Porque senão, quando a gente fala de rupturas de fornecimentos, muitas vezes a gente pode falar de horas, mas riscos significa meses, anos muitas vezes. (Minlog2)

**[37]** a identificação de riscos é feita primeiro pela Logística (Mppc2)

**[38]** A KAPPL-FC já passou por várias fases, e eu já vivi várias destas. Teve uma fase que a KAPPL-FC viveu que seria, por exemplo, como empresa global, vinha lá da Suécia o pensamento dizendo o seguinte, que é muito melhor você ter poucos fornecedores, onde você consolida os volumes e você consegue um custo melhor. Você consolidou o volume, teoricamente eu compro 10 eu vou ter um preço e se compro 20 eu vou ter outro preço. Mas aqui é Brasil, é um pouco complicado. Então, dai ainda bem que a empresa percebeu um pouco isso depois né, e ela acha que, por exemplo, você tem que ter pelo menos 3 fornecedores homologados - 2 fornecendo e um como backup, *standy by*. (Mpurc2)

**[39]** Então, paralelo a isso, a gente começou um trabalho de desenvolvimento de fornecedores, porque o desenvolvimento de item é bastante complexo, envolve construção de ferramentas, dispositivos e a aprovação também é bastante rigorosa da KAPPL-FC. (Mpurc2)

**[40]** O primeiro ponto para que ele forneça, tem que ser competitivo. A gente vive em um mundo competitivo, então o fornecedor é competitivo, ai nós vamos tomar providências para que ele seja um fornecedor KAPPL-FC. [...] Compras é o canal de entrada do fornecedor dentro da empresa. Nenhum fornecedor começa a fornecer sem passar por compras. Eu acho que compras é o principal responsável por avaliação. (Mpurc2)

**[41]** Existem vários trabalhos. Existem o workshop dos fornecedores, onde você traz ele aqui, mostra o que você tem de sistema, mostra a forma de trabalhar, o que a gente tá fazendo.. os fornecedores geralmente demandam informações de longo prazo que eles querem entender qual a participação deles dentro do negócio, porque também eles dependem de investimento né. Isso quanto mais próximo, mais aberto, melhor esta relação.. acho muito mais duradouro. (Minlog2)

**[42]** A gente está muito bem entrosado, não existe aí, olha, está aqui, se vire etc e tal. A gente é muito bom, muito bem entrosado. (Psale2s2)

**[43]** A gente procura fornecedores na região, principalmente se for itens que demandam um espaço. Você imagina o tanque e cesto da lavadora para lavar as peças básicas.. é mais ou menos isto aqui.. transporta ar. Se você pegar um fornecedor de sp, você paga 5 reais por produto a mais só de frete e custa 2000 reais um frete de lá para cá, e carrega 400 peças. Quer dizer, este fator, por exemplo, aqui influencia muito. Então enquanto tiver aqui, esse é o cara que vai ser importante né. Então a gente busca estes fornecedores, mas tem fornecedores .. internacional.. na china, na Índia, na França, na Itália... a gente tem fornecedores espalhados no mundo inteiro, até porque tem fornecedores q são globais, q fornecem para todas as plantas (Mpurc2)

**[44]** olha, muito raramente você pode ter um aéreo, sim. A gente lança muito pouco aéreo, porque é muito caro!

**[45]** esse transporte é por navio, é marítimo. Então talvez a flexibilidade para agilizar é um frete aéreo que é raríssimo.

## APPENDIX VII: Original codes from the interviews (Case 3)

**[1]** Compras não é uma área sozinha. Para a gente colocar um fornecedor como contingência, por exemplo, a gente precisa ter esse fornecedor aprovado. Então, a área técnica é uma que tem que trabalhar junto com a gente e... ou seja, o negócio, a unidade negócio em si tem que ser um ponto de apoio para a gente tomar uma decisão de ter uma contingência com A ou B. (Bmet3)

**[2]** Eventualmente, nós temos problema de praga, mas a praga, você consegue combatê-la, ela não te dá quebra de safra tão ruim quanto à falta de água, né. (Msales3s2)

**[3]** No meu caso, o principal motivo de ruptura que acontece é devido a um fator que, muitas vezes, a gente não consegue prever, que é o fator climático, e agora a situação está fora do nosso controle (Bnut3).

**[4]** O principal ponto é no final do ano. No final do ano, os fornecedores entram de férias coletivas. Porque ano passado, a gente teve um problema que os cafés foram rejeitados. O fornecedor estava de férias, não tinha como puxar café de um outro fornecedor. E aí teve um problema na produção da fábrica. As ações tomadas, eu não sei. Porque eu não estava aqui, mas pelo histórico não existiu ação. Realmente, teve prejuízo. Aí tem que arcar... arcar com as consequências (Bcof3)

**[5]** Então, a gente tem que de alguma forma alinhar os dias de estoque da matéria prima juntamente com a necessidade do café virgem chegar na fábrica. Então, a gente conversa com a fábrica, dizendo que o fornecedor, teoricamente, ele vai entrar em férias coletivas, aquele café vai ter que, ao invés de quinze dias de antecedência, vai ter que solicitar... vai ter que ser solicitado com trinta dias. Com trinta dias, para que, se caso aquele café seja rejeitado, a gente tenha tempo hábil para conversar com o fornecedor antes que ele entre de férias. (Bcof3)

**[6]** Em 2008, eu acompanhei uma importação que veio da Nigéria, que foi, para nós, um péssimo exemplo que a gente trouxe em container, deu muito problema de qualidade com esse nuts. Então 2010, a gente começou a perceber que a safra não ia decolar, nós não íamos ter produto, a gente ia deixar 2000 funcionários parados, ia ter quebra de, é, de contratos. (Mproc3s2)

**[7]** Então, percebendo isso em março, eu já estava dentro da área...Já tinha feito o trabalho anterior, a gente começou em novembro e em dezembro a gente já começou, nós começamos a trabalhar e fizemos uma pressão política para que saíssem as instruções normativas autorizando as importações. Quando foi em março, eu já estava dentro da África já, fazendo essa compra, tá certo? Por que? Porque, a partir de março, você tem o período de entre safra, você vai até agosto, e aí? Você ficaria março, abril, maio, junho, julho, agosto, parado esperando a próxima safra? Não dava. Como a gente já sabia que não ia, nós não íamos ter estoque de passagem, né, em 2011, em 2010, nós já começamos a trabalhar com o governo para a questão de liberação das importações. A gente tinha uma janela que era a Nigéria e que estava fechada e a gente precisava das outras janelas. (Mproc3s2)

**[8]** Ano passado.... a gente tem um outro fornecedor de alumínio que é a "CBA", uma produtora de metais. E, no ano passado, eles tiveram uma greve e a greve fechou a fábrica. E eles tem uma planta de produzir no Brasil e a gente tem uma fábrica que consome esse alumínio. Todo o resto do alumínio que a gente consome, vem da Alemanha. Mas a gente tem uma única tampa que a gente faz com esse alumínio deles e a fábrica ficou parada duas semanas. E a gente tem um estoque de basicamente uma semana. Com eles e com a nossa tampa que a gente fornece para Ituiutaba, mas não tinha alumínio, não tinha como sair um caminhão da fábrica, o portão fechado e aí foi, foi simplesmente, assim, no limite de uma semana, no dia que abriu a fábrica, o caminhão nosso estava lá esperando para retirar. E a gente quase parou aí por duas semanas por causa disso. (Bmet3)

**[9]** Mas a ação imediata nesse caso, não é nem imediata, porque ela não é a curto prazo. Mas ela serviu para reforçar uma ação que a gente já vem tentando tomar há um tempo e que, agora, ela foi reforçada pelas necessidades que é substituir a tampa. Hoje, a gente trabalha [neste produto] com uma tampa é aquela que você usa a faca para abrir, para cortar o alumínio de dentro. [Esta tampa existe] há 40 anos. As outras todas que você tem é o alumínio que você puxa. Para substituir a tampa do alumínio que você puxa pela tampa da faquinha tem investimento, tem tudo isso. Por outro lado, se a gente substitui, a gente tem quem faz a tampa no mercado, a gente tem mais fornecedores de alumínio, o próprio aço, a gente recupera o investimento muito rápido. Então, na verdade, esse, esse acontecimento, e toda essa, isso que aconteceu serviu para reforçar um projeto que a gente tem de substituir essa tampa, que começou andar mais rápido. (Bmet3)

**[10]** Então, para uma safra acontecer bem, a gente precisa de: a chuva no momento correto, o calor no momento correto, é, não pode ter nenhuma, nenhuma praga, se tiver praga isso afeta; e isso são coisas que, por mais que existam estudos que avaliem: ai como é que vai estar o tempo, ah, vai chover não vai chover, esse ano a tendência é que seja um momento mais seco ou não. É o quanto isso realmente vai repercutir em quantidade e isso em preço... Mas a gente tem um problema agora que a gente está enfrentando com polpa de pêssego. Tiveram algumas geadas em setembro, em outubro, no Chile, e quebrou a safra do pêssego e eu estou vindo falar isso para os meus clientes desde setembro: vai quebrar, vocês vão ficar sem, vamos trazer amostras de outros países. Agora, em fevereiro, teve gente que começou a se mexer, entendeu? (Bnut3)

**[11]** Então, até o IBGE e a própria Conab, eles acompanham a evolução de vários produtos agrícolas, inclusive a castanha, e aí em novembro, assim como nós, o próprio IBGE também previa uma safra de 200 a 250 mil toneladas no Brasil esse ano. E aí no final, onde a coisa tinha que acontecer, tivemos problemas de estiagem ou chuva fora de época. É, e trouxe essa nossa expectativa de safra para 136 mil toneladas, ou seja, tivemos uma redução aí de quase 50% de um mês para o outro a expectativa de colheita. Em 2011, a safra foi um desastre total. E aí várias fábricas foram fechadas, muita mão de obra demitida. (Msales3s2)

**[12]** É conversando com os fornecedores para antecipar e aí ir falando para o negócio. Olha, a gente tem tendência a ter aumento de preço, existe risco de volume, vamos desenvolver outro fornecedor, sim ou não. E talvez seja até necessário homologar mais um fornecedor, porque pode ser que não tenha volume disponível. Então, a forma como hoje a gente interage a esse, a essa, a isso é justamente isso, sempre antecipando, conversando com a cadeia que, no nosso caso, são os fornecedores. Eu não lido direto com o produtor. (Bnut3)

**[13]** Porque, geralmente, a gente fala 2010/2011? 2010, se você pegar os dados de importação de café, nós tivemos que, que puxar essa castanha da África Ocidental, a gente importou de Gana, Costa do Marfim, Guiné Bissau. Nós tivemos que puxar, porque, senão, nós teríamos entrado em colapso total. (Mproc3s2)

**[14]** Um ponto que a gente surgiu recentemente foi com as enchentes do Espírito Santo que dificultou bastante pra gente o transporte. Foi um caso pontual que fez com que, teoricamente, afetasse a nossa cadeia. E aí entra um pouco nesse caso do que fazer. (Bcof3)

**[15]** O que fazer para poder suprir essa possível perda, que, nesse caso, que... um dos pontos que a gente acordou com a fábrica...a gente teve que, teoricamente, prorrogar... é, não prorrogar, mas avisá-los, alertá-los: olha, a gente pode ter problema e pode ser que atrase um ou dois dias. A chegada do café, porque ele vai ter que fazer uma outra mudança de rota e, além disso também, a gente alinhou com a qualidade da fábrica: qualquer café que chegasse não fora dos padrões, mas um pouquinho fora, eles... é, olhariam com outros olhos, lógico que... que não prejudicasse... A qualidade, mas eles... mas não precisasse ser tão a fundo na...Nos critérios, porque qualquer problema, a gente poderia ter... realmente qualquer problema de rejeição, aí sim a gente ia ter bastante problema para a reposição desse café. A gente fez esse... essa união emergencial tanto com a programação quanto com a qualidade, para chegar num acordo que fosse bom devido ao problema que a gente estava tendo de... de transporte lá do Espírito Santo devido às chuvas que ocorreram em dezembro. (Bcof3)

**[16]** Em 2012, é, uma parte da nossa equipe foi para a Costa do Marfim e lá teve um golpe de Estado. É, e aí todos os portos foram fechados, é, as milícias tomaram conta, o pessoal nosso via gente andando com ara para lá e para cá nas ruas, isso fez com que os portos ficassem fechados por um tempo e atrapalhou um pouco o nosso planejamento de recebimento, né. (Msales3s2)

**[17]** A África tem problemas climáticos assim como nós e a África tem outros problemas como guerras civis, então, é, é, eu lembro que acho que foi o fim de 2012, a gente estava com tudo certinho para importar e aí estourou a guerra da Costa do Marfim e aí a gente ficou sem conseguir, 25 dias se conseguir embarcar um navio, porque tinha estourado a guerra civil da Costa do Marfim. Mais uma delas, das muitas que a Costa do Marfim tem. (Mproc3s2)

**[18]** tem coisas que você não tem o que fazer, você tem que esperar a guerrilha liberar o porto. Não teve grande impacto, porque a gente tinha um pouco de estoque, enfim, no caso da FOOD-FC não, mas atrasa para a gente, atrasa a produção, né, atrasa com certeza ali no dia a dia da fábrica impacta. Nos negócios com a FOOD-FC não, porque a gente nunca trabalha justo. A gente sempre tem um estoque, porque a gente sabe que eles podem precisar de antecipações e tal. (Msales3s1)

**[19]** Então, se fecha algum, se tem algum problema, você escoa por outra fronteira, tá certo? Se tiver um problema em Guiné Bissau, você puxa para o Senegal. Se tiver no Senegal, você puxa para Gâmbia, tá

entendendo? Então, você tem ali a questão de lugar que te favorece quanto a isso, todos eles têm bons pontos, então dá para você escoar essa produção. (Mproc3s2)

**[20]** ...todas as áreas, elas olham para o seu fim, né? Então, para o seu objetivo final, então a fábrica não quer que a fábrica pare, custo precisa que seja o menor custo possível, só que o que as pessoas não entendem, assim, isso é, é, claro que todo mundo caminha para o mesmo fim, mas o problema da crise é que parece que todo mundo continua sempre trabalhando para esse mesmo fim. Só que, na crise, não adianta, esse fim não vai existir, esse mesmo fim não existe. Então talvez, o que talvez eu acredito que seja o que melhoraria é as pessoas entenderem e fazerem um pouco mais de gestão de riscos e como atuar numa gestão de risco. Então, quando eu tenho uma crise, esquece, qual que vai ser a prioridade? É abastecimento ou é custo? Entendeu? É definir isso, porque tudo ao mesmo tempo você não vai conseguir. Então, definir mais essa prioridade. (Bnut3)

**[21]** ...se a gente tivesse uma, uma estrutura, é... uma estrutura de gestão de riscos. Analisando, vendo as possibilidades, é que nem um projeto, né? Um projeto, você tem lá, todas as fases e uma delas é a análise de riscos, onde você faz um *brainstorming* e tudo o que pode dar de errado. E para tudo o que realmente é factível, depois de um tempo, você coloca um plano de ação. Se a gente tivesse uma área pensando nisso, né? Quais são os riscos, onde que precisa ser feito um plano de ação. É... O que que, qual é o plano para então, qual é o plano de ação, e monitorando esse plano de ação para reduzir e mitigar os riscos. Acho que ajudaria muito. (Blog3)

**[22]** É, eu acho que, assim, eu acho que para melhorar isso é justamente não só, como eu te falei, não é só olhar a base de fornecimento em si, que a gente tem fora da FOOD-FC, dentro da FOOD-FC, a gente também tem opções. Ou seja, itens sendo produzidos no México ou no Chile que podem atender a própria FOOD-FC e começar a explorar mais isso. Explorar o que a gente tem dentro para depois a gente ver o que a gente tem fora como necessidade, mas a gente tem que olhar ainda muito dentro, é... , as opções que a gente tem... Para usar isso melhor, para usar isso como uma maneira de, não só de custo, mas para trazer benefício para o grupo. (Bmet3)

**[23]** Então eu acho que o que eles fazem como política de compra de comprar um bid anual e não ficar comprando mensal ou bimestral, não sei, ajuda, esse, essa forma de compra deles ajuda as indústrias a se programarem com antecedência para que não haja problemas de estrutura, problemas de variação de preço, enfim. Então, com essa política deles anual, a gente consegue, digamos assim, deixar mais flat a nossa operação, né. Até porque o volume que a FOOD-FC consome é muito alto. (Msales3s2)

**[24]** Então, teria que ter todas as indústrias, ter um grupo técnico: seja do corpo, seja funcionário direto ou terceirizado para que a gente tivesse essa junção e aí, nesse núcleo, qual que seria o núcleo? Seria a Embrapa? Seria a Fundação Cearense de Meteorologia? Seria a IBBA? Seria o núcleo? Seria a parte científica para dizer: olha, as ferramentas que vocês vão usar são essas, tá certo? E chegando a essas informações, nós vamos tratar esses dados e repassar para vocês no panorama de como pode acontecer isso... Dessa teia de informação, trabalhando o que é realmente, o que a gente realmente precisa... tem que ser criada uma teia para, justamente, mitigar essa questão dos riscos na nossa cadeia. (Mproc3s2)

**[25]** Se o Brasil tivesse mais, por exemplo, igual o açúcar. Açúcar, a gente tem a Única, que é um órgão que acompanha os produtores. Então, se a gente tivesse mais órgãos, mais cooperativas, talvez fosse mais fácil de uma grande indústria entrar em contato com um ou dois produtores. (Bnut3)

**[26]** É, eu acho que, assim, é, tem sido muito difícil para a indústria do caju, por conta das suscetíveis quebras de safra, né? Então, como eu te falei, em média uma em cada quatro anos, só que a gente já vem aí no terceiro, quarto ano seguido. Então, se continuar por muito tempo, esse problema com safra, é, esse é um problema grave, seria um problema grave, porque o mercado não vai assimilar importação, não vai assimilar o preço, devido à importação de África, né, nem e nem nós temos também bala na agulha para fazer essa operação durante a vida inteira. A não ser que nós montemos lá uma fábrica de beneficiamento na África, né, o que também tem que se olhar com muita cautela, porque, às vezes, você está tudo bem, no outro dia estourou uma guerra civil, o presidente é deposto, tem golpe militar... enfim. (Msales3s2)

**[27]** Não, eu acho que tem que fazer um trabalho de campo e aí é um trabalho conjunto da indústria com o produtor, tá? Tem que melhorar a parte agrícola, no caso específico de castanha de caju, tá? Por outro lado, tem que ter um ponto de equilíbrio melhor de preço, tá? Ou seja, quando tem muita castanha, o produtor não pode receber pouco. (Bnut3)

**[28]** Então, eu acho que, se o governo do Estado intervisse, é, incentivando o pequeno produtor, como ele deve fazer a poda do cajueiro, o coroamento, ou mesmo, é, distribuindo mudas de cajueiro anão, que é um cajueiro de mais fácil cultivo (Msales3s2)

**[29]** Olha, todas as rupturas frequentes que a gente encontrou, a gente tem desenhado planos e tem resolvido elas rapidamente. (Blog3).

**[30]** O conhecimento adquirido, não necessariamente interno, tá? Então, assim, se eu já trabalhei em outros casos de ruptura de abastecimento em outras, em outras empresas. Porque, muitas vezes, você segue uma conduta que é a que a empresa está acostumada pela cultura. Só que, no momento de crise, se você tem alguma outra experiência externa de alguma cultura diferente, talvez você tenha uma visão diferente de como lidar com aquilo. Então, conhecimento adquirido: sim, faz diferença. (Bnut3)

**[31]** No momento de crise o que precisa é conversa. Então, união presencial; no momento de crise, comunicação tem que fluir. Interna e externa".

**[32]** É que, assim, por mais que você tome alguma ação, se você não souber o quanto, quando, o que impacta, se as pessoas estão dispostas a ceder ou não, você não consegue seguir. Então, eu vejo hoje primordial a comunicação. (Bnut3)

**[33]** Não, ele tem um *shelf life*, se não me engano, de mais de seis meses. Assim, é claro que um estoque maior, ele não faz com que a sua crise desapareça. Ele te dá um tempo maior, mas dependendo do tamanho da crise, só ele não adianta, entendeu? (Bnut3)

**[34]** Mas acho que, de repente, algumas dessas empresas grandes poderiam trabalhar um pouco nessa prevenção, o que a gente pode fazer? Vamos aprovar um fornecedor novo? Vamos mudar a nossa formulação? Esse ano não temos pêssego, que é o caso que está na minha cabeça agora. Vamos fazer um produto e deixar pronto em outra formulação com damasco, entendeu? Trabalhar nesse sentido...porque tem épocas, Carla, acabou a safra, não tem produto. Zero. E daí não tem como você tirar um néctar de pêssego da tua linha. Em alguns casos, você vai ter que até que tirar, já vi isso. (Msales3s1)

**[35]** Mas a FOOD-S2 também tem um sisteminha lá que eles usam, porque todo o pedido que eu fecho daqui, eu jogo no sistema já lá para cair em Fortaleza, entendeu? (Msales3s1)

**[36]** Então, na verdade, assim, é igual eu estava te falando, então previsão do tempo, é, se a gente tiver algum instituto que nos assessorasse talvez isso poderia facilitar. Não sei, mas acredito que sim, dá para fazer diferença. (Bnut3)

**[37]** E, nesse caso, todos os indicadores, se você quiser entrar no site da CONAB, do IBGE, os indicadores diziam que a safra vinha bem. Tem uma publicação inglesa também que fala da safra de castanha no Brasil, que é o *Food News*, tudo vinha falando que vinha bem. (Msales3s1)

**[38]** Sim, a gente, a gente fez um trabalho no ano passado em 2013 de materiais chave que a gente tem risco. Por exemplo, papelão, a gente tem seis, sete, oito fornecedores aprovados, então, se a gente tiver um risco com esse material numa fábrica em Araras, depois um outro fornecedor pode começar a trabalhar nessa mesma linha amanhã, exemplo. Diferente de metal, porque metal também tem um outro lead time, então, se amanhã uma SCN pega fogo aqui, não tem bobina para entregar, ninguém vai me entregar no outro dia, eu vou ter que trazer isso da Alemanha, do Japão, da Coreia ou da China ou da França e isso vai chegar aqui em sete, oito, nove semanas. Então, esses sim são o de risco iminente que a gente tem que ter mais cuidado. (Bmet3)

**[39]** Eu tenho uma pessoa aqui na FOOD-S1, 100% dedicada a estudar mercado para evitar ruptura. A qualquer mudança, a gente tenta detectar isso o mais rápido possível. A gente chama marketing, inteligência comercial... tá.

**[40]** Em relação a esses três ou quatro pedidos específicos, é, que nós tivemos esse problema de atraso, é, eles [FOOD-FC] sentaram, conversaram com a gente e eles sabiam que isso era um problema, mas eles têm outros fornecedores, entendeu? A FOOD-FC, uma empresa grande, jamais, jamais vai comprar um contrato grande de um fornecedor só. Lógico, causou um impacto? Causou. Causou problema? Causou. Eu tenho, eu tenho total consciência do tamanho do problema que a gente causou a eles, mas tinha uma opção de outro fornecedor, que eles conseguiram suprir e não teve ruptura de linha. (Msales3s1)

**[41]** Então, como você se prepara para uma greve de motoristas, uma greve de transportes... sei lá. Você pode trabalhar com várias empresas. Hoje, a nossa estratégia, ela está em permanecer em grandes empresas as quais conseguem garantir um nível de serviços. O que vinha antes com pequenas empresas é que tinha muito facilmente as quebras, né. (Blog3)

**[42]** ...a gente coloca assim, as duas pontas: tem uma questão de custo e tem uma coisa de avaliação técnica dos fornecedores. Uma vez que ele estiver aprovado tecnicamente, a questão de custo, a gente vai bater (Bmet3)

**[43]** O critério de seleção ele passa por algumas etapas. Não só a etapa técnica, uma etapa também financeira e tudo isso para entender se os fornecedores estão aptos ou não a atender a FOOD-FC (Bmet3).

**[44]** Então, o desafio, ele é externo, mas ele também é interno. A gente tem um desafio externo de achar quem faça. É, mas também tem um desafio interno de garantir o apoio para ter esse outro, esse segundo ou terceira opção desenvolvido

**[45]** Temos a empresa XW que consegue absorver um grande volume... tudo o que a gente precisa, só que a gente não deu 100% do volume para ela. Parte a gente colocou na empresa ZZ, que é uma empresa que tem começado, ela não tem toda a estrutura. Aí foi uma auditoria de gerenciamento de risco para entender tudo que a empresa ZZ precisa... investir em maquinário, em estrutura para poder chegar na qualidade da XW. (Blog3)

**[46]** Sim, na verdade, ser auditado pela FOOD-FC, ela passa o manual. Entendeu? Do que você tem que ter na sua fábrica. Esse manual, só ele por si já é um aprendizado. Se você cumprir aquilo, você está pronto para fornecer para a FOOD-FC e para o mercado. (Msales3s1)

**[47]** [O relacionamento com o fornecedor faz] total diferença, porque, se você tem um contato próximo e um contato cordial, muitas vezes eles antecipam isso para a gente. Eu não preciso ir atrás, entendeu? Então, eu já me deparei com alguns fornecedores que me ligam: Olha, a gente está enfrentando um momento de inverno muito rígido, isso deve afetar lá na frente. E eu não precisei nem ligar para o fornecedor. É um fornecedor que eu tenho contato próximo, contato meio que semanal pela grandeza do fornecedor dentro da FOOD-FC. Assim, é conversando com os fornecedores para antecipar e aí ir falando para o negócio. (Bnut3)

**[48]** Sim, sabe por que? Ajuda a evitar ruptura? Sim, porque normalmente o fornecedor sabe antes de ser divulgado na imprensa. Então, muitas vezes, quem avisa o comprador que vai ter problema é o fornecedor. E aliás, deveria ser assim, né? Sempre. (Msales3s1)

**[49]** Forma de transporte depende, mas, assim, pegando a minha categoria, é rodovia, [mas já ouve o caso de utilizar o] aéreo para casos urgentes. Assim, se eu pegar a minha categoria, 70% da minha categoria é rodovia, mas eu tenho alguns itens que são importados e aí a gente tem, trabalha com marítimo. Mas, no caso de produtos nacionais, eu nunca tive que acionar um transporte aéreo. É mais quando é importado e aí deu algum problema e aí a gente faz transporte aéreo. (Bnut3)

**[50]** Então, por exemplo, quando eu estava em Guiné Bissau, na Costa do Marfim, tinha estourado um problema. O presidente não queria entregar ao sucessor o cargo. Então, como ela é uma colônia francesa, a França pressionou, né, mandou lá um grupo, os militares foram lá e tomaram à força e entregaram para o cara que tinha sido eleito. A fronteira ficou fechada com Gana, tá certo? Então, o pessoal que estava em Gana ficou meio que: como é que vai acontecer? Então, se fecha algum, se tem algum problema, você escoa por outra fronteira, tá certo? Se tiver um problema em Guiné Bissau, você puxa para o Senagal. Se tiver no Senegal, você puxa para Gâmbia, tá entendendo? Então, você tem ali a questão de lugar que te favorece quanto a isso, todos eles têm bons pontos, então dá para você escoar essa produção. (Mproc3s2)

## APPENDIX VIII: Original codes from the interviews (Case 4)

**[1]** Agora o meu contato na AGRO-FC é tudo cá comigo, desde a parte de vendas até a parte técnica

**[2]** é.. nós temos interação com todas as áreas, por exemplo, o planejamento de onde a gente recebe a demanda, onde a gente vê o forecast e tudo mais; o financeiro que é toda área de suporte para todos os nossos custos, gastos, expendes, receitas. A área de desenvolvimento, a parte de tecnologia, 100% ligada. Regulatório, tudo que a gente faz passa 100% pelo regulatório, a parte de MAPA, ANVISA e IBAMA, é 100% seguindo regras. (Mproc4)

**[3]** E foi uma coisa interessante, por que quando você justifica a seu cliente que houve um problema, um desastre natural, ele geralmente não parte pra ruptura, ele entende o problema e [busca] ações conjuntas (Psale4s1).

**[4]** ... na maioria dos casos ela [ruptura] pode prejudicar em termos de custo, mais em termo de imagem não, por que os clientes geralmente falam: poxa vida, vocês me trazem o problema, mas também me trazem a solução. (Psale4s1)

**[5]** ...uma das exigências para que seja plantado o milho semente é que o produtor tenha um campo que tenha irrigação. De qualquer forma, se a gente tem um verão como a gente teve aqui no Brasil, muito atípico, com falta de chuva, então este produtor às vezes não vai conseguir uma quantidade apropriada de água para fazer a irrigação, isso consequentemente afeta a qualidade da semente, tanto em germinação quanto em produtividade. Porém se a gente tiver um período de chuva muito próximo da época da colheita, ai isso também é prejudicial porque ele apodrece o grão dentro da espiga. (Mproc4)

**[6]** Então, contra esse intempéries, quando a gente tem falta de chuva, por exemplo, a saída é buscar água ou recursos de água em outro lugar. Quando a gente tem chuva em demasiado, não tem nenhuma ação que a gente possa fazer para impedir isso. (Mproc4)

**[7]** Ano passado (2013) a gente teve um problema grande, com uma matéria prima pra uma herbicida nosso, não seletivo, que é o maior volume nosso de produto... é esse material, eles tiveram, não tinham produto, não tinham como atender. E a gente tinha um volume imenso, ai teve que importar as pressas, e pagou-se um preço alto pra importar as pressas. (Amat4)

**[8]** A gente teve que remanejar algumas produções de alguns meses, mexer nos volumes mensais pra não ter nenhuma ruptura durante a produção. Esse ano a gente quis trabalhar diferente pra não ter o mesmo problema. A gente tem uma reunião de planejamento, onde tem o pessoal de São Paulo, que ta mais ligado a área comercial, da onde vem a demanda, o planejamento aqui da fábrica, nós. E se a gente tiver algum problema aqui de abastecimento de material que a gente não vai atender a produção nesse momento, ou a gente posterga essa produção, a gente faz um alinhamento entre as áreas de planejamento pra analisar essa ruptura e ver o que que a gente pode fazer. (Amat4)

**[9]** A gente teve várias paradas de produção por conta de bombonas de 20 litros. Este é um item muito complexo de trabalhar, porque você tem que ter um alto volume de estoque para atender a produção durante a safra. Você usa ai um milhão de bombonas em um mês, e a produção de bombonas de 20 litros é muito lenta. Então os fornecedores nossos, a gente teve alguns problemas ai durante uns meses e alguns fornecedores não conseguiram atender. Ai a gente teve bastante problemas. Durante o ano de 2012 a gente chegou até a perder algumas vendas, por não ter bombonas mesmo, por não ter como embalar produtos. Então chegava uma demanda de um exemplo de 300 mil litros de um produto, mas a gente podia só 200, 250. (Amat4)

**[10]** Em 2013 a gente trabalhou diferente. Montou um estoque de segurança baseado na necessidade e fez um estudo de quanto a gente teria em estoque para conseguir abastecer o período de safra. Na verdade, foram ações simples para deixar de ter esse problema de falta de matéria prima. (Amat4)

**[11]** ...a gente enfrentou sim, recentemente, alguns problemas de qualidade que deu uma ruptura maior. Foi até com relação a um fornecedor terceiro nosso. Ele não pôde atender a nossa necessidade e ficamos ai devendo material para o fornecedor por volta de 15 a 20 dias. (Mscm4s1)

**[12]** ... conseguimos deslocar um material de um outro cliente que tinha uma quantidade extra no estoque para este outro cliente. E neste meio termo antecipar umas outras ordens de fornecedores. A gente tem alguns fornecedores em background, ai em caso a gente tenha algum problema e posso suprir a nossa necessidade. Foi dessa forma que a gente resolveu o problema. (Mscm4s1)

**[13]** Tivemos um cliente, de household, um cliente também global. Ele planejou, mais ou menos, uma tonelada de corante, quinhentos pro mês de dezembro e quinhentos pro mês de janeiro, porém, houve uma mudança de localização da fábrica que produzia esse tipo de corante. Ela foi transferida pra um outro lugar, e nessa transferência, o estoque que foi feito pra essa empresa tomar todos os pedidos não foi o suficiente. Pedido vamos supor, tinha 10 toneladas de pedido e eles fizeram 8 toneladas. Dai eles priorizaram os clientes né, o pessoal de marketing sento e definiram a tal produto e tal produto (Psale4s1)

**[14]** ...ai tive que entrar em contato com esse meu cliente e fala ó cara, vocês em vez de mil vocês vão receber a metade. E o que aconteceu? essa metade não teria, não definiram, não daria mais pra fazer marítimo. Então que que nós fizemos? "botamo" o aéreo pra entregar em tempo no primeiro faturamento, e o segundo faturamento já dava tempo pra entrar a nova produção. Que que aconteceu? A nova produção não entrou. Então nós tivemos outra situação!! Alternativas que apresentamos pro cliente e o cliente aceito, por que como o histórico era muito semelhantes e aceito somente naquele pedido. E quando entrou a nova produção a gente trouxe os outros 500 quilos do corante do pedido inicial, então nós trouxemos. Do problema nós trouxemos a solução, que era solução 1°) trazer aéreo e solução 2°) apresenta uma alternativa até a chegada dos outros 500 quilos. (Psale4s1)

**[15]** Lembra do vulcão na Islândia...em 2010 que espalhou aquela fumaça pela Europa inteira?? Então bloqueou um monte de aeroporto e ficamos quase 20 dias sem receber avião...Você recebia, mais gato pingado né, ai paro todo o sistema e ai, é uma coisa até engraçada, por que quando acontece uma coisa dessa, o cliente que tá com produto atrasado ele entende. Você citou uma coisa que agora... me faz pensar, por que quando acontece alguma, Tsunami no Japão também, quando acontece algum eventos... agora recentemente a nevasca nos Estados Unidos, atrasou algumas importações nossa também via aérea. E foi uma coisa interessante, por que quando você justifica para seu cliente que houve um problema, um desastre natural, ele geralmente ele não parte pra ruptura, ele entende o problema. (Psale4s1)

**[16]** ... tem ações conjuntas, mais ele não fica com... digamos assim, com uma raiva... Ah você pisou na bola comigo, entendeu? Não, ele não fica assim. Ele entende. Geralmente a média nossa é 20-30 dias pra entregar pro cliente; demorou 45 dias e o cara não reclamo, e a produção dele seguiu. Ou ele tinha estoque de segurança lá (e nós éramos exclusivo nesse caso), ou ele simplesmente transferiu a produção, ou outras matérias-primas que tavam para chegar também não chegaram. (Psale4s1)

**[17]** ...então, eu acho que o que falta é foco. Eu acho que a gente acaba fazendo no dia a dia muita coisa sem focar, sem parar para fazer assim: vamos falar sobre risco. Acho que se tivesse um processo assim, onde a gente parasse e analisasse o risco de cada produto, o risco de cada função, talvez teríamos mais frutos e mais ações gerenciais direcionados. Hoje a gente faz, só que elas são parte do dia a dia; então muitas vezes é até difícil separar, que ação que eu tomei para prevenir riscos e que ação que eu tomei para garantir o produto aqui dentro. Ele acaba ficando tudo na mesma balança e você não consegue nem separar. Então talvez seria necessário algumas ações mais focadas, assim, mitigação de risco. (Mproc4)

**[18]** Nossa cadeia é muito extensa...[e por isso] tem várias interferências. Então é difícil apontar um único ponto. Eu acho que quanto mais a AGRO-FC estuda os seus materiais e desenvolve tecnologia, é a única forma da gente minimizar as rupturas de entrega. (Mproc4)

**[19]** Hoje a gente ta fazendo um trabalho aqui no planejamento de reparametrização de todos os itens... A gente ta pegando cada material, cada item e analisando se é um produto A, B, C; qual é o lead time; qual a melhor estratégia de cobertura desse material...então hoje a gente tá fazendo um levantamento 100% dos itens, avaliando as opções de fornecedor, aonde ta o fornecedor, se tá num ponto estratégico ou não para a AGRO-FC, se é necessário desenvolver outros fornecedores que tenham um lead time menor, conseguir ter mais agilidade para a entrega, porque assim nos da mais flexibilidade na produção, porque se eu tenho um lead time muito longo, a gente fica muito travado e não tenho flexibilidade de mudar de produto. Estamos fazendo um estudo este ano de reparametrizar todos esses itens agora no 1° semestre antes da safra para trabalhar diferente ai na safra. Uma curva ABC olhando volume e analisando tudo mesmo, a fundo no produto, verificando fornecedor, aonde ele ta, uma análise bem crítica. (Amat4)

**[20]** ...você depois deve fazer uma análise crítica, tipo onde falhamos? o que não percebemos? o que nós não prevemos? conseguimos antever? faltou algum procedimento? faltou atenção? faltou informação? faltou comunicação? faltou fiscalização? faltou o que? Seguindo por estes passos, a gente com certeza arruma um jeito de fazer um caminho que se evite o mesmo problema, as mesmas coisas né. Seria essa análise depois de qualquer ruptura depois de qualquer problema. E assim não se esconder né, mostrar que você quer resolver, procurar um time multidisciplinar pra tratar... (Msale4s2)

**[21]** Olha é o que eu te falei, a gente participo desses estudos no ano passado e estão sendo implementandos agora. E uma das coisas que a gente tá implementando, é que quem coloca, o cliente que

coloca o pedido mais cedo, eles tem um risco maior de receber o produto, então, na nossa cadeia aqui, eu como vendedor o que que eu falo? Com meus clientes, coloquem o pedido mais cedo o possível, quanto mais o pedido chegar mais cedo e tiver no sistema mais vai ser percepção de você garantir resultado. (Psale4s1)

**[22]** A gente trabalha a ideia de ter vários fornecedores atendendo a gente né, pra não ter falta de produto, e os fornecedores que a gente trabalha hoje, a gente procura tá bem próximo deles pra gente fazer o planejamento, pra não ter nenhuma ruptura principalmente durante a produção. [...] e a gente ta com um planejamento para que todos os itens tenham pelo menos dois fornecedores, pra gente não ficar sem produtos, correr risco de ficar sem abastecimento, durante a safra, coisa desse tipo (Amat4)

**[23]** Se eu tenho um fornecedor que eu defino ele como estratégico, eu vou trabalhar na parceria. Eu vou falar para ele o projeto de inovação, vou focar todos os meus esforços para crescer esse meu fornecedor, eu vou trabalhar todos os meses em conjunto para ver quais são as oportunidades, qual é o volume que eu vou crescer... esse é estratégico, parceria." (Mproc4)

**[24]** "é, isso realmente é muito importante. Porque cada safra é diferente, mas um material pode se comportar em várias safras de modo iguais. Então realmente, o conhecimento ele é um facilitador." (Mcom4)

**[25]** "É, o ideal é você registrar o que aconteceu, e deixar o histórico do problema e da solução, isso... Isso já deixei isso... Aqui, uma digamos uma janela dentro do sistema interno, pra ir jogando essas informações, mais com certeza ainda, é a pessoa a experiência da pessoa sim, então o que mais conta, a já passei por isso tenho essa solução vamos ver? Acredito muito nisso." (Msale4s1).

**[26]** Sim, eu acho que é um fator essencial. [...] Às vezes a gente recebe informação muito em cima da hora e isso dificulta bastante a gente poder tomar uma ação que seja ainda dentro do prazo, entendeu? Hoje a comunicação, como eu falei, por às vezes ela ser falha, ela é o que gera maiores danos, justamente por a gente não tem um tempo hábil pra trabalhar e ter como suprir as necessidades dos fornecedores e dos clientes (Mscm4s1)

**[27]** [...] vamos dizer assim, o caso mais crítico ele é o produto que é *single sourcing*, volume altíssimo que entra num produto que se ele faltar, a margem que eu vou perder ou *gross profit* que eu vou perder é muito grande. [Neste caso] é só o estoque; Mesmo que a gente faça um alinhamento com o fornecedor para também manter estoque, a AGRO-FC também faz um estoque de segurança. tá? (Mproc4)

**[28]** Hoje o que acontece com o nosso estoque. Ele é um estoque vivo. Cada dia que ele passa, a gente perde a qualidade dele. Então se passou um mês e a gente não vendeu, a gente ta perdendo a qualidade disso e consequentemente a gente tem que reduzir o custo de venda. Isto no final do dia acaba entrando como custo de produção, né. Estoque que a gente tem que descartar. (Mcom4)

**[29]** Um sistema de comunicação que a AGRO-FC usa seria o *Team Space*, onde uma área coloca ali as atividades que estão acontecendo, as etapas de cada processo e dividi isso com os outros *stakeholders*. Essa é uma ferramenta que a gente tem. (Mcom4)

**[30]** A gestão de matéria-prima é feita de 3 ou 4 formas. Você concentra produto na mão de um fornecedor estratégico, onde você pode, por exemplo, usar estratégia de parceria; você pode colocar uma parcela desses produtos na mão de fornecedores comuns que ai você faz toda a gestão com base na competitividade, ou você também tem fornecedores que são específicos de produtos que não tem alternativa ou por decisão da empresa ou porquê o mercado não tem outro produto alternativo. E ai, para cada linha, para cada estratégia de negociação, tem em paralelo um plano de risco. (Mproc4)

**[31]** A situação é: eu tenho vários produtos que a situação é *single sourcing* mesmo, não tem alternativa. Alguns casos de *single sourcing* por conta da AGRO-FC, porque a AGRO-FC não correu atrás para aprovar um outro fornecedor, mas tem muitos casos que é *single sourcing* do mercado. É um produto específico desenvolvido para a AGRO-FC e ai o mercado não consegue chegar perto. (Mproc4)

**[32]** "A AGRO-FC tem muito pouco contrato ou compra com fornecedores de pequeno porte. A grande maioria são fornecedores globais. Isso também é para mitigar risco" (Mproc4).

**[33]** Tem um nacional que a gente ta trabalhando também, só que esse a gente ainda não tem dois fornecedores. O maior volume é um mineral que a gente puxa da Petrobrás, só que esse é bem complicado, porque fica na não da Petrobrás que é um órgão bem complicado de trabalhar. Então a gente ta trabalhando pra ter mais de uma opção desse material. (Amat4)

**[34]** Se eu tenho um fornecedor que eu defino ele como estratégico, eu vou trabalhar na parceria. Eu vou falar para ele o projeto de inovação, vou focar todos os meus esforços para crescer esse meu fornecedor,

eu vou trabalhar todos os meses em conjunto para ver quais são as oportunidades, qual é o volume que eu vou crescer... esse é estratégico, parceria." (Mproc4)

**[35]** Uma vez por mês eu faço uma visita, in loco, tá... e a cada 15 dias a gente se fala pelo telefone, principalmente com o Mproc4 e Amat4, através de telefone e e-mail. (Psale4s1)

**[36]** ...os produtos não podem estar mais que 300 km da minha usina de beneficiamento. Como se trata de um material perecível, assim que eu retiro do campo eu tenho que levar ele para o tratamento. (Mcom4)

**[37]** Já teve caso de, por exemplo, o cliente pedir 40 dias antes e ai, por um problema de logística ou algum problema no produto, o produto só ia ficar pronto em 50 dias. A gente avisa o cliente e então se tiver que fazer frete aéreo, a gente faz frete aéreo, tudo pra evitar essa falta. (Psale4s1)

**[38]** Assim o nosso produto entrou na linha de produção, e a gente trabalha pra não parar a produção de maneira alguma. Então itens que a gente acha importantes, tem tanques de armazenagem externa, então a AGRO-FC contrata esses tanques. Então a gente tem um produto lá de alto volume, e quantidades muito grandes, e a gente deixa nesses tanques que a gente deixa lá, e os fornecedores abastecem desses tanques. (Amat4)

**[39]** É.. a AGRO-FC também adota para alguns produtos um estoque de segurança, dentro da empresa ou terceirizado. Então a gente aluga, algumas vezes para alguns produtos, aluga um galpão, faz um estoque de segurança para poder garantir que não vai faltar produto. (Mproc4)

## APPENDIX IX: Original codes from the interviews (Cross-analysis and research findings)

**[1]** Interno, externo ou qualquer outro conhecimento disponível.

**[2]** Na verdade, todos os nossos clientes internos, a gente tem uma ligação forte. Então a empresa inteira, vamos dizer, trabalha com compras né. É, porque na verdade, todos tem uma necessidade em particular. Então nós somos uma área que a gente atende a empresa no todo. Uma área com maior demanda, outra com menor, mas todas abastece o nosso setor. (Mpurc1)

**[3]** No momento de crise, o que precisa é conversa. Então, união presencial; no momento de crise, comunicação tem que fluir. Interna e externa".

**[4]** Então, assim, aconteceu e depois que tomou providências, entendeu? Tem alguns, há casos, que, realmente, só vão tomar providências depois que acontece, porque, né, a gente é acomodado. (Psale1s2)

**[5]** Aumenta bastante o custo, sem duvida. Mas é o tal negócio, aquilo que eu tinha dito. Como eu não tenho alternativa, quer dizer eu até tenho, coisa e tal, mas eu não importo sendo que isto garantiria rodar a fábrica (Mmint1s1)