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Supply chain resilience: a case study analysis of a  
supply network in a developing country context

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*By:*

Benjamin Tukamuhabwa Rwakira

Department of Management Science

Lancaster University Management School

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This thesis is submitted in partial fulfilment of the  
requirements for the degree of  
Doctor of Philosophy

## **Declaration**

This thesis is my own work and it has not been submitted in support of an application for another higher degree or qualification elsewhere.

Benjamin Tukamuhabwa Rwakira

November, 2015

## Dedication

To my loving wife Pamela, my sons Elijah, Elisha and Christian for being a source of my inspiration and support. *I love you.*

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## **Publications**

Parts of this thesis have been published in the following outlets:

1. Supply chain resilience: definition, review and theoretical foundations for further study, **International Journal of Production Research**, 2015, 53:18, 5592-5623 – with Mark Stevenson, Jerry Busby & Marta Zorzini
2. Supply chain resilience in a developing country: a case study analysis of a supply network in Uganda. **Proceedings of the 22nd EurOMA Conference on Operations Management for Sustainable Competitiveness, June 26th - July 1st, 2015 Neuchâtel, Switzerland** – with Mark Stevenson & Jerry Busby

## **Abstract**

In recent years, building Supply Chain Resilience (SCRES) has gained considerable interest as the best way firms can face up to disruptions and gain a competitive advantage. The need for more empirical work on SCRES is well expressed in the literature, but there are few prior empirical studies on SCRES to date; and their focus has been on the developed world, especially Western Europe and North America. Yet, developing countries constitute a significant part of the world population and global supply chains; and there is evidence to believe that developing countries have also faced disastrous effects of supply chain failures. And the current global interconnectedness suggests that such effects can propagate into the developed world. Further, while several potential strategies for improving SCRES have been proposed in the literature, the relationships between them remain ambiguous, with some researchers arguing they are independent and others considering them to be interrelated – meaning they could contradict or reinforce each other, potentially affecting SCRES.

This thesis presents findings from the case study of a supply network of 20 manufacturing firms in the developing country of Uganda, to answer the following related questions: what do manufacturing firms in Uganda perceive to be the threats to their supply chains? What strategies do they adopt to build resilience? What are the outcomes of implementing these strategies? The thesis also investigates how the threats and strategies are interrelated, and what it means for SCRES. The findings reveal that the context of a developing country characterised, for example, by weak legal controls and social acceptance of certain customs and practices can produce threats to SCRES like corruption and dishonest employees that are less pronounced in the developed world. It is also found that the threats to SCRES are mainly chronic and endogenous events rather than the exogenous discrete, large-scale catastrophic events typically emphasised in the literature.

This study initially applies Complex Adaptive Systems (CAS) theory to interpret the data, which shows how environmental conditions, supply chain threats, and resilience strategies are inherently inter-related. This proves to be a useful theory frame – it emerges that the systemic nature of the threats to SCRES and of the strategies for dealing with these threats clearly produces non-linear and non-stationary outcomes. But it was also found that these systemic relationships among threats, strategies and their outcomes are explained by the context in which the supply chain is situated. Hence an embeddedness perspective was adopted to show that the political, cultural and territorial embeddedness of supply networks in a developing country can produce threats or render resilience strategies either ineffective or even counterproductive. This study therefore finds that both CAS and embeddedness perspectives are needed jointly to explain SCRES – it is embeddedness in a developing country that contributes to the phenomenon of “supply chain risk migration”, whereby an attempt to mitigate one threat produces another threat and/or shifts the threat to another point in the supply network. This portrays resilience as a continual process of supply network members responding to chronic and catastrophic events that may be endogenous and/or exogenous, and to the outcomes of their own previous responses – not to a specific set of structures or practices.

These findings have implications for managers wishing to build SCRES. For example, managers are informed that supply chain events of continuous possibilities deserve attention. Managers are also reminded of the potential migration of threats – they should thus understand how threats, strategies and potential outcomes are interconnected. Further, managers should understand the contexts in which their supply chains are embedded.

**Keywords:** *Supply Chain Resilience; Threats; Strategies; Complex Adaptive Systems (CAS); Embeddedness.*

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## CHAPTER 1

### INTRODUCTION

#### 1.1. Research Background and Motivations

The contemporary wave of globalisation and increased interdependence of firms have shown that companies can no longer compete in isolation of other entities in their supply chains – competition is no longer between companies but supply chains (Cabral et al., 2012). This interconnectedness has increased the vulnerability of firms to disruptive events at any point in their supply chains (Pereira et al., 2014; Kim et al., 2015a; Levalle & Nof, 2015).

Managing disruptions from supply chain threats has therefore gained a considerable interest in the field of supply chain management (Hohenstein et al., 2015; Das & Lashkari, 2015; Kim et al., 2015a); and recent research has emphasised the importance of Supply Chain Resilience (SCRES) for effectively surviving the adverse effects of disruptive events (e.g. Carvalho et al., 2012; Xiao et al., 2012; Brandon-Jones et al., 2014; Das & Lashkari, 2015). It has been recently reported, for example, that more than 80% of companies are concerned about the resilience of their supply chains (World Economic Forum, 2013). SCRES is based on the premise that not all risks are avoidable (Jüttner & Maklan, 2011; Hohenstein et al., 2015), and by building resilience, firms can manage disruptions to their supply chains and continue delivering goods and services to customers (Ambulkar et al., 2015; Scholten & Schilder, 2015). A full consensus on a definition of SCRES is not yet reached (Scholten et al., 2014; Kim et al., 2015a), but most researchers agree that it is concerned with a supply chain's readiness, effective response to, and recovery from a disruption – recovering to the previous level or, preferably, a better level of operational performance (Carvalho et al., 2014; Hohenstein et al., 2015).

The need for more research on the phenomenon of SCRES has been recently emphasised in the operations and supply chain management literature (Pereira et al., 2014; Ambulkar et al., 2015; Hohenstein et al., 2015; Kim et al., 2015a; Scholten & Schilder, 2015). But to date, few empirical studies on SCRES have been reported in the literature (Scholten & Schilder, 2015); and there is a noticeable limited use of theory frames to improve our understanding of SCRES. Further, the available empirical studies on SCRES were mainly conducted in Western Europe and North America (e.g. Zsidisin & Wagner, 2010; Gölgeci & Ponomarov, 2014; Scholten & Schilder, 2015), leaving developing countries severely underrepresented. Yet developing countries, which constitute a significant part of global supply chains and the world's population, have similarly experienced the devastating effects of supply chain failures (Chika et al., 2011). For example, it was reported that the infiltration of counterfeits to pharmaceutical supply chains led to the death of 2,500 people in 1995 and 192,000 people in 2001 in Nigeria and China, respectively (Chan et al., 2010). Similarly, in 2011, during the Arab Spring, Uganda suffered a severe fuel crisis and raw material shortage that disrupted the production and delivery of many goods and services. This sparked massive country-wide protests, and was followed by a violent police crackdown that led to many injuries and fatalities (*The Independent*, 2011). Such events illustrate the vulnerability of supply networks in developing countries and the severity of the outcomes when they fail.

We should therefore be concerned with the resilience of developing world supply chains because, in a globally-connected world, their failure has repercussions elsewhere (Diabat et al., 2012; Pereira et al., 2014; Kim et al., 2015a; Levalle & Nof, 2015), as developing countries are often either the sources of basic manufactured goods and raw materials for the developed world, or destination markets for products from the developed world. Moreover, the human consequences of supply chain disruptions in developing countries can be so significant.

Further, the literature has presented many possible strategies for improving the resilience of supply chains, such as increasing flexibility and creating redundancy. But there is a noticeable lack of research on the relationships between the various strategies. Some scholars consider these strategies to be independent (Sheffi & Rice, 2005; Zsidisin & Wagner, 2010); but others argue that they are interrelated (e.g. Jüttner & Maklan, 2011; Ponis & Koronis, 2012; Johnson et al., 2013), with their outcomes either complementing or contradicting each other. An example is where it is argued that supply chain collaboration and redundant resources/spare capacity facilitate flexibility (Jüttner & Maklan, 2011; Scholten & Schilder, 2015), while it is also argued that close collaborative relationships can either conflict with some aspects of flexibility (Stevenson & Spring, 2007; Scholten & Schilder, 2015), or lead to confidentiality threats emanating from sharing sensitive information (Jüttner & Maklan, 2011). This suggests that the relationships between SCRES strategies and their implementation outcomes should be investigated. And given that supply chains have been described as “complex adaptive systems”, exhibiting features such as non-linearity, coevolution, self-organisation and emergence (Choi et al., 2001; Surana et al., 2005; Day, 2014), it logically becomes important to study resilience systemically – investigating the inter-relationships between supply chain threats, resilience strategies, and outcomes – rather than analysing them individually and separately. This systemic analysis has not been done in prior empirical work on SCRES and although complex adaptive systems theory has been proposed in the literature as an appropriate lens for understanding SCRES (e.g. Day, 2014), it has not been applied in empirical studies before to ascertain how it could actually help to understand SCRES.

## 1.2. Objectives and Research Questions:

The above background shows there is clear motivation to conduct more empirical research on SCRES in a developing country context – it has been shown that developing countries which have been largely neglected, also suffer severe effects of disrupted supply chains. Moreover, the cultural, economic and other differences that exist between developed and developing countries suggest that perceptions and responses to threats may differ between the two contexts. Meanwhile, differences in levels of economic and political maturity and the quality of infrastructure may suggest certain developing countries are more vulnerable to certain disruptions than more mature, developed countries. Thus, it is important to understand what it means to be resilient for supply chains in these developing countries. Considering the argument that the inter-relationships between threats, strategies and outcomes should be analysed systemically rather than individually and separately to reflect the current framing of a supply chain as a Complex Adaptive System (CAS), this study aims to address two related research questions outlined below.

### *Research questions*

RQ1: What are the elements of supply chain resilience in a developing country?

- a) What do manufacturing firms in Uganda perceive to be the threats to their supply chains?
- b) What strategies do they adopt to build resilience to these threats?
- c) What are the outcomes of implementing these strategies?

RQ2: How are threats and strategies interconnected with the outcomes?

- a) What does this interconnectedness mean for supply chain resilience?

From the literature in Chapter 2, it will be shown that SCRES is a complex adaptive system phenomenon (e.g. Hearnshaw & Wilson, 2013; Day, 2014). Further, it will be

established that SCRES research is still in its infancy with limited focus on the context of developing countries, which differs from that of developed countries as already mentioned above, with potential implications for SCRES. Against this backdrop, this thesis adopts a case study approach, conducting interviews across a supply network of 20 manufacturing firms in the developing country of Uganda, to address the above research questions. The case study approach has been found suited to conducting research on such an emerging complex phenomenon and in such a unique context as suggested by Stuart et al. (2002). By studying a network of firms, this thesis concurs with the notion that SCRES is a network level phenomenon, whose appropriate unit of analysis should be a network rather than individual firms, as recently advocated by Kim et al. (2015a).

Uganda was deemed suitable for this study because evidence shows that like other developing countries, it has experienced disastrous effects of supply chain disruptions. As will be shown in section 1.3, the Ugandan environment could be a suspect in contributing to threats to the resilience of supply networks located there. It has been acknowledged, for example, that Uganda's business environment is constrained by a poor work ethic, institutional weaknesses, infrastructural bottlenecks, policy changes, crime, theft and disorder, power outages, limited access to finance, weak legal system, political instabilities, inadequacy of technology readiness and corruption (Mawejje, 2013). There are also reported socially accepted practices that facilitate dishonest behaviour between buyers and suppliers like product adulteration and counterfeiting, deliberate delivery failures and deliberate supply of poor quality products (Ntayi et al., 2012) – these are suspected to cause disruptions to the functioning of supply chains.

This thesis answers the first research question by developing taxonomies of threats, strategies and outcomes (in Chapter 4). This chapter finds that there are threats and conditions unique to a developing country context, which affects resilience. To address the

second question (in Chapter 5), Complex Adaptive Systems (CAS) theory is applied qualitatively to account for how an intervention in the process of building resilience produces unexpected, successive adaptations within the supply chain that require further intervention. This produces non-linear inter-relationships between threats, strategies and outcomes. However, it also emerges that it is important to understand the role of the political, geographical and cultural context in which the supply chain is located, if we are to explain why and how such inter-relationships occur. Thus, an embeddedness framework is also adopted to supplement CAS.

The concept of embeddedness was founded by Polanyi (1944) and later re-visited by Granovetter (1985). The basic idea behind embeddedness is that economic actions and behaviour are constrained or facilitated by their relationships with other economic and non-economic actors whether voluntarily or involuntarily (e.g. Granovetter, 1985). Various categories of embeddedness have been suggested including cultural, political and territorial embeddedness (e.g. Hess, 2004) – these three have been found especially relevant for this study. Many of the inter-relationships between threats, strategies and outcomes identified from the data were caused by Uganda’s distinct political, geographical and cultural environment in which the supply networks were situated. A more detailed discussion on embeddedness will be provided in Chapter 5, since it was not the original guiding theoretical framework, but only emerged from the data to supplement CAS theory – it later emerged that the CAS perspective could not, on its own, help to interpret the data appropriately.

### **1.3. The Study Context – Uganda**

The section describes the study context i.e. the developing country of Uganda. It is suspected that the context of a developing country might have an important influence on SCRES.

Understanding this context is therefore expected to improve analysis of data and interpretation of the case study findings in the later Chapters 4 and 5, for example, in terms of identifying which points can be considered important. The need to describe the context within this case study research arises from the fact that although it is acknowledged that case studies are beneficial for allowing examination of the context and its relevance, the context is different from case study data in a sense that data is collected from part of the wider context and it is important to understand whether it is representative of that context. The case study data collected is more in-depth and specific but this section provides a more general view and can, for example, guide on which findings should be given emphasis during data analysis and interpretation of the findings.

### **1.3.1. Brief Overview of Uganda**

Uganda is a developing, landlocked country located in Eastern Africa – bordered to the north by South Sudan, to the west by the Democratic Republic of Congo, to the southwest by Rwanda, to the south by Tanzania and to the east by Kenya. Most of these neighbouring countries have recently encountered or are still encountering significant political instabilities. In the past two decades, Uganda has achieved sustained economic growth, with GDP growing at an average annual rate of 7.1% from 1992 to 2011, making it the third highest growth rate recorded in Sub-Saharan Africa during this period (UNDP, 2013). In the financial year 2013/14, Uganda's GDP stood at \$ 26,505 million. However, this is just about 1% and 0.2% of the GDPs of the UK and USA respectively (World Bank, 2015). It also reported that the country experienced a decline in growth in the financial year 2013/14, with its growth rate only standing at 4.5% of GDP, which is below the average annual growth rate of 7.1% of GDP – a decline of 2.6%. This decline, especially in the manufacturing sector, was attributed to demand and supply factors, including high interest rates and market disruptions caused by uncertainty resulting from political instability in South Sudan (World Bank Report, 2015).

Uganda lies astride the Equator between longitudes 29 ½° East and 35° East and between latitudes 4 ½° North and ½° South, at an average altitude of 1,100 meters above sea- level, occupying a total area of about 241,550.7 square kilometres – about 18% of which is open inland waters and wetlands (UNDP, 2013). The rest of the land cover is estimated at about 38% agricultural land, followed by grassland (22 %), forests 11%, bush land 10% and built-up areas 2% (Uganda Bureau of Statistics Report, 2014). Uganda has a total population of about 34.9 million people, a population density of about 174 persons per square kilometre (Uganda Bureau Of Statistics Report, 2014), a GDP per capita of \$759, and about 19.7% of the population is below the poverty line (World Bank report, 2015). The map of Africa below illustrates the location of Uganda.



Figure 1.1: Map of Africa Showing the Location of Uganda

### **1.3.2. Uganda's Business Environment: Social, Political and Economic Situation**

The services sector is the major contributor to Uganda's GDP (i.e. 48%), followed by agriculture (26.2%), with the manufacturing sector contributing only 18.4% to the GDP (World Bank Report, 2015). In the developed countries such as the UK and USA, the services sector contributes about 80% and 78% of GDP respectively, followed by the manufacturing sector contributing 20% and 21% of GDP respectively, while agriculture contributes only about 1% of GDP in both economies (World Bank, 2015). Recent studies have shown that Uganda's business environment has been deteriorating over time, especially in terms of infrastructure, institutions, and the general macroeconomic environment (Mawejje, 2013). This is further revealed in Uganda's competitiveness ranking which shows that the Ugandan business environment deteriorated to 123 in 2013 from 108 in 2009 – a decline that is largely attributed to factors such as insufficient education and skills (UNDP, 2013). Uganda's business environment is further constrained by a poor work ethic, institutional weaknesses, infrastructural bottlenecks e.g. transport and telecommunication, a lack of innovation, policy changes, crime, theft and disorder, power outages, customs and trade regulations, unstable taxation system, limited access to finance, unfair competitive practices by the informal sector, weak legal system, macro-economic instabilities, political instabilities, inadequacy of technology readiness and corruption (Mawejje, 2013). A weak legal system for example is reportedly caused by a lack of political will where the government is not willing to fight vague legal definitions and where legal institutions have been undermined through political interference, bribery, underfunding, harassment and, and threats to prosecutors and witnesses (Human Right Watch Report, 2013).

Uganda has consistently been ranked as one of the more corrupt countries in the world, and this has been mainly attributed to politics of patronage and interference with the rule of law (Mbabazi & Yu, 2015). Transparency International ranks countries according to their

relative perceived level of public sector corruption on a scale of 0 (highly corrupt) to 100 (very clean), also known as the Corruption Perception Index (CPI). The 2014 CPI which included 175 countries rated Uganda at 29 out of 100, ranking it 142<sup>nd</sup> out of 175 countries (Transparency International Report, 2014). Further, dishonest behaviours such as connivance and deliberate failure to fulfil promises are common in Uganda's commercial transactions, which adversely affect buyer-supplier transactions, e.g. by influencing contract enforcement behaviour (Ntayi et al., 2011). For example, it is reported that employees in Uganda value their social identity more than professional standards; and consequently, it is such social relations and cohesion that facilitate dishonest behaviour between buyers and suppliers (Ntayi et al., 2012). This may include adulterating products by adding sand and stones to increase the weight, mixing good quality with poor quality products, refusing to pay post-delivery, accepting advance payment from one buyer before selling the product to another, suppliers' colluding to supply sub-standard and fake items, and failing to adhere to delivery schedules intentionally (Ntayi et al., 2012). The dishonest behaviour of suppliers, customers and employees and the effect of social cohesions together with some of the contextual factors highlighted above will later emerge as important aspects of the case study findings.

### **1.3.3. Uganda's Export and Import Trade (Outbound and Inbound Supply Chain)**

Uganda's exports are significantly increasing but the imports bill significantly exceeds export receipts, leading to persistent trade deficits – a scenario that is compounded by the fact that Uganda mainly exports low value unprocessed agricultural products compared to imports of high value manufactured products (Uganda Bureau Of Statistics Report, 2014). Agricultural products constitute the largest proportion of Uganda's exports (i.e. 37.61%), followed by manufactured products (i.e. 26.73%), marine products (i.e. 7.4%) and minerals (i.e. 2.82%). Manufactured/processed exports include fish and fish products, petroleum products, cement,

sugar & sugar confectionary, iron and steel, hides and skins, soap, beer and mineral water (Uganda Bureau of Statistics Report, 2014).

The main destination for Uganda's exports is the Common Market of Eastern and Southern African states (COMESA) which accounts for close to 50% of the total export value. This is followed by European Union, accounting for over 23% and the Middle East accounting for over 8% of total export value (Uganda Export Promotions Board, 2010). The highest value imports include petroleum and petroleum products followed by road vehicles, medical and pharmaceutical products, iron and steel, and cereals. The main source of Uganda's imports is Asia especially India and China (55.3%). This is followed by Africa (17.3%), the EU (11.7%), the Middle East (10.2%), North America (2.5%) and other European countries (1.5%) (Uganda Bureau of Statistics Report, 2014). The above discussion shows that supply chains in Uganda extend globally. This suggests the consequences of supply chain disruptions in Uganda can be felt elsewhere, including in the developed world – reinforcing the need to investigate the resilience of supply chains in this developing country context.

#### **1.3.4. Uganda's Manufacturing Sector**

Uganda's manufacturing sector is steadily growing and highly promoted by the government – its contribution to the economy increased by 2.8%, contributing 18.4% to the GDP in the financial year 2013/14 (World Bank report, 2015). Manufacturing in Uganda is heavily reliant on imported materials and is faced with challenges like the dominance of the informal sector, financial constraints and high interest rates, inadequate transportation and logistics infrastructure, poor telecommunication, corruption, weak institutions, inadequate skills, power shortages and reliance on imports of petroleum products (Obwona et al., 2014). The categories of Uganda's manufacturing firms are indicated in the table below:

*Table 1.1: Categories of Uganda's Manufacturing Firms*

<b>Major category</b>	<b>Sub-categories</b>
Food Products	Manufacture of meat and meat products, processing & preserving of fish & fish products, manufacture of vegetable and animal oils and fats, manufacture of dairy products, coffee processing, manufacture of grain milling products, manufacture of prepared animal feeds, tea processing, manufacture of bakery products and manufacture of Sugar.
Drinks and Tobacco	Manufacture of malt liquors and malt, manufacture of soft drinks and manufacture of Tobacco Products
Textiles, Clothing and Footwear	Cotton ginning, manufacture of made-up textiles & wearing apparel, manufacture of leather & foot wear
Paper Products	Sawmilling, paper & paper products, printing & publishing
Chemicals, Paint, Soap & Foam Products	Manufacture of paint and varnishes, manufacture of pharmaceuticals, manufacture of soap & chemical products and manufacture of mattresses
Bricks & Cement	Manufacture of bricks and ceramic products, manufacture of cement, lime and other articles of cement
Metal & Related Products	Manufacture of basic iron and steel, manufacture of structural metal products, other metal products
Miscellaneous Products	Manufacture of plastic products, manufacture of furniture

Source: Adapted from UBOS report (2014).

#### **1.4. Organisation of the Thesis**

This thesis consists of six chapters as outlined below:

Chapter 1 has presented a brief background and motivation for the study. This includes highlighting the gaps in the literature that need to be addressed through answering two related research questions, which are also outlined. This chapter has also briefly highlighted how the stated research questions will be addressed, including the choice of the study context and the theoretical frameworks that are used in interpreting the findings. Finally, a brief description of the study context of Uganda is provided, in order to gain understanding of the broader study environment and enhance the interpretation of findings. Uganda's political environment, economic environment, socio-cultural environment, outbound and inbound supply chains as well as the manufacturing sector are briefly described.

Chapter 2 presents a comprehensive review of the SCRES literature to date, including the broad related concepts like supply chain risk management, supply chain robustness, supply

chain security and supply chain vulnerability. This positions the thesis in the context of previous research. This chapter further analyses the available different definitions of SCRES and develops a more comprehensive working definition. SCRES strategies are discussed and prior empirical work is analysed in terms of the research focus, method, theory used and the country/context. The research gaps to be addressed are identified and CAS theory is presented and justified as an appropriate lens for the study of SCRES.

Chapter 3 follows to describe the research methodological design applied in this thesis. This chapter includes discussion and justification of the methodological choices made in this study.

Chapter 4 then presents the first level analysis of case study data. This level of analysis is more detailed and aims to develop a category structure from the data, where taxonomies of supply chain threats, resilience strategies and outcomes that emerge from the data are discussed. This chapter addresses the first research question and also makes some conclusive remarks that provide a springboard for Chapter 5.

Chapter 5 follows with the second more integrative level of analysis using CAS and embeddedness theory frames to explain the relationships between supply chain threats, resilience strategies and outcomes; and in the process interprets what such interrelationships mean for SCRES. This chapter constitutes the study's main attempt at theory building.

Finally, Chapter 6 provides conclusions and discussion, which include the contributions of the findings, theoretical implications, practical implications, limitations and future research directions.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1. Introduction**

This chapter presents a critical review of the relevant literature and identifies the existing research gaps that need to be addressed. Note: Part of this chapter – a systematic literature review paper was published in the International Journal of Production Research. This chapter will try to show how limited the current understanding of SCRES is, conceptually and empirically. Perhaps most obviously, it is focussed almost entirely on developed economies – while the worst experiences of disrupted and corrupted supply chains exist in the developing world. Further, the contradictions regarding the relationships among the suggested SCRES strategies and the limited use of theory frames that would help to improve understanding in empirical work will be revealed. The chapter begins with the main concepts related to SCRES in order to contextualise the study in the wider related literature – concepts such as supply chain risk management (in 2.2.1), supply chain robustness (in 2.2.2), supply chain vulnerability (in 2.2.3) and supply chain security (in 2.2.4) will also be discussed.

The rest of the chapter proceeds with defining SCRES (2.3), analysing SCRES literature (2.4), key Strategies for building SCRES (2.4.1), an overview of empirical work on SCRES (2.4.2), use of theory (2.4.3), Complex Adaptive Systems (CAS) theory (2.5); and finally, conclusion and summary of the research gaps (2.6).

#### **2.2. Concepts Related to Supply Chain Resilience (SCRES)**

The concept of SCRES is closely related to other broad concepts which are often highlighted and /or discussed in the SCRES literature. While some of these concepts encapsulate threats of supply chain disruption e.g. supply chain uncertainty and supply chain vulnerability, others

encapsulate responses to such threats e.g. supply chain risk management, supply chain security and supply chain robustness. The term supply chain robustness, for example, is at times either used interchangeably with SCRES (e.g. Christopher & Rutherford 2004; Zhang et al., 2011; Spiegler, et al., 2012), or considered a component of SCRES (Christopher & Rutherford, 2004; Wieland & Wallenburg, 2013; Yang & Xu, 2015). Other scholars have argued that creating supply chain robustness is one of the strategies for enhancing SCRES (e.g. Tang, 2006b; Vlajic et al., 2012); while others suggest robust supply chains can be achieved by reducing vulnerability and improving resilience (Vlachos et al., 2012). Also, ensuring supply chain security has been identified as a way of managing security-related supply chain risk (Maruchek et al., 2011; Yang & Wei, 2013). Some of the concepts related to SCRES are relatively well established research fields in their own rights and are consequently more mature than SCRES. It is argued for example that SCRES emerged from supply chain risk management (Ponomarov & Holcomb, 2009). Further, some of these concepts can appear confusing – they can sometimes be used interchangeably e.g. supply chain uncertainty and supply chain risk (Ekwall, 2010; Sodhi et al., 2012). Hence, it is logical that a more profound understanding of SCRES can be gained from a clear understanding of these closely related areas.

SCRES related concepts that encapsulate threat can, for example, help us to answer the fundamental question of “*Supply chain resilience against what*”? This is important because the existing SCRES research has focused on high-profile catastrophic, discrete events (Jüttner & Maklan, 2011; Johnson et al., 2013; Urciuoli et al., 2014; Scholten et al., 2014; Saenz & Revilla, 2014; Yang & Xu, 2015). This is perhaps because the idea of SCRES emerged following such large scale exogenous events (Spiegler, 2013) – it is observed from the literature that research specifically on the concept of SCRES can be traced back to the early 2000s when the earliest definitions were coined. This was triggered by large scale discrete

catastrophic events such as the 9/11 terrorist attacks (e.g. Rice & Caniato, 2003; Christopher & Peck, 2004). Nevertheless, recent research has acknowledged that SCRES can also be relevant to smaller but much more frequent chronic disruptions (e.g. Carvalho et al., 2014; Ambulkar et al., 2015). Thus, the more general answer could, for example, be that supply chains should be resilient against disruptions (e.g. Brandon-Jones et al., 2014; Ambulkar et al., 2015). But SCRES literature considers supply chain disruption to be interwoven with other concepts such as supply chain risk and supply chain vulnerability (Jüttner & Maklan, 2011). For example, some scholars have defined supply chain risks as anything that may disrupt the flows of information, materials or products along the supply chain (Peck, 2006). Moreover, supply chain disruption has been portrayed as a form of supply chain risk (Tang, 2006a; Manuj & Mentzer, 2008; Deane et al., 2009; Zsidisin & Wagner, 2010; Singhal et al., 2011; Chen et al., 2013; Wakolbinger & Cruz, 2011). And supply chain vulnerability is also at times regarded as a risk factor (Lavastre et al., 2012). Further, Peck (2006) claimed that when something is at risk, it means it is vulnerable. Jüttner & Maklan (2011) added that when the vulnerability of a certain supply chain is addressed, its risks are also addressed. Likewise, constructs such as risk, uncertainty, disruption and disaster in supply chains have often been used interchangeably (Singhal et al., 2011).

The other two concepts that have been linked to SCRES are: Business Continuity Planning and Crisis management (Macdonald, 2008). These concepts are also relatively more established research fields than SCRES. The following sub-sections present a more detailed discussion of the SCRES related concepts introduced above. We first begin with brief overviews of Business Continuity Planning, crisis management and supply chain uncertainty – concepts which will not receive any further detailed consideration throughout the thesis. Later, Table 2.1 provides reasons why some of the above concepts will or will not be discussed further. This will be followed by a more detailed discussion of four related

concepts i.e. supply chain vulnerability, supply chain risk management, supply chain robustness and supply chain security.

- **Business Continuity Planning and Crisis Management**

The Business Continuity Institute (2011) defines business continuity management as “*a holistic management process that identifies potential threats to an organization and the impacts to business operations those threats, if realized, might cause, and which provides a framework for building organizational resilience with the capability of an effective response that safeguards the interests of its key stakeholders, reputation, brand and value-creating activities*”. Blos et al. (2009) argued that business continuity management training (which is part of business continuity planning) is important in supply chain risk management and reduction of supply chain disruptions. Similarly, Rice and Caniato (2003) argued that business continuity planning means developing plans to prepare for, respond to and restore operations following the occurrence of unexpected disruptive phenomena. More specifically, Macdonald (2008) observed that both business continuity planning and crisis management are related to SCRES. Coombs (2007) defined a crisis as a potential threat to the organisation and crisis management as a process designed to prevent or lessen the damage a crisis can inflict on an organisation and its stake holders. Crisis management is meant to facilitate organizations in overcoming the outbreak of threats in order to be able to survive in the market (Leung & Lam, 2004). From the foregoing explanations and in accordance with the observation by previous scholars (e.g. Macdonald, 2008), it is clear that business continuity planning and crisis management apply more specifically to organisations or events in general than they do to supply chains. This thesis focusses on analysing the resilience of a network of firms and not of individual firms in isolation – the phenomena to be studied such as threats to resilience involve connections between firms as either suppliers or customers. Hence,

business continuity planning and crisis management as organisational rather than supply chain level constructs are not within the scope of this study.

- **Supply Chain Uncertainty**

Some previous researchers have attempted to distinguish between risk and uncertainty (e.g. Spekman & Davis, 2004; Simangunsong et al., 2012). However, others have maintained that the distinction is unclear and unnecessary (Jüttner et al., 2003; Tang & Musa, 2011). For example, Tang & Musa (2011) argued that risk and uncertainty in supply chains are hard to distinguish and their definitions remain vague. The multidisciplinary nature of the concept of uncertainty and the difficulty of clearly defining it was also acknowledged by Carey & Lawson (2011). Ritchie and Brindley (2007) asserted that the concepts of risk and uncertainty are quite often interchangeably used. Moreover, scholars who believe that the two concepts differ also appear to be inconsistent. For instance, Simangunsong et al. (2012) considered supply chain uncertainty as a broader term that incorporates risk and claimed that unlike risk which has only negative consequences, uncertainty may either have negative or positive consequences. This position seems to contradict previous scholars such as Tummala and Schoenherr (2011) who argued that risk is associated with an undesirable loss – arguing that such a loss is in the form of unwanted negative consequences and uncertainty. Blome and Schoenherr (2011) added that environmental uncertainty can be mitigated through risk management. It is further argued that decision making under conditions of uncertainty may be perceived as high risk (Ritchie and Brindley, 2007) which further demonstrates the closeness of these concepts – meaning uncertainty is an ingredient of risk.

Ritchie & Brindley (2007) explained that risk consequences are not only negative but can as well be positive to justify the existence of risk taking for potential gain. Similarly, Rao & Goldsby (2009) argued that risk entails not only the down side possible consequences but also upside possibilities in terms of higher performance expectations – emphasising that risk

must fulfil two concurrent conditions of both exposure and uncertainty. Ritchie and Brindley (2007) also added that variations from the expected level or target level whether positive or negative have an influence on the measurement of risk. Likewise, Cagliano et al. (2012) borrowed from the previous literature to state that both undesirable and desirable unexpected outcomes are incorporated in defining risk. Drawing from the existing literature, Simangunsong et al. (2012) further realised that, both risk mitigation and coping with uncertainty, share the same viewpoint. It is also believed that the sources of risk are the same sources of uncertainty (Lavastre et al., 2012; Simangunsong et al., 2012). Waters (2007) differentiates between risk and uncertainty only on the basis of probability of their occurrence by claiming that unlike uncertainty, the likelihood of risk can be estimated.

The above brief overview demonstrates that the distinction between risk and uncertainty is not only insignificant but also still elusive. Therefore, for the purposes of this study and consistent with other scholars (e.g. Jüttner, 2005; Spekman & Davis, 2004; Waters, 2007; Cagliano et al., 2012; Ekwall, 2010; Rao & Goldsby, 2009; Christopher et al., 2011; Tummala & Schoenherr, 2011; Pfohl et al., 2010), supply chain risk is addressed as having a negative connotation in the first place, thereby justifying the reason as to why supply chains should be resilient against it. Both supply chain risk and supply chain uncertainty arguably lead to or compound supply chain vulnerability and disruption that require constructing resilient supply chains (e.g. Cardoso et al., 2015). A summary of the SCRES related concepts and the reasons for or against addressing them in further details in this study is shown in Table 2.1.

*Table 2.1: Decisions on the Concepts Related to SCRES*

Concept	Decision	Reason	Example references
Business continuity planning	Not addressed	Applies more at an organisational level	Macdonald ( 2008 )
Crisis management	Not addressed	Applies more at an organisational level	Macdonald ( 2008 )
Supply chain disruption	Used interchangeably with supply chain risk	Synonymous with supply chain risk	Tang (2006a); Manuj & Mentzer (2008); Wakolbinger & Cruz (2011); Zsidisin & Wagner (2010); Singhal et al. (2011)
Supply chain risk management	Addressed	Related	Jüttner & Maklan (2011)
Supply chain robustness	Addressed	Related	Christopher & Peck (2004); Tang (2006b)
Supply chain security	Addressed	Related	Barksh & Kleindorfer (2009); Zhang et al. (2011); Yang & Wei (2013)
Supply chain uncertainty	Used interchangeably with supply chain risk	Trivially different from supply chain risk in the context of this study	Jüttner et al. (2003); Singhal et al. (2011), Simangunsong et al. (2012); Sodhi et al. (2012)
Supply chain vulnerability	Addressed	Related	Closs & McGarrell (2004); Speier et al. (2011)

Table 2.1 above shows four concepts are to be discussed further in the sub-sections that follow – to explore their relationships with SCRES. The concepts are: supply chain risk management, supply chain vulnerability, supply chain robustness and supply chain security. Further, in order to maintain the discussion within the scope of the study – as these are distinct broad research areas in their own right – we shall focus only on the aspects that relate them to SCRES.

### **2.2.1. Supply Chain Risk Management**

There is not yet any consensus on the definition of supply chain risk (e.g. Peck, 2006; Ho et al., 2015). For example, Ho et al. (2015) defined supply chain risk as ‘the likelihood and

impact of unexpected macro and/or micro level events or conditions that adversely influence any part of a supply chain leading to operational, tactical, or strategic level failures or irregularities’. Like SCRES, supply chain risk management is considered a relatively new discipline (Juttner et al., 2003; Ritchie & Brindley, 2007; Trkman & McCormack, 2009; Tummala & Schoenherr, 2011; Sodhi, et al., 2012; Ghadge et al., 2012; Chen et al., 2013). Supply chain risk management has emerged at the confluence of two relatively well established concepts i.e. supply chain management and risk management (Christopher & Lee, 2004). Christopher et al. (2011) established that the majority of companies do not have structured supply chain risk management systems. Other researchers have commented on the lack of empirical studies on supply chain risk management (e.g. Tang & Musa, 2011; Sodhi et al., 2012), and on the lack of general consensus on how to define supply chain risk management (e.g. Ponomarov & Holcomb, 2009; Sodhi, et al., 2012). Some of the different definitions suggested are outlined in Table 2.2.

*Table 2.2: Examples of Definitions of Supply Chain Risk Management*

<b>Authors</b>	<b>Definitions</b>
Carter & Rogers (2008)	Supply chain risk management is “the ability of a firm to understand and manage its economic, environmental, and social risks in the supply chain” which is possible through adoption of contingency planning and creating resilient and agile supply chains
Ho et al. (2015)	Supply chain risk management is ‘an inter-organisational collaborative endeavour utilising quantitative and qualitative risk management methodologies to identify, evaluate, mitigate and monitor unexpected macro and micro level events or conditions, which might adversely impact any part of a supply chain
Juttner (2005), Juttner et al. (2003)	Supply chain risk management is the identification and management of risk for the supply chain through a coordinated approach among supply chain members to reduce supply chain vulnerability as a whole
Manuj & Mentzer (2008)	Global supply chain risk management is the identification and evaluation of risks and consequent losses in the global supply chain, and implementation of appropriate strategies through a coordinated approach among supply chain members with the objective of reducing one or more of the following – losses, probability, speed of event, speed of losses, the time for detection of the events, frequency, or exposure – for supply chain outcomes that in turn lead to close matching of actual cost savings and profitability with those desired
Tang (2006a)	Supply chain risk management is the management of supply chain risks through coordination or collaboration among the supply chain partners so as to ensure profitability and continuity

Most of the above definitions in table 2.2 have included important aspects necessary for building SCRES like identification, evaluation, mitigation and monitoring of supply chain risk events or conditions (Manuj & Mentzer, 2008; Ho et al., 2015). These aspects can, for example, be important in the preparation phase of SCRES. Other relevant variables identified in the above definitions include collaboration and coordination (Jüttner et al., 2003; Jüttner, 2005; Tang 2006a; Manuj & Mentzer, 2008; Ho et al., 2015), ensuring continuity (Tang, 2006a), reducing vulnerability (Jüttner et al., 2003; Jüttner, 2005), contingency planning and supply chain agility (Carter & Rogers, 2008). All the above have been acknowledged as critical antecedents of SCRES (e.g. Christopher & Peck, 2004; Pettit et al., 2010; Jüttner & Maklan, 2011).

#### *2.2.1.1. Categorisation of Supply Chain Risks*

Some researchers have argued that in order to develop appropriate supply chain risk management approaches, risks should be identified and categorised in some way (e.g. Habermann, 2009; Schlegel & Trent, 2012). Similarly, SCRES researchers have acknowledged that categorising supply chain risks is important because there may be suitable resilience strategies for specific categories (Spiegler, 2013). Indeed, Pettit et al. (2010) contended that the desired level of resilience is achieved when there is a match between vulnerabilities and corresponding capabilities. However, it is not well known how broadly applicable some SCRES strategies are, i.e. whether they are suitable for dealing with a wide range of threats. If so, it may be these that are favoured by managers in practice. But it may be, for example, that some strategies increase resilience to one threat but increase susceptibility or vulnerability to another (Tukamuhabwa et al., 2015). For example, it is argued that maintaining redundant resources to increase flexibility in mitigating disruptions may produce a liquidity risk (Jüttner & Maklan, 2011).

To date, there is no consensus on the most appropriate way of categorising supply chain risks. For example, some have grouped risks in relation to the supply chain in question e.g. according to whether they are external to the supply chain, internal to the supply chain but external to the focal firm and whether they are internal to the focal firm (e.g. Jüttner et al., 2003; Christopher & Peck, 2004; Spiegler, et al., 2012). Most recently, Ho et al. (2015) observed that some other researchers have simply identified risk types without any clear basis of categorisation (e.g. Chopra & Sodhi, 2004; Blackhurst et al., 2008; Manuj & Mentzer, 2008; Tang & Tomlin, 2008; Wagner & Bode, 2008; Tummala & Schoenherr, 2011). Others have included disruption as a type of supply chain risk (e.g. Chopra & Sodhi 2004; Tang, 2006a; Blackhurst et al., 2008; Tummala & Schoenherr, 2011). Finally, others have classified supply chain risks according to the magnitude of the potential adverse effect of risk events (Tang, 2006a; Kumar et al., 2010; Ho et al., 2015). The different categories of supply chain risks identified from the literature are summarised in Table 2.3.

*Table 2.3: Categories of Supply Chain Risks*

<b>Authors</b>	<b>Categories of supply chain risks</b>
Blackhurst et al. (2008)	1) Disruptions/disasters, 2) Logistics, 3) Supplier dependence, 4) Quality, 5) Information systems, 6) Forecast, 7) Legal, 8) Intellectual property, 9) Procurement, 10) Receivables, 11) Inventory, 12) Capacity, management, 13) Security risks
Chopra & Sodhi (2004)	1)Disruptions, 2) Delays, 3) Systems, 4) Forecast, 5) Intellectual property, 6) Procurement, 7) Receivables, 8) Inventory, 9) Capacity risks
Christopher & Peck (2004)	1) External to the network: environmental risk 2) External to the firm but internal to the supply chain network: demand and supply risks, 3) Internal to the firm: process and control risks
Ho et al. (2015)	1) Macro-risks e.g. earthquakes and weather-related disasters, war and terrorism and political instability), 2) Micro-risks i.e. demand risk, manufacturing risk, supply risk and infrastructural risk.
Jüttner et al. (2003)	1) Network-related risk, 2) Organisational risk, 3) Environmental risk.
Kumar et al. (2010)	1)Internal operational risks e.g. demand, production and distribution, supply risks, 2) External operational risks e.g. terrorist attacks, natural disasters, exchange rate fluctuations
Manuj & Mentzer (2008)	1) Supply, 2) Demand, 3) Operational, 4) Other risks
Peck (2005)	1)Value stream/product or processes risks, 2)Assets and infrastructure, 3)Dependences, 4) Organizational and inter-organizational network, 5) Environment
Rao & Goldsby (2009)	1) Environmental factors, 2) Industry factors, 3) Organizational factors,

	4) Problem specific factors, 5) Decision maker factors
Samvedi et al. (2013)	1) Supply risk, 2) Demand risk, 3) Process risks, 4) Environmental risks
Spekman & Davis (2014)	1) Risks associated with goods flows, information flows and cash flows, 2) Security risks, 3) Relationship risks, 4) Risks associated with Corporate social responsibility
Spiegler et al. (2012)	1) Internal to the firm, 2) Risks which are external to the firm but internal to the supply chain, 3) Risks which are external to the supply chain.
Tang & Musa (2011)	1) Material flow risks, 2) Financial flow risks, 3) Information flow risks.
Tang & Tomlin (2008)	1) Supply, 2) Process, 3) Demand, 4) intellectual property, 5) Behavioural, 6) Political/Social risks.
Tang (2006a)	1) Operational risks: uncertain customer demand, uncertain supply and uncertain cost, 2) Disruption risks: earthquakes, floods, hurricanes, terrorist attacks, economics crises
Trkman & McCormack (2009)	1) Endogenous risks e.g. market and technology turbulence, 2) Exogenous risks e.g. discrete events (such as terrorist attacks, contagious diseases) and continuous risks (e.g. inflation rate, consumer price index changes)
Tummala & Schoenherr (2011)	1) Demand risks, 2) Delays, 3) Disruptions, 4) Inventory, 5) Manufacturing (process) breakdown, 5) physical plant (capacity), 5)Supply (procurement), 6) System, 7) Sovereign, 8) Transportation risks.
Wagner & Bode (2008)	1) Demand side risks, 2) Supply side risks, 3) Regulatory and legal risks, 4) Infrastructure risk, 5) Catastrophic risks

### 2.2.1.2. *The Relationship between Supply Chain Risk Management and SCRES*

Supply chain resilience is said to have emerged from supply chain risk management (Ponomarov & Holcomb, 2009; Petit et al., 2010). Although some scholars have argued that the relationship between supply chain risk management and SCRES depends on the target objective of the supply chain risk management strategy (Jüttner & Maklan, 2011), others emphasise that supply chain risk management should aim at enhancing SCRES (e.g. Thun et al., 2011; Thun & Hoenig, 2011). It has also been argued that ensuring SCRES is the best way of managing the risk of supply chain disruptions (e.g. Xiao et al., 2012; Ambulkar et al., 2015). The table below provides a summary of the literature which emphasises that supply chain risk management should aim to build resilient supply chains.

*Table 2.4: Summary Example of the Literature Indicating that Supply Chain Risk Management Enhances SCRES*

<b>Authors</b>	<b>Argument</b>
Christopher & Rutherford (2004)	Risk management strategies should aim at building both robust and resilient supply chains
Jüttner & Maklan (2011)	An approach to risk through increasing knowledge about supply chain risk is expected to result in increased SCRES. Further, risk sharing as a component of supply chain risk management positively influences SCRES in terms of enhancing visibility, collaboration and flexibility. Also, knowledge creating risk management helps in building SCRES through facilitating supply chain visibility.
Kong & Li (2008)	Efficient supply chain risk management reduces uncertainty and makes supply chains resilient – supply chain risk management should not end at visibility and planning, but should proceed to facilitate a response management capability. Supply chain risk planning during supply chain risk management facilitates SCRES.
Levesque (2012)	Resilient supply chains require among others, honest risk assessment of the likelihood and potential downside impact of a major disruption, building flexible contingency plans as well as conducting other activities that can facilitate supply chain risk mitigation
Lin & Zhou (2011)	Managing supply chain risks enables smooth operation of the whole supply chain as well as the building of a resilient global supply chain. Further, the requirements of product design change significantly impacts on the supply chain risks thereby directly affecting supply chain vulnerability and resilience
Schlegel & Trent (2012)	Supply chain risk management is an important enabler in building SCRES
Soni et al. (2014)	Resilience in the supply chain will be enhanced, and indeed made possible by the creation of a risk management culture in the organization
Tang & Musa (2011); Tang (2006a)	Some of the supply chain risks e.g. single sourcing risk and sourcing flexibility risks can be managed through creating resilient supply chains
Tang (2006a, 2006)	Firms prefer implementing robust supply chain risk management strategies that provide both efficiency and resilience. Such strategies include selecting and maintaining additional suppliers, crafting appropriate supply contracts, responsive pricing, demand postponement, product postponement, information sharing, collaborative forecasting, replenishment planning and increasing supply chain visibility
Thun & Hoenig (2011)	Supply chain risk identification, analysis and control help to establish effective supply chain risk management, which in turn facilitate the creation of secure and resilient supply chains
Thun et al. (2011)	Supply chain risk management instruments should be suitable for creating resilient supply chains
Tummala & Schoenherr (2011)	Supply chain risk management action plans should preferably aim to avoid risks and if this cannot be possible, they should focus on at least mitigating, containing and controlling them. In essence, supply chain risk management action plans should not only target risk avoidance but also creating SCRES.

From table 2.4 above, it can be observed that most scholars believe that implementing supply chain risk management strategies can increase SCRES (Colicchia et al., 2010). For example, supply chain risk mitigation strategies which were highlighted by Tang & Musa (2011) and Tang (2006a) including multiple sourcing, flexibility, early warning systems, supply chain design, operational hedging, postponement, contract and incentive alignment, investing in environmental protection, contingency planning, improving visibility and collaboration were also suggested by others as appropriate for creating SCRES (e.g. Chopra & Sodhi, 2004; Sheffi & Rice, 2005; Xu, 2008; Zsidisin & Wagner, 2010). Moreover, Tang (2006a, 2006) indicated that robust supply chain risk management strategies provide both efficiency and SCRES. It therefore follows that creating SCRES involves managing risks which in turn could mean that a resilient supply chain facilitates supply chain risk management. For example, the strategies suggested by Christopher et al., (2011) for mitigating global sourcing risks i.e. network re-engineering, collaboration, creating a global sourcing risk management culture and agility were adopted from the model for resilient supply chains earlier developed by Christopher & Peck (2004). This is also in line with Waters' (2007) suggestion that the design of a resilient supply chain is one of the cores of supply chain risk management. Further, Tang et al. (2012) argued that in order to cope with supply chain risk management difficulties, there is a need in part, to design resilience plans before risk occurrence as well as resource mobilisation to mitigate risk after occurrence.

From the foregoing discussion, it can be observed that several authors have linked the general concept of supply chain risk management to SCRES. But Jüttner & Maklan (2011) established a difference between the two concepts using empirical data – arguing that some components of supply chain risk management such as supply chain risk measures do not necessarily mitigate supply chain vulnerability or enhance resilience.

Finally, supply chain risk management is also related to supply chain robustness – a concept that is also arguably related to SCRES (Spiegler et al., 2012). It is argued that the most appropriate supply chain risk management strategies are those that create both robust and resilient supply chains (Christopher & Rutherford, 2004; Tang, 2006a). The concept of supply chain robustness is explored further in the next subsection.

### 2.2.2. Supply Chain Robustness

Supply chain robustness is another broad concept which is closely related to SCRES – with some researchers claiming there is completely no difference between the two concepts (Christopher & Rutherford, 2004; Zhang et al., 2011; Spiegler et al., 2012; Spiegler, 2013). For example, Asbjørnslett (2009) stated, “a supply chain is robust, or resilient, with respect to a threat, if the threat is not able to produce any ‘lethal’ effects on the system.” But the author further argued that what differentiates a robust system from a resilient one is that the latter has the ability to adapt to the threat. Supply chain robustness enables smooth operation under varying situations as well as minimisation of undesirable risk consequences thereby providing a competitive advantage (Vieira & Lemos, 2009). Similar to SCRES, supply chain robustness is an emerging concept that still lacks a generally agreed definition (Vieira & Lemos, 2009). Thus it is important to understand the different ways supply chain robustness has been defined in order to improve understanding of the concept and its relationship with SCRES.

*Table 2.5: Definitions of Supply Chain Robustness*

<b>Authors</b>	<b>Definitions</b>
Durach et al. (2015)	Supply chain robustness is the ability of a supply chain to resist or avoid change.
Han & Shin (2015)	Robustness is the ability of a supply network to resist the risks and recover from the disruption.
Klibi et al. (2010)	Supply chain network design is robust, for the planning horizon considered, if it is capable of providing sustainable value creation under all plausible future scenarios (normal business conditions as

	well as major disruptions
Kouvelis et al. (2006)	The supply chain is robust if it hedges the firm's performance against the worst contingencies in terms of uncertain factors over a planning horizon
Meepetchdee & Shah (2007)	Supply chain robustness is the extent to which the supply chain is able to carry out its functions despite some damage done to it, such as the removal of some of the components in the logistical network
Sawik (2014)	Robustness refers to an equitably efficient performance of a supply chain in average-case as well as in the worst-case, which reflects the decision-makers common requirement to maintain an equally good performance of a supply chain under different conditions
Spiegler et al. (2012)	Supply chain robustness implies that the system has acceptable changes in performances due to changes in uncertain parameters
Vieira & Lemos (2009)	A supply chain is considered robust when it is insensitive to variations or noises in not so regular operating conditions.
Vlajic et al. (2012)	Supply chain robustness is the degree to which a supply chain shows an acceptable performance during and after an unexpected event that caused disturbances in one or more logistics processes
Wieland & Wallenburg (2013)	Supply chain robustness refers to the ability of a supply chain to withstand disruption and continue operating. Whether normal operations would continue, the firm would be able to meet consumer demand, performance would not deviate from targets, and the supply chain could carry out regular functions
Wieland (2013)	A supply chain is robust if it uses resources that enable it to resist change without adapting its initial situation
Xiao et al. (2012)	Robustness of a supply chain system shows the ability to resist external disturbances
Zhang & Wang (2011)	Supply chain robustness is the ability of a supply chain to resist supply chain risks and disruptions and maintain normal operations

From Table 2.5 above, most of the authors seem to agree that supply chain robustness involves resistance or avoidance of supply chain disruptions and maintaining normal operations during and post supply chain disruption. This general view was also upheld by Vlajic et al., (2012) who, after analysing different definitions from several articles, concluded that supply chains are robust if their structures are not altered as a result of supply chain disruptions. Meepetchdee and Shah (2007) also contended that supply chain robustness is required to guard against undesirable disruption and to ensure long term survival. Thus, a robust supply chain has the ability to continue functioning normally amidst the occurrence of a risk event (Tang, 2006a; Waters, 2007; Meepetchdee & Shah, 2007; Zhang & Wang, 2011). From the above definitions, it seems clear that unlike SCRES whose major defining feature is

adaptation (e.g. Christopher & Rutherford 2004), supply chain robustness involves deploying proactive measures to cope with turbulence, with no adaptation needed during times of change ( Durach et al., 2015).

While some authors have associated robustness with resistance (e.g. Zhang & Wang 2011; Xiao et al., 2012; Wieland, 2013), others have argued to the contrary. Fiksel (2003), for example, claimed that a system's robustness can be achieved through resilience and not resistance – a view that is re-echoed by Vlachos et al. (2012) who contended that supply chain robustness can be created by reducing vulnerability and improving resilience. Brandon-Jones et al. (2014) added that in creating robustness, components of the system can adapt in response to specific perturbations while maintaining overall operating performance. But Wieland (2013) insisted that a robust supply chain resists rather than responds to changes – suggesting that robust supply chains must be strong, but not necessarily adaptable (e.g. Christopher & Rutherford 2004; Wieland, 2013). Indeed Brandon-Jones et al. (2014) conceptualised robustness and resilience as two different supply chain performance outcomes.

The above discussion shows there are still some contradictions in the literature regarding the relationship between robustness and resilience of supply chains. Some scholars consider supply chain robustness as one of the components of SCRES (Christopher & Rutherford 2004; Vlajic et al; 2012; Wieland & Wallenburg, 2013; Yang & Xu, 2015; Han & Shin, 2015). Others argue that both SCRES and supply chain robustness can be achieved using the same strategies such as additional suppliers, supply contracts, responsive pricing, demand postponement, product postponement, information sharing, collaborative forecasting, replenishment planning and increasing supply chain visibility, flexible sourcing, visibility, creating a risk management culture (Christopher & Rutherford, 2004; Tang, 2006a, 2006b; Spiegler et al., 2012; Xiao et al., 2012; Azevedo et al., 2013; Brandon-Jones et al., 2014).

However, others have maintained that supply chains that are robust are not necessarily resilient (e.g. Ekwall, 2009; Christopher & Rutherford, 2004; Spiegler et al., 2012). This means they may lack adaptive capability, which is implied for SCRES (Christopher & Rutherford 2004; Wieland, 2013).

In conclusion, although some authors have claimed that supply chain robustness is a component of resilience (e.g. Christopher & Rutherford 2004; Vlajic et al; 2012; Wieland & Wallenburg, 2013; Yang & Xu, 2015; Han & Shin, 2015), the above discussion seems to suggest that ‘robustness’ means there is no discernible change in the supply chain system under threat, whereas ‘resilience’ means there is discernible change but no loss in function (e.g. Tang, 2006a; Waters, 2007; Meepetchdee & Shah, 2007; Zhang & Wang, 2011; Wieland, 2013).

### 2.2.3. Supply Chain Vulnerability

The concept of supply chain vulnerability gained attention due to increased interest in supply chain risk management and resilience (Schlegel & Trent, 2012). And like SCRES, research on supply chain vulnerability is still limited (Svensson, 2000; Christopher & Peck, 2004). Further, the concepts of supply chain vulnerability and supply chain risk are at times used interchangeably (Peck, 2006; Lavastre et al., 2012). Hence, it is also important to look at how different scholars have defined supply chain vulnerability in order to clearly understand what the concept means.

*Table 2.6: Definitions of Supply Chain Vulnerability*

<b>Authors</b>	<b>Definitions</b>
Barnes and Oloruntoba (2005)	Vulnerability is defined as a susceptibility or predisposition to change or loss because of existing organizational or functional practices or conditions
Christopher and Peck, (2004)	Supply chain vulnerability is an exposure to serious disturbance, arising from risks within the supply chain as well as risks external to the supply chain
Jüttner et al. (2003)	Supply chain vulnerability is the propensity of risk sources and risk drivers to outweigh risk mitigating strategies, thus causing adverse

	supply chain consequences
Jüttner (2005)	Supply chain vulnerability is the exposure to serious disturbance arising from supply chain risks and affecting the supply chain's ability to effectively serve the end customer market
Pettit et al. (2010)	Supply chain vulnerabilities refer to the fundamental factors that make an enterprise susceptible to disruptions
Svensson (2002)	Vulnerability is the condition that is caused by time and relationship dependences in a company's business activities in supply chains. The degree of vulnerability may be interpreted as proportional to the degree of time and relationship dependencies and the negative consequence of these dependencies in a company's business activities towards suppliers and customers.
Svensson (2000)	Vulnerability refers to the existence of random disturbances that lead to deviations in the supply chain of components and materials from normal, expected or planned schedules or activities, all of which cause negative effects or consequences for the involved manufacturer and its sub-contractors.

From the above definitions, it can be concluded that supply chain vulnerability is the supply chain's condition of exposure to a threat/ risk. The fact that not all supply chain risks can be controlled means that every supply chain has some degree of vulnerability – and this is the premise on which SCRES is built (Jüttner & Maklan, 2011; Christopher & Holweg, 2011; Tummala & Schoenherr, 2011; Cox et al., 2011; Ivanov & Sokolov, 2013; Hohenstein et al., 2015).

Supply chain vulnerability can signify a supply chain's lack of resilience to both internal and external threats (Asbjørnslett, 2009). Hence, building SCRES is important for reducing supply chain vulnerability (Jüttner & Maklan, 2011; Xiao et al., 2012). Likewise, Sheffi & Rice (2005) argued that reducing vulnerability implies reducing the likelihood of a disruption and thereby enhancing resilience. Although these scholars have generally argued that minimising supply chain vulnerability enhances SCRES, others have argued to the contrary. For instance, Jüttner & Maklan (2011) claim that a highly vulnerable supply chain may either have a high or low resilience. The authors contend that some strategies may reduce supply chain vulnerability without necessarily causing any effect on SCRES. For example, a supply chain risk strategy which avoids certain geographical risk areas can reduce vulnerability e.g.

to political instability in the avoided region without necessarily increasing the response to and recovery from a disruption if it still took place. Indeed Petit et al. (2010; 2013) contended that SCRES is about appropriately balancing vulnerabilities and corresponding capabilities.

#### **2.2.4. Supply Chain Security**

Supply chain security has been linked to supply chain risk management, supply chain robustness and SCRES (Barksh & Kleindorfer 2009; Zhang et al., 2011; Yang & Wei, 2013). Supply chain security is considered important for reducing vulnerability – especially arising from threats of intentional acts e.g. terrorism, theft and food contamination (Zhang et al., 2011; Speier et al., 2011). Like other SCRES related concepts already discussed above, supply chain security is relatively new (Williams et al., 2008; Speier et al., 2011). And despite its growing importance due to potential security related supply chain disruptions, research about supply chain security is still scarce (Williams et al., 2008).

Scholars have proposed different definitions of supply chain security. For example, Closs & McGarrell (2004) stated that supply chain security management is the application of policies, procedures, and technology to protect supply chain assets (product, facilities, equipment, information, and personnel) from theft, damage, or terrorism, and to prevent the introduction of unauthorised contraband, people, or weapons of mass destruction into the supply chain. Pfohl et al. (2010) also defined supply chain security as the protection of the supply chain against attacks and disturbance with a criminal intent, or as an aftermath of juridical consequences in the case of liability and perpetuation of the companies under those kinds of circumstances.

The definition by Closs and McGarrell (2004) appears to be the most comprehensive – and it has been adopted by subsequent authors (e.g. Williams et al., 2008; Pfohl et al., 2010; Speier et al., 2011). But, supply chain security is not only about intentional threats as

emphasised by this definition but also unintentional threats. For example, Speier et al. (2011) stated that supply chain security measures are aimed to prevent or minimise the negative impact of both intentional and unintentional supply chain risk events, so as to enhance supply chain's continual operations without interruption arising from constraints in facilities, resources and capacity. Supply chain security is needed to mitigate disruptions from intentional threats like theft, contamination/sabotage, or a terrorist attack; as well as unintentional supply chain disruptions e.g. hurricanes, tornados and floods that may for example disrupt transportation infrastructure and/or manufacturing; accidents and unintentional food contamination (Speier et al., 2011). Similarly, Rice and Spayd (2005) noted that today's globalised supply chains have become increasingly vulnerable to several security threats including terrorism, product adulteration, infrastructural failure and brand/franchise destruction, which require supply chain members to commit some level of investment in supply chains' security so as to enhance SCRES. Such investments include collaboration among supply chain members, enhancing visibility and tracking, standards development, appropriate supplier selection, quality management initiatives; and transportation and conveyance security (Rice & Spayd, 2005).

Likewise, Pettit et al. (2010) also argue that improving security is crucial for addressing increased vulnerability of the global supply chain in order to ensure SCRES through for example providing protection against disruptions from cyber-security threats as well as threats to employees' safety. Further, the study by Park (2011) identified security compliance as a flexible supply chain practice that enhances SCRES capabilities in terms of readiness and response to, as well as recovery from disruptions. This can be achieved through supply chain partners' prioritising security, conducting regular security audits to ensure adherence to security standards like packaging procedures, prescribing penalties for non-compliance and offering specific security education programs to supply chain partners (Park, 2011).

Some scholars have however, argued that supply chain security may not guarantee SCRES (Rice & Caniato, 2003). In order to enhance SCRES, it is argued that supply chain security should be supplemented with other initiatives e.g. contingency planning (Ekwall, 2010) and collaboration between public and private actors (Rice & Spayd, 2005; Barksh & Kleindorfer, 2009; Pettit et al., 2010). Zhang et al. (2011) claimed that both supply chain robustness and SCRES can help to enhance supply chain security – presenting supply chain security as broader than supply chain robustness and SCRES. But from the above argument, it seems clear that most researchers recognise creating supply chain security as one of the strategies for enhancing SCRES.

#### **2.2.5. Concluding Remarks**

The extant literature supports the existence of relationships between the four broad concepts discussed above i.e. supply chain risk management, supply chain vulnerability, supply chain robustness and supply chain security – these concepts are also related to SCRES in different ways as discussed. Three of these concepts encapsulate the response to threat i.e. supply chain risk management, supply chain robustness and supply chain security. And these have a positive relationship with SCRES – we find that some strategies that enhance these concepts could also enhance SCRES. We also find these concepts differ from SCRES in certain ways. For example, supply chain risk management is understood to be relatively broader than SCRES – with the latter being the preferred sub-set of the former. It was also found that adaptation is implied by SCRES, as is resistance by supply chain robustness – it was found that resilience suggests there is a discernible change in the supply chain system under threat of disruption but without loss in function while robustness suggests there is no such a discernible change. Further, supply chain security was seen as a strategy of supply chain risk management or creating SCRES against especially threats from malign actors. Finally, the concept of supply chain vulnerability encapsulates the supply chain condition of

susceptibility to disruption by a potential threat – and most scholars acknowledge the existence of an inverse relationship between supply chain vulnerability and SCRES. The relationships between the four concepts and SCRES can be illustrated in Figure 2.1.

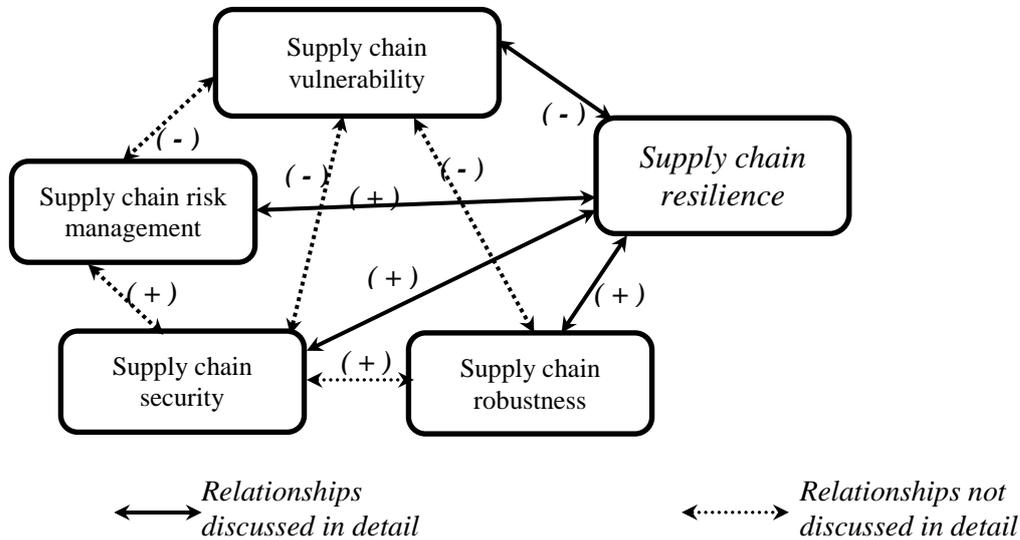


Figure 2.1: Conceptual Model of the Relationship among the Broad Concepts Related to SCRES

The arrows in Figure 2.1 show that the SCRES related concepts that encapsulate response to threat are mutually re-inforcing and they all facilitate SCRES. However, together with SCRES, they all have an inverse relationship with supply chain vulnerability. Although relationships between these concepts and SCRES have been acknowledged in the literature, it has been clearly indicated that some scholars still do not agree with some of the relationships. Moreover, it was found that there is not yet a general consensus on the definition of each of the concepts. Likewise, SCRES – which the four concepts are arguably related to – has not yet achieved a generally accepted definition (Kim et al., 2015a; Hohenstein et al., 2015). The lack of unified definitions suggests these related concepts are likely to be understood and interpreted differently thereby confusing the relationships between them. Hence, like for the related concepts discussed above, the next section provides an account of how SCRES has been defined in the literature so as to enhance understanding of the concept and develop a more comprehensive working definition for the study.

### **2.3. Defining Supply Chain Resilience (SCRES)**

Supply Chain Resilience (SCRES) is a relatively new concept that has emerged from the broader concept of “resilience” that has been explored in a number of disciplines to which the broad notion of resilience is relevant. These disciplines include ecology, sociology, psychology, economics, organisational studies, and sustainable development (Ponomarov & Holcomb, 2009). Indeed, several authors have acknowledged that resilience is a multidisciplinary phenomenon (e.g. Ponomarov & Holcomb, 2009; Bhamra et al., 2011; Ponis & Koronis, 2012; Spiegler et al., 2012). The disparate nature of the resilience literature – spread across many fields – and the broad notion of what the concept means has led to authors developing and using differing perspectives to describe the nature of SCRES. For example, resilience has been considered a property of supply chains (Day, 2014; Kim et al., 2015a); or an ability or capability (e.g. Pettit et al., 2013; Brandon-Jones et al., 2014; Pereira et al., 2014; Scholten et al., 2014; Ambulkar et al., 2015; Hohenstein et al., 2015; Levalle & Nof, 2015); or a dynamic and adaptive capability (Ponomarov & Holcomb, 2009; Golgeci & Ponomarov, 2013; Rajesh & Ravi, 2015). This understanding of SCRES from differing perspectives has led to authors acknowledging the problem of a lack of consensus on the definition of SCRES in the extant literature (e.g. Spiegler et al., 2012; Mensah & Merkurjev, 2014; Kim et al., 2015a; Hohenstein et al., 2015). The various definitions that can be identified from the SCRES literature are summarised in Table 2.7a, while the main elements of these definitions have been extracted and summarised in Table 2.7b.

Table 2.7a: Existing Definitions of SCRES from the Literature

<b>Authors</b>	<b>Definitions</b>
Barroso et al. (2010)	SCRES is the supply chain's ability to react to the negative effects caused by disturbances that occur at a given moment in order to maintain the supply chain's objectives.
Brandon-Jones et al. (2014)	SCRES is defined as the ability of a system to return to its original state, within an acceptable period of time, after being disturbed
Carvalho et al. (2011)	SCRES is concerned with the system's ability to return to its original state or to a new more desirable one after experiencing a disturbance and avoiding occurrence of failure modes.
Carvalho et al. (2012b)	SCRES is the ability of the supply chain to cope with unexpected disturbances.
Christopher & Peck (2004)	SCRES is the ability of the supply chain to return to its original state or move to a new, more desirable state after being disturbed.
Christopher & Rutherford (2004)	Resilience is the ability of a system to return to its original (or desired) state after being disturbed.
Closs & McGarrell (2004)	SCRES is the supply chain's ability to withstand and recover from an incident. A resilient supply chain is proactive - anticipating and establishing planned steps to prevent and respond to incidents. Such supply chains quickly rebuild or re-establish alternative means of operations when the subject of an incident.
Datta (2007)	SCRES is not only the ability to maintain control over performance variability in the face of disturbance but also a property of being adaptive and capable of sustained response to sudden and significant shifts in the environment in the form of uncertain demands.
Datta et al. (2007)	Resilience of the supply network is the ability of the production–distribution system to meet each customer demand for each product on time and to quantity.
Erol et al. (2010)	Resilience is a response to unexpected or unforeseen changes and disturbances, and an ability to adapt and respond to such changes.
Farasca et al. (2008)	SCRES is the ability of a supply chain to reduce the probabilities of a disruption, to reduce the consequences of those disruptions when they occur and to reduce the time to recover normal performance.
Gaonkar & Viswanadham (2007)	SCRES is the ability of a supply chain to maintain, resume and restore operations after a disruption.
Guoping & Xinqiu (2010)	SCRES is the ability of the supply chain to return to its original or ideal status under emergency risk environment.
Hohenstein et al. (2015)	SCRES is the supply chain's ability to be prepared for unexpected risk events, responding and recovering quickly to potential disruptions to return to its original situation or grow by moving to a new, more desirable state in order to increase customer

	service, market share and financial performance.
Longo & Oren (2008)	Resilience is a critical property that, in a context of supply chain change management, allows the supply chain to react to internal/external risks and vulnerabilities, quickly recovering an equilibrium state capable of guaranteeing high performance and efficiency levels.
Munoz & Dunbar (2015)	Operational SCRES can be thought of as the existing capability to recover from disruptions by restoring and maintaining the continuity of operations across the multiple supply chain echelons that match supply and demand.
Pettit et al. (2010)	Supply chain resilience is the ability to survive, adapt and grow in the face of turbulent change.
Ponis & Koronis (2012)	SCRES is the ability to proactively plan and design the supply chain network for anticipating unexpected disruptive (negative events), respond adaptively to disruptions while maintaining control over structure and function and transcending to a post robust state of operations, if possible a more favourable one than that prior to the event, thus gaining a competitive advantage.
Ponomarov & Holcomb (2009)	SCRES is 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.
Ponomarov (2012)	SCRES is the adaptive capability of a firm's supply chain to prepare for unexpected events, respond to disruptions, and recover from them in a timely manner by maintaining continuity of operations at the desired level of connectedness and control over structure and function.
Rice & Caniato (2003)	Resilience in the supply network environment is the ability to react to unexpected disruption and restore normal supply network operations.
Sheffi (2005)	Resilience in terms of the corporate world is the ability of the company to bounce back from a large disruption including the speed with which it returns to a normal level of performance.
Shuai et al. (2011)	Resilience is defined as the rapid recovery ability to equilibrium after the supply chain is attacked by a disturbance and we use the recovery time to measure the ability.
Xiao et al. (2012)	SCRES is the supply chain's ability to return to the original or ideal status after external disruption and includes both the abilities of adaptability to the environment and recovery from the disruption.
Yang & Xu (2015)	SCRES refers to the ability to respond to supply chain disruption caused by natural disasters, and this can be analysed by considering robustness of the supply chain and rapidity of recovery.
Yao & Meurier (2012)	Supply resilience is defined as the ability to bounce back from disruptions and to permanently deal with and respond to the changing environment.

Table 2.7b: Key Characteristics of Existing SCRES Definitions

Characteristics Article author(s)	Failure modes	Ability/ Capability	Adaptability	Preparation	Response	Recovery	Time	Original state	Better state	Control /connectedness	Robustness	Competitive advantage	Cost effectiveness
Barroso et al. (2010)		X			X			X					
Brandon-Jones et al. (2014)		X					X	X					
Carvalho et al. (2011)	X	X				X		X	X				
Carvalho et al. (2012b)		X	X		X								
Christopher & Peck (2004)		X			X	X		X	X				
Christopher & Rutherford (2004)		X			X	X		X	X				
Closs & McGarrell (2004)		X		X	X	X	X						
Datta (2007)		X	X		X			X	X				
Datta et al. (2007)		X			X		X						
Erol et al. (2010)		X	X		X								
Farasca et al. (2008)		X		X	X	X	X	X					
Gaonkar & Viswanadham (2007)		X			X	X		X					
Guoping & Xinqiu (2010)		X				X		X	X				
Hohenstein et al. (2015)		X		X	X	X	X	X	X				
Longo & Oren (2008)					X	X		X	X				
Munoz & Dunbar (2015)		X				X		X					
Pettit et al. (2010)		X	X		X				X				
Ponis & Koronis (2012)		X	X	X	X	X		X	X	X	X	X	
Ponomarov & Holcomb (2009)		X	X	X	X	X		X	X	X			
Ponomarov (2012)		X	X	X	X	X	X	X	X	X			
Rice & Caniato (2003)		X			X	X							
Sheffi (2005)		X				X	X	X					
Shuai et al. (2011)		X				X	X	X	X				
Xiao et al. (2012)		X	X			X		X	X				
Yang & Xu (2015)		X			X	X	X				X		
Yao & Meurier (2012)		X			X	X		X					

From tables 2.7a and 2.7b above, it can be argued that the two most comprehensive definitions of SCRES are those provided by Ponis & Koronis (2012) and Ponomarov (2012). For example, these two definitions incorporate the most characteristics in Table 2.7b, including adaptive capability and capacity, preparation, response and timely recovery to the original or, preferably, an improved level of operational performance. However, like the rest

of the definitions, these two have equally ignored the important aspect of cost effectiveness (see final column of Table 2.7b). Yet the World Economic Forum (2013) indicated that cost efficiency and resilience can coexist without a major negative impact and should ideally be complementary. Similarly, Ishfaq (2012) recently argued that SCRES can be achieved without prohibitively high operational costs. Table 2.8 indicates literature supporting the need to consider cost effectiveness in SCRES. Although formal definitions of SCRES do not appear to incorporate cost effectiveness, this table shows that cost effectiveness has been acknowledged as an important consideration in the meaning of SCRES.

Table 2.8: Cost Effectiveness as Part of SCRES

Argument for Inclusion	Authors
Resilient capabilities in the aspect of logistics and supply chain management should enable cost effective minimisation of vulnerabilities.	Asbjørnslett (2009)
There is a need to minimize the expected cost of mitigation when building SCRES.	Bakshi & Kleindorfer (2009)
The attributes which are capable of enhancing the firm's supply resilience are those that increase its ability to quickly and efficiently recover from disruptive phenomena.	Blackhurst et al. (2011)
Too high investments in creating SCRES may overshadow its marginal benefits.	Brandon-Jones et al. (2014)
Lean (cost minimisation and waste elimination) and resilience can co-exist in supply chain management.	Cabral et al. (2012)
Time and cost are key performance indicators of resilient supply chains.	Carvalho et al. (2011)
Supply chain resilience strategies should provide efficient and effective response.	Carvalho et al.( 2012d); Carvalho et al.( 2012c)
Network resilience should be measured considering the cost, time and resources incurred in the recovery process.	Chen & Miller-Hooks (2012)
SCRES can be created efficiently and cost effectively through the agile six sigma approach.	Christopher & Rutherford (2004)
Investment in SCRES-building measures should be balanced against the need to maintain a cost-efficient supply chain.	Dahlman (2008)
SCRES strategies, such as maintaining enough slack, should not adversely affect the normal operational efficiency.	Datta (2007)
Through flexible system optimization, a resilient supply network can be realised both effectively and efficiently.	Fang et al. (2012)
Resilience aims to recover the desired values of the states of a system not only within an acceptable time but also at an acceptable cost.	Haimes (2006); Haimes et al. (2008)
Disruptions should be mitigated at minimum cost in order to achieve an optimum state of SCRES.	Ivanov et al. (2014)
A supply chain should be designed in such a way that it is resilient as well as optimal in its operations.	Mandal (2012)
Optimisation models aim to allocate limited resources among mitigation strategies in order to achieve SCRES cost effectively.	Ratick et al. (2008); Sawik (2013)
Strategies for enhancing SCRES, such as increasing safety inventory and improving the efficiency of reserve capacity should be within the cost margins.	Shuai et al. (2011)
An increase in relationship resources results in increased network resilience, but such resources should not be increased beyond a certain limit, where it is not cost effective.	Smith & Vidal (2010)
The resilience of a system involves its ability to use the lowest possible amount of resources during recovery processes. The system that incurs the lower resilience costs will be considered the more resilient one.	Vugrin et al. (2011)
The recovery time and recovery cost are important considerations in selecting appropriate strategies to build grain SCRES against disasters	Yang & Xu (2015)

Resilient supply chains may not necessarily be those with the lowest costs (Carvalho et al., 2012b; Carvalho et al., 2012c), but it is argued here that any definition of the resilience of an economic system without regard for cost is incomplete. Supply chain disruptions should be minimised cost effectively (e.g. Lee, 2004; Wagner & Neshat, 2012). Cost efficiency has been identified as a feature of resilient systems (e.g. Fiksel 2003) and the reduction of costs through rapid and effective coordination is a necessary focus of resilient supply chains (Xiao et al., 2012). Moreover, SCRES should not be taken as merely the ability to manage risk, but also the ability to respond to risk in a better and more cost effective way than competitors; and, in the process, gain a competitive advantage (e.g. Hamel & Valikangas 2003; Yao & Meurier 2012).

In order to take into account all of the above, we define SCRES as:

*The adaptive capability of a supply chain to prepare for and/or respond to disruptions, to make a timely and cost effective recovery, and therefore progress to a post-disruption state of operations – ideally, a better state than prior to the disruption.*

The above definition implies that a supply chain's resilience can be assessed on four aspects – preparation for a disruptive event; response to an event; recovery from the event; and, growth/competitive advantage after the event (e.g. Hohenstein et al., 2015) – while SCRES strategies or capabilities should aim to ensure these aspects are maximised in a timely way and at minimum cost. In addition, the capability to adapt underpins these four aspects. Adaptation means a supply chain has the ability to develop different responses to match the nature of the threats it faces (Tukamuhabwa et al., 2015). This implies that the supply chain's elements may change to provide an appropriate response to a disruptive event rather than selecting from a pre-existing set of responses. As an example, the 1997 fire that destroyed Aisin Seiki's Kariya plant – Toyota's key supplier of P-valves, a critical component to

vehicle manufacture – was not anticipated and the responses had not been predetermined. But a quick recovery was enabled by the adaptive capability of the supply network that had been built into strong relationships between the company and its suppliers. This facilitated coordinated and self-organised responses that included setting up alternative p-valve production sites at suppliers used to providing other components (Nishiguchi and Beaudet 1998). This adaptive capability reflects the nature of disruptive events, which may be unforeseeable, inherent to the supply chain, co-evolving with the supply chain's responses, and so on. Over time, the supply chain may learn from disruptive events and corresponding responses; and it may develop new capabilities that make it more resilient to similar threats in the future (Tukamuhabwa et al., 2015).

The foregoing section has helped in consolidating the different definitions of SCRES and redefining the concept in order to gain a deeper understanding of the concept for purposes of the study. The next section analyses and categorises the literature on SCRES so as to highlight the research gaps that form the basis of the research questions addressed in this thesis.

#### **2.4. Analysis of the SCRES literature**

To date, much of the available SCRES literature focuses on outlining strategies for enhancing SCRES. For example, recent modelling work includes that of Kristianto et al. (2014), which focused on supply chain design and redundancy; Levalle & Nof (2015) on network formation and configuration; Rajesh & Ravi (2015) on appropriate supplier selection for enhancing SCRES, Wang et al. (2015) on contingent re-routing to enhance resilience, Gong et al. (2014), on supply chain redesign and cooperation between supply chain managers and managers of infrastructure, Yang & Xu (2015) on collaboration with the government in order to acquire government facilitation during disasters, Cardoso et al. (2015) on supply chain

design and planning; and Das & Lashkari (2015) on risk readiness and planning. Recent theoretical contributions include Day (2014), on a CAS framework that links SCRES to disaster relief; and Pereira et al. (2014), on the link between procurement and SCRES. In addition, Stevenson & Busby (2015) analysed the counterfeiting threat to supply chains and how supply chains can build resilience against product counterfeiting. Meanwhile, Kim et al. (2015a) indicated how different types of structural relationships affect SCRES, arguing that SCRES should be analysed from a network perspective. Most of these studies highlighted the need for more empirical work on SCRES.

A similar focus on SCRES strategies can also be observed in the current empirical work on SCRES. Although empirical researchers have used various terms such as antecedents (Mandal, 2012; Brandon-Jones et al., 2014; Scholten et al., 2014; Gölgeci & Ponomarov, 2014; Scholten & Schilder, 2015), enablers (Blackhurst et al., 2011), practices (Zsidisin & Wagner, 2010; Azevedo et al., 2013), capabilities (Pettit et al., 2010; Jüttner & Maklan, 2011; Fakoor et al., 2013), competencies (Wieland & Wallenburg, 2013) and strategies (Urciuoli et al., 2014), they all refer to what can help in building SCRES. Indeed, Hohenstein et al. (2015) recently argued that all the above terms can in some way be rephrased as SCRES strategies and include, for example, improving flexibility, creating redundancy, building collaborative supply chain relationships, improving supply chain agility, and enhancing visibility. Specific practices like information sharing (Brandon-Jones et al., 2014) and resource reconfiguration (Ambulkar et al., 2015), which were treated as antecedents of SCRES, can be considered as components of collaboration and flexibility, respectively. Therefore, in this section, the SCRES literature is first discussed in terms of the SCRES strategies proposed (Section 2.4.1). This is followed by an overview of the available empirical research on SCRES in terms of e.g. the research areas/topics, methods, geographical contexts (2.4.2) and the use of theory in SCRES empirical work (2.4.3).

In the following table (Table 2.9), the various SCRES strategies that have so far been proposed in the literature will be identified together with corresponding authors. And after the table, the key strategies will further be analysed in detail.

Table 2.9: Summary of Proactive & Reactive SCRES Strategies & Respective Authors

	<b>Supply Chain Resilience Strategies</b>	<b>Respective Authors</b>
<b>Proactive Strategies</b>	<i>Appropriate supplier selection/Procurement</i> – Using selection criteria that can help to minimise disruptions and their impact, such as political stability in suppliers’ territories, quality, capabilities (e.g. technological), financial stability, business continuity, reliability, etc.	Mascaritolo & Holcomb (2008); Pereira et al. (2014); Rajesh & Ravi (2015)
	<i>Building logistics capabilities</i> – Capabilities for managing supply and information flows necessary for minimising vulnerabilities, e.g. risk hedging capabilities, information technology upgrades, and information sharing.	Ponomarov & Holcomb (2009); Ponomarov (2012)
	<i>Building security</i> – Measures to protect the supply chain against deliberate disruptions, e.g. theft, terrorism & the infiltration of counterfeits	Rice & Caniato (2003); Pettit (2008); Barksh & Kleindorfer (2009); Pettit et al. (2010); Park (2011); Fakoor et al. (2013)
	<i>Building social capital and relational competences</i> – Effective communication and information sharing before the risk event increases risk awareness and limits vulnerability, e.g. communication, cooperation, trust, reciprocity, etc.	Johnson et al. (2013); Wieland & Wallenburg (2013)
	<i>Coopetition</i> – Creating and maintaining collaboration between competitors so as to gain from synergies, e.g. sharing resources for building security & resilience.	Barksh & Kleindorfer (2009); Borekci et al. (2014)
	<i>Creating appropriate contractual agreements</i> – Long term and short term contracts that can enable flexibility in supply to minimise shortages.	Tang (2006a, 2006b); Urciuoli et al. (2014)
	<i>Collaboration with the government/ Creating public-private partnerships /</i> – Contractual agreement between a public agency and a private sector entity to share skills & assets, risks and rewards in order to deliver services or facilities to the general public. It increases government interest in private entities’ supply chains.	Stewart et al. (2009); Gong et al. (2014); Urciuoli et al. (2014); Yang & Xu (2015)
	<i>Creating risk management culture</i> – Ensuring that all organisational members embrace supply chain risk management, and this involves, e.g. top management support and firm integration/team work.	Christopher & Peck (2004); Sheffi & Rice (2005); Sheffi (2005); Xu (2008); Zhang et al. (2011); Mandal (2012); Leat & Revoredo (2013)
	<i>Increasing innovativeness</i> – The motivation and capability to seek and invent new business ideas, e.g. new products, technologies, processes and strategies that can reduce vulnerability.	Golgeci & Ponomarov (2013)
	<i>Increasing visibility</i> – The ability to see through the entire supply chain (all nodes and links), which helps to identify potential threats.	Glickman & White (2006); Datta et al. (2007); Lakovou et al. (2007); Longo & Oren (2008); Pettit (2008); Pettit et al. (2010); Zhang et al. (2011); Carvalho et al. (2012b); Saenz & Revilla (2014)
	<i>Inventory management</i> – The strategic alignment of inventory management using a	Boone et al. (2013)

	system-wide approach to minimise inventory risks	
	<i>Knowledge management</i> – Developing knowledge and understanding of supply chain structures (i.e. physical and informational), and the ability to learn from changes as well as educate other entities.	Rice & Caniato (2003); Christopher & Peck (2004); Xu (2008); Kong & Li (2008); Ponis & Koronis (2012); Ponomarov & Holcomb (2009); Lakovou et al. (2007); Jüttner & Maklan (2011); Scholten et al. (2014)
	<i>Portfolio diversification</i> – Indulging in different products to reduce dependence on particular products and suppliers.	Urciuoli et al. (2014)
	<i>Supplier development</i> – Facilitating suppliers with incentives, e.g. financial, training and technical knowledge to improve efficiency, commitment and reliability.	Tang (2006b); Leat & Revoredo (2013)
	<i>Supply chain collaboration</i> – The ability to work effectively with other supply chain entities for mutual benefit, e.g. sharing information and other resources to reduce vulnerability.	Rice & Caniato (2003); Christopher & Peck (2004); Datta et al. (2007); Mascaritolo & Holcomb (2008); Pettit (2008); Ji & Zhu (2008); Bakshi & Kleindorfer (2009); Ponomarov & Holcomb (2009); Pettit et al. (2010); Pettit et al. (2013); Barroso et al. (2010); Erol et al. (2010); Peters (2010); Jüttner & Maklan (2011); Zhang et al. (2011); Park (2011); Soni & Jain (2011); Mandal (2012); Ponis & Koronis (2012); Carvalho et al. (2012b); Leat & Revoredo (2013); Fakoor et al. (2013); Scholten et al. (2014); Brandon-Jones et al. (2014); Scholten & Schilder (2015)
	<i>Supply chain network structure/ design</i> – Constructing the supply chain network for resilience, e.g. balancing redundancy, efficiency, vulnerabilities, etc.	Datta et al. (2007); Diabat et al. (2012); Carvalho et al. (2012a); Mandal (2012); Leat & Revoredo (2013); Scholten et al. (2014); Kristianto et al. (2014); Levalle & Nof (2015); Gong et al. (2015); Cardoso et al. (2015)
	<i>Sustainability compliance</i> – Compliance to economic, social and environmental requirements to mitigate associated supply chain risks, e.g. reputational risks.	Soni & Jain (2011)
	<i>Use of information technology</i> – Information technology enhances connectivity and supports other resilience strategies, e.g. visibility and collaboration, which can help in signalling potential disruptions.	Kong & Li (2008); Erol et al. (2010)
<i>Reactive Strategies</i>	<i>Building logistics capabilities</i> – Capabilities for supply and information flows, e.g. to reduce cycle times, increase delivery competence, knowledge management and customer service to quickly recover from a disruption.	Ponomarov & Holcomb (2009); Ponomarov (2012)
	<i>Building social capital and relational competences</i> – Effective communication, trust and information sharing can enable rapid access to resources necessary for recovery, e.g. communication, cooperation, trust, reciprocity, etc.	Johnson et al. (2013); Wieland & Wallenburg (2013)
	<i>Contingency planning</i> – Anticipating potential events and specifying the measures to deal with supply chain risks and disruptions before they actually occur, e.g. by	Glickman & White (2006); Tang (2006b); Pettit (2008); Mascaritolo & Holcomb (2008) Pettit et al. (2010); Park (2011); Vlachos et al.

forecasting and monitoring early warning signals.	(2012); Urciuoli et al. (2014); Cardoso et al. (2015); Das & Lashkari (2015)
<i>Contingency re-routing</i> – Using alternative routes (transportation) as contingency measure in case of threat of disruption to the current route e.g. turbulence and bad weather at sea	Wang et al. (2015)
<i>Creating redundancy</i> – The strategic and selective use of spare capacity and inventory that can be used to cope with disruptions, e.g. spare stocks, multiple suppliers and extra facilities.	Rice & Caniato (2003); Christopher & Rutherford (2004); Sheffi (2005); Sheffi & Rice (2005); Peck (2005); Tang (2006b); Lakovou et al. (2007); Xu (2008); Ratick et al. (2008); Longo & Oren (2008); Ji & Zhu (2008); Zsidisin & Wagner (2010); Carvalho et al. (2011); Park (2011); Azevedo et al. (2011); Diabat et al. (2012); Carvalho et al. (2012d); Ponis & Koronis (2012); Vlachos et al. (2012); Xu et al. (2014); Urciuoli et al. (2014); Saenz & Revilla (2014); Kristianto et al. (2014); Wang et al. (2015)
<i>Demand management</i> – Mitigating the impact of disruptions by influencing customer choices through, e.g. dynamic pricing, assortment planning and silent product rollovers.	(Tang 2006b); Urciuoli et al. (2014)
<i>Ensuring supply chain agility</i> – The ability to respond quickly to unpredictable changes in demand and/or supply.	Christopher & Rutherford (2004); Christopher & Peck (2004); Kong & Li (2008); Tang & Tomlin (2008); Longo & Oren (2008); Ji & Zhu (2008); Erol et al. (2010); Peters (2010); Carvalho et al. (2011b); Ponis & Koronis (2012); Carvalho et al. (2012b); Mandal (2012); Scholten et al. (2014)
<i>Increasing flexibility</i> – The ability of a firm and supply chain to adapt to changing requirements with minimum time and effort.	Rice & Caniato (2003); Sheffi, (2005); Sheffi & Rice (2005); Tang (2006b); Glickman & White (2006); Lakovou et al. (2007); Datta et al. (2007); Xu (2008); Pettit(2008); Ratick et al. (2008); Tang & Tomlin (2008); Mascaritolo & Holcomb (2008); Longo & Oren (2008); Ji & Zhu (2008); Zsidisin & Wagner (2010); Pettit et al. (2010); Erol et al. (2010); Zhang et al. (2011); Azevedo et al. (2011); Soni & Jain (2011); Carvalho et al. (2011b); Park (2011); Xiao et al. (2012); Ishfaq (2012); Diabat et al.(2012); Carvalho et al. (2012a); Ponis & Koronis (2012); Vlachos et al. (2012); Carvalho et al. (2012b); Fakoor et al. (2013); Azevedo et al. (2013); Mensah & Merkurjev (2014); Geng et al. (2014); Ambulkar et al., 2015).
<i>Increasing velocity</i> – The pace of flexible adaptations that can determine the recovery speed of the supply chain from a disruption.	Longo & Oren (2008); Carvalho et al. (2012b)
<i>Increasing visibility</i> – The ability to see through the entire supply chain (all nodes	Longo & Oren (2008); Pettit (2008); Pettit et al. (2010); Soni & Jain

<p>and links) so as to effectively respond to a disruption.</p>	<p>(2011); Carvalho et al. (2011); Zhang et al. (2011); Azevedo et al. (2011); Azevedo et al. (2013); Brandon-Jones et al. (2014); Saenz &amp; Revilla (2014)</p>
<p><i>Supply chain collaboration</i> – The ability to work effectively with other supply chain entities for mutual benefit, e.g. sharing information and other resources necessary for response and recovery.</p>	<p>Rice &amp; Caniato (2003); Sheffi (2005); Datta et al. (2007); Mascaritolo &amp; Holcomb (2008); Pettit (2008); Ji &amp; Zhu (2008); Ponomarov &amp; Holcomb (2009); Pettit et al. (2010); Pettit et al. (2013); Erol et al. (2010); Peters (2010); Jüttner &amp; Maklan (2011); Zhang et al. (2011); Park (2011); Soni &amp; Jain (2011); Carvalho et al. (2011); Ponis &amp; Koronis (2012); Leat &amp; Revoredo (2013); Brandon-Jones et al., 2014; Scholten et al. (2014); Gong et al. (2015); Scholten &amp; Schilder (2015)</p>
<p><i>Use of information technology</i> – Information technology enhances connectivity and supports other resilience strategies, e.g. visibility and collaboration, which can help in coordinating responses to disruptions.</p>	<p>Kong &amp; Li (2008); Erol et al. (2010); Mensah et al. (2015)</p>

### **2.4.1. Key Strategies for Building Supply Chain Resilience**

In Table 2.9, the different strategies for achieving SCRES are summarised together with relevant authors, e.g. who have identified, referred to, or investigated the particular strategy. The strategies have been broadly organised into two categories – proactive and reactive strategies – although some particular strategies can be either proactive or reactive depending on when and why they are applied. For example, collaboration can help to mitigate disruptions before they occur, e.g. by facilitating information sharing and the use of other strategies, like building security and supplier development. But it can also be used to aid recovery after a disruption by enabling supply chain actors to share resources and provide a coordinated response (Nishiguchi & Beaudet 1998; Scholten et al., 2014). Also, some of the strategies in the table are interrelated while others reinforce each other. For example, building social capital and relational competences can be regarded as facilitators of collaboration. Visibility and velocity can support agility (Christopher & Peck, 2004) while the use of information technology seems indispensable for most of the strategies. It is also noticeable from the table that more proactive than reactive strategies are highlighted in the literature. On the one hand, these strategies may be preferred in practice as they can be applied to prepare for a disruption rather than to respond. Thus, they are likely to support the continuation of ‘operations as normal’ and minimise vulnerability. On the other hand, managers may be reluctant to implement proactive strategies since it becomes difficult to justify investments that mitigate potential disruptive events which may not ultimately occur.

Finally, although these strategies have been categorised according to when they are applied – in accordance with other scholars (e.g. Ghadge et al., 2012; Wieland & Wallenburg, 2013; Saenz & Revilla, 2014; Hohenstein et al., 2015) – some strategies may be planned and crafted before a disruption but only applied after the disruption. For example, redundant suppliers may be selected before the risk event but only contracted afterwards. Related to this

observation, Tang (2006b) attempted to categorise SCRES strategies through theoretical work. The author categorised the strategies broadly as supply and demand management, and argued that SCRES strategies fall into nine sub-categories i.e. postponement to create product flexibility, strategic stock, flexible supply base, make and buy, economic incentives, flexible transportation, revenue management, dynamic assortment planning and silent product rollover.

Table 2.9 reveals that the most commonly cited SCRES strategies involve increasing flexibility, creating redundancy, forming collaborative supply chain relationships and improving supply chain agility. This is consistent with previous researchers who have considered these strategies as the most critical for SCRES (e.g. Longo & Oren, 2008; Jüttner & Maklan, 2011; Ponis & Koronis, 2012). These four key strategies – some of which are inter-related – are briefly discussed below before a broader discussion and assessment of resilience strategies follows.

#### *2.4.1.1. Increasing Flexibility*

Erol et al. (2010) defined flexibility as the ability of an enterprise to adapt to the changing requirements of its environment and stakeholders with minimum time and effort. Literature reveals various flexibility practices that can enhance SCRES such as postponement, a flexible supply base, flexible transportation, flexible labour arrangements, and order fulfilment flexibility (e.g. Tang, 2006b; Christopher & Holweg, 2011; Pettit et al., 2013). For example, it is argued that flexibility through postponement enhances resilience during a crisis by deferring demand to a future period (Tang, 2006b). Thus, flexibility creates SCRES by enhancing prompt adaptability during turbulence (e.g. Christopher & Holweg, 2011). It also aids a supply chain's rapid response and recovery, and this can be facilitated by the availability of alternative choices (redundancy), including alternative suppliers (e.g. Sheffi & Rice, 2005). Flexibility also enables resources to be more easily redeployed, including

transportation and labour resources (Pettit et al., 2013). More generally, flexibility is necessary given that threats to resilience are non-stationary, requiring responses that are similarly adaptive.

#### *2.4.1.2. Creating Redundancy*

Redundancy involves the strategic and selective use of spare capacity and inventory that can be invoked during a crisis to cope, e.g. with supply shortages or demand surges (Christopher & Peck, 2004). Creating redundancy can be an expensive means of building resilience. For example, spare capacity is needed along the critical path to reduce potential vulnerability and build resilience (Christopher & Rutherford, 2004). It is however important to note that certain factors like geographical location and the total (global) demand should be considered when relying on redundancy to build SCRES. For example, if redundant suppliers are in close proximity to the disrupted supply network, they may also be affected by the event (such as in the case of an earthquake or flood).

Further, it is also asserted that redundancy involves the duplication of capacity in order to continue operations during a failure (Rice & Caniato, 2003), and that it can therefore also be considered a route to flexibility (e.g. Jüttner & Maklan, 2011; Kristianto et al. 2014). Indeed, Johnson et al. (2013) found that redundancy increases flexibility, which facilitates response through the adaptable deployment of resources. This helps to avoid delay, thereby increasing SCRES. Although building flexibility is closely linked to redundancy, flexibility can also be achieved in other ways, e.g. by employing a multi-skilled labour force, installing multi-purpose machines, and creating flexible contractual arrangements. Such flexibilities that do not necessarily rely on redundancy have been preferred by various scholars because they save firms' resources (e.g. Christopher & Holweg, 2011; Thun et al., 2011).

#### *2.4.1.3. Supply Chain Collaboration*

According to Pettit et al. (2013), supply chain collaboration refers to the ability to work effectively with other entities for mutual benefit in areas such as forecasting, postponement and risk sharing. Collaboration could also involve information exchange, which can reduce uncertainty, increase transparency and facilitate the creation and sharing of knowledge, such as about supply chain risks and uncertainties (Christopher & Peck, 2004). Collaboration can also enable supply chain partners to share the costs of building security and resilience (Bakshi & Kleindorfer, 2009). Moreover, it influences the processes adopted by supply chain partners to ensure supply chain recovery (Ghadge et al., 2012). For example, collaboration can facilitate the sharing of resources and other complementary skills necessary for recovery from a disruption (Scholten et al., 2014; Scholten & Schilder, 2015).

Collaboration also enhances SCRES by enabling supply chain partners to support each other during a disruptive event (Jüttner & Maklan, 2011) and to provide a flexible and coordinated response. For example, Toyota's collaboration with suppliers following the 1997 Aisin Seiki Kariya plant fire referred to earlier in Section 2.3 (Nishiguchi & Beaudet, 1998). This example is also useful in reminding us how certain practices in supply chain relationships, like just-in-time supply and single-sourcing supply partnerships create vulnerabilities that must be traded off against the benefits of these practices, like strong networks that could potentially facilitate a rapid response to a crisis. But such collaboration can also produce fragility, for example, in making social commitments that have to be honoured even when counter-productive. This was evident in the findings of this study where firms could be requested to wait patiently in case of supplier delivery delays and failures – limiting flexibility to switch suppliers and affecting the downstream by similarly delaying delivery to customers.

#### 2.4.1.4. Supply Chain Agility

Christopher & Peck (2004) defined supply chain agility as the ability to respond quickly to unpredictable changes in demand or supply; this could perhaps be achieved through a rapid change to business processes and systems (Erol et al., 2010). Christopher & Peck (2004) suggested that supply chain agility is mainly composed of visibility and velocity. Supply chain *visibility* refers to the ability to see through the entire supply chain (Christopher & Peck, 2004). It enables a clear view of the whole chain, which may help in detecting signals of impending disruptions. Visibility implies having knowledge of the status of a supply chain's assets and environment (Pettit et al., 2013), thereby also helping to avoid overreactions, unnecessary interventions and ineffective decisions in circumstances of risk (Christopher & Lee, 2004). Furthermore, it helps the supply chain to effectively respond to and recover from disruptions through, for example, identifying vulnerable suppliers, thereby allowing enough time to develop countermeasures against potential failures (Jüttner & Maklan, 2011). For example, Procter & Gamble planners have tried to strengthen their supply chain visibility by installing monitoring tools to map the supply chain so as to improve threat awareness and receive timely warnings of potential disruptions (Saenz & Revilla, 2014).

Saenz & Revilla (2014) further describe how supply chain visibility helped Cisco to improve its agility and resilience to the Japanese earthquake and tsunami of 2011. Within twelve hours of the disaster, Cisco was able to map out its supply base beyond tier one suppliers (more than 300 suppliers) and within twenty-four hours, it was able to trace its customers and field 118 customer enquiries. This helped it to build a firm SCRES agenda and survive the effects of the disaster (Saenz & Revilla, 2014). The second element of agility referred to by Christopher & Peck (2004) – supply chain *velocity* – focuses on the pace of flexible adaptations (Stevenson & Spring, 2007), and thus determines the recovery speed of the supply chain from a risk event (Jüttner & Maklan, 2011).

#### *2.4.1.5. An Assessment of Research on SCRES Strategies*

The four core strategies discussed above have received the majority of the attention in the SCRES literature. Beyond these four strategies, the literature on means of developing resilience to supply chain threats or disruptions is broad but limited in depth (see Table 2.9). Moreover, although the SCRES literature has identified many strategies for creating SCRES, few studies have gone beyond this to focus on how firms can actually develop or implement these strategies (Blackhurst et al., 2011). Yet, SCRES research should not only be about identifying strategies, but also about understanding how they can be successfully implemented. For example, it is abundantly clear that SCRES strategies have financial implications that may limit their implementation. Other issues, such as corruption, socio-political instability, and unethical competitive practices, which are common sources of business risks (Lakovou et al., 2007), may also pose a threat to a SCRES strategy implementation. Similarly, how firms can choose between different SCRES strategies is under-researched. Given that a firm has limited resources to deploy, what factors should a manager take into consideration when deciding how to improve SCRES? One of the factors influencing the choice of strategy to adopt is likely to be a firm's or individual's perceptions of risk (Martin et al., 2009; Park, 2011). Cox et al. (2011) argued that the perception of a threat plays a fundamental role in building SCRES. Thus, perceptions of supply chain threats and how such perceptions shape decisions concerning the choice of certain SCRES strategies over others could be an important consideration for future research.

Although, clearly, several SCRES strategies have been proposed, the relationships between them remain ambiguous (Jüttner & Maklan, 2011; Ponis & Koronis, 2012; Johnson et al., 2013; Hohenstein et al., 2015). There are varying views on the exact relationship between constructs such as flexibility, redundancy, collaboration and agility (e.g. Tang & Tomlin 2008; Zsidisin & Wagner, 2010; Jüttner & Maklan, 2011; Ponis & Koronis, 2012;

Johnson et al. 2013). All can be considered as antecedents of SCRES (e.g. Zsidisin & Wagner 2010; Carvalho et al. 2012b; Ponis & Koronis 2012). But, for example, while some SCRES scholars consider constructs like flexibility and redundancy to be independent (Sheffi & Rice, 2005; Zsidisin & Wagner, 2010), others argue they are interrelated (e.g. Jüttner & Maklan, 2011; Ponis & Koronis, 2012; Johnson et al., 2013). Further, it is argued that supply chain collaboration and redundant resources facilitate flexibility (Jüttner & Maklan, 2011; Scholten & Schilder, 2015; Tukamuhabwa et al., 2015); and that both flexibility and collaboration can improve agility (Carvalho et al., 2012b) – suggesting these strategies can complement each other. Nevertheless, it seems equally possible that different strategies for building SCRES can conflict with one another. For example, it has been argued that building close collaborative relationships can conflict with some aspects of flexibility (Stevenson & Spring, 2007; Scholten & Schilder, 2015). Collaboration through information sharing may facilitate the disclosure of sensitive information leading to loss of confidentiality (Jüttner & Maklan, 2011) and enhancing redundancy to facilitate flexibility may result in a liquidity risk (Jüttner & Maklan, 2011).

Based on the above discussion, it can be argued that enhancing each SCRES strategy in isolation may be counterproductive, raising the possibility of a moving problem known as risk migration (e.g. Grabowski & Roberts, 1997; Alcock & Busby, 2006). In other words, in a bid to achieve one facet of resilience – by enhancing one of its antecedents – other facets are likely to be degraded through the effects on other antecedents. This – which is likely to reduce the effectiveness of SCRES strategies – requires a more holistic approach and should be investigated further.

#### **2.4.2. Overview of the Empirical Research on SCRES**

The current SCRES research is dominated by conceptual, theoretical and modelling work mainly focussing on the strategies for building resilience (Tukamuhabwa et al., 2015). The

focus of a sample of the current papers in these categories has been outlined in section 2.4. Recently, out of the 91 papers reviewed through a comprehensive systematic search by Tukamuhabwa et al. (2015), 39 belonged to the conceptual and theoretical category while 33 were modelling work. The empirical research in the form of case studies and surveys were limited to just 19 papers (Tukamuhabwa et al., 2015). The table below provides an updated version of the current empirical work on SCRES.

Table 2.10: Overview of Empirical Research on SCRES (Cross-sectional & Longitudinal Case Studies & Cross-sectional Surveys)

<b>Authors</b>	<b>Focus</b>	<b>Methodology</b>	<b>Description</b>	<b>Research Design</b>	<b>Theory</b>	<b>Country</b>
Rice & Caniato (2003)	Secure and resilient supply chains to terrorist attacks	Case Study	Case study of 20 medium and large scale companies ranging from high-tech and aerospace to pharmaceuticals and consumer packaged goods.	Cross-sectional	-	USA
Pettit et al. (2010)	SCRES through matching capabilities with vulnerabilities	Case Study	Case study/ focus group of an apparel and beauty care products retailer. 8 separate focus groups were conducted, each as an individual case study.	Cross-sectional	-	USA
Blackhurst et al. (2011)	Enablers and inhibitors of supply resilience	Case Study	Case study of an automobile manufacturer, two suppliers and a distributor; and a pharmaceuticals manufacturer, three retailers and two logistics providers.	Cross-sectional	Resource Based View (RBV), Dynamic Capabilities, Systems theory	USA, China, Korea
Johnson et al. (2013)	Social capital and SCRES: UK rail crash	Case Study	Case study of The Lambrigg, UK rail crash. Data collected from 3 separate tiers of the supply chain.	Cross-sectional	Social capital	UK
Leat & Revoredo (2013)	Developing resilient agri-food supply	Case Study	Case study of the ASDA Pork-Link supply chain involving 7 respondents.	Cross-sectional	-	UK
Azevedo et al. (2013)	An assessment model based on green and resilient practices.	Case Study	Four companies; one automaker and three first-tier suppliers.	Cross-sectional	-	Portugal

Pettit et al. (2013)	An assessment tool for supply chain resilience	Case Study	Case study of 7 global manufacturing and service firms and focus groups (global retailer of personal care, beauty, and apparel products, electronics, medical transportation firm operating as a non-profit firm, personal care items, building materials and chemicals).	Cross-sectional	-	USA
Borekci et al. (2014)	Relational dynamics and resilience in buyer-supplier triads	Case Study	Case study of eight buyers and their suppliers from the textile industry in Turkey	Cross-sectional	-	Turkey
Scholten & Schilder (2015)	Collaboration and SCRES	Case Study	Case study of 2 food processing companies and 8 of their suppliers	Cross-sectional	-	Netherlands
Scholten et al. (2014)	Mitigation processes and SCRES	Case Study	Case study of the Voluntary Organisations Active in Disaster (VOAD); nine interviews in three different VOAD lead member organisations.	Cross-sectional	-	USA
Urciuoli et al. (2014)	Strategies for building the resilience of energy supply chains	Case Study	Case study of five companies operating in the energy market, including oil and gas.	Cross-sectional	Rational choice theory	EU
Jüttner & Maklan (2011)	SCRES capabilities in a global financial crisis	Case Study	Case study of 3 large firms: a chemical products supplier, a timber wholesaler and a cabling supplier.	Longitudinal	-	Not indicated
Boone et al. (2013)	Strategic alignment of inventory and SCRES	Case Study	Field study involving 10 United States Air Force (USAF) locations and two years of data.	Longitudinal	-	USA
Zsidisin & Wagner (2010)	SCRES practices, supply risk sources and disruption occurrences	Survey	Survey conducted within 5 large companies in construction, paper and other capital equipment, aircraft manufacture, and material handling equipment industries – sample size of 499 and a response rate of 59.3%.	Cross-sectional	-	USA & Germany
Mandal (2012)	Antecedents of SCRES	Survey	Survey of 141 IT executives with a response rate of 36.91%.	Cross-sectional	-	India

Fakoor et al. (2013)	SCRES through matching capabilities with vulnerabilities	Survey	Survey of 126 managers and experts in the automobile supply chain.	Cross-sectional	-	Iran
Gölgeci & Ponomarov (2013)	Firm innovativeness and SCRES	Survey	Survey of 121 participants from the USA & Europe with a response rate of 10.16 %.	Cross-sectional	Resource Based View, Dynamic Capabilities	USA & Europe
Wieland & Wallenburg (2013)	Relational competences and SCRES	Survey	Survey of manufacturing firms with a response rate of 19.8%.	Cross-sectional	Relational view	Germany, Australia & Switzerland
Brandon-Jones et al. (2014)	Antecedents of SCRES and robustness	Survey	Survey of 264 UK manufacturing plants, with a response rate of 22%.	Cross-sectional	Resource Based View, Dynamic Capabilities, Contingency theory	UK
Gölgeci & Ponomarov (2014)	Firm innovativeness & SCRES	Survey	Survey of 121 participants from the USA & Europe with a response rate of 10.16 %.	Cross-sectional	-	USA & Europe
Ambulkar et al. (2015)	Antecedents of SCRES	Survey	Survey of 199 respondents with a response rate of 11.01%	Cross-sectional	-	Not indicated

The number of empirical papers – case studies or surveys – is limited to just twenty articles, as summarised in Table 2.10 above. These articles have predominantly focussed on the strategies a supply chain may use or has previously used to build SCRES. All the different terms used such as antecedents, enablers and practices refer to what can help in building SCRES and can be rephrased to mean strategies (Hohenstein et al., 2015). The lack of empirical work on SCRES presents a distinct knowledge gap. It means that we cannot clearly understand how SCRES can be either achieved or, indeed, lost in practice. What is proposed in theory may not apply in practice. For example, it is now generally theorised that a supply chain is a CAS (e.g. Wycisk et al., 2008; Hearnshaw & Wilson, 2013; Day, 2014), which suggests empirically adopting an intergrated view of threats, strategies and outcomes if we are to understand SCRES. Also, the few available empirical papers constitute a sizable number of cross-sectional surveys typically being based on a single respondent from each firm. Previous scholars have acknowledged that resilience is interpreted differently by particular groups of people, based on how their interpretation fits their understanding and purpose (Walker et al., 2004). Moreover, McCarthy et al. (2006) recommended the use of a multiple case study approach when researching CAS phenomena such as SCRES. This approach is important in understanding how and why firms construct particular influences on SCRES as either effective or ineffective, and therefore, how they deal with them as a result.

Further, it is observed that SCRES researchers have predominantly used a firm as the unit of analysis. But the processes involved in SCRES, such as adaptation and co-evolution are arguably difficult to understand by studying a single entity in the supply chain – they need to be examined across multiple related firms in a network. SCRES is a network phenomenon arising from connectivity and interdependence between firms. This suggests that we should consider supply chains, rather than individual firms, as the unit of analysis as recommended by Kim et al. (2015a) . Busby & Alcock (2008) observed that most contemporary risk events

have emerged at the level of networks rather than individual firms. It is further claimed that the resilience of a firm is determined by the resilience of its supply chain (Sheffi & Rice, 2005; Wedawatta et al., 2010).

The final column in Table 2.10 shows that SCRES research has mainly been conducted in developed countries, particularly in Western Europe and North America. SCRES research to date has concentrated almost exclusively on the developed world context. Yet, there are grounds for believing that the most catastrophic effects of supply chain failures (particularly on human life) have occurred in developing countries. For instance, the infiltration of counterfeit drugs into the pharmaceutical supply chain has been more prevalent and caused more severe effects in the developing world than in developed countries (Chika et al., 2011). For example, it was reported that counterfeit pharmaceuticals led to the death of 2,500 people in 1995 and 192,000 people in 2001 in Nigeria and China, respectively (Chan et al., 2010). Furthermore, the cultural and economic differences that exist between developed and developing economies suggest that perceptions and responses to threats may differ between these contexts. Meanwhile, differences in economic development and the relatively poor quality of infrastructure, like road and rail networks, may mean certain developing countries are more susceptible to certain disruptions than more mature, developed countries. Thus, investigating how SCRES issues are handled in developing countries is an important future research direction.

It is also observed that much prior work has focused on high-profile catastrophic, discrete events, e.g. SARS, terrorist attacks and the foot-and-mouth disease (Rice & Caniato, 2003; Christopher & Peck, 2004; Sheffi, 2005), the global financial crisis (Jüttner & Maklan, 2011), rail crashes (Johnson et al., 2013), war (Urciuoli et al., 2014), and Hurricane Katrina (Scholten et al., 2014). A similar focus on large-scale disasters can also be found in conceptual papers on SCRES (e.g. Boin et al., 2010; Abe & Ye, 2013; Day, 2014; Saenz &

Revilla, 2014). But supply chains also suffer from smaller, yet much more frequent, chronic problems that affect their resilience (e.g. Carvalho et al., 2014; Ambulkar et al., 2015; Das & Lashkari, 2015) – an example being the threat of product counterfeiting. And once we view a supply chain as a CAS, that can exhibit inherent non-linearities, it becomes apparent that even relatively small external and internal events can cause a considerable impact. This will be developed later in section 2.5.

### **2.4.3. Use of Theory in the SCRES Literature**

This subsection briefly reviews the theories that have been used thus far in SCRES empirical research. Established theoretical lenses help in understanding a phenomenon, in identifying the relationships among variables and in enhancing the generalisability of findings across different contexts (Foy et al., 2011). The notable theories that have been used so far in SCRES empirical research and indicated in Table 2.10 are: Resource Based View (RBV), Dynamic Capabilities, Systems theory, Rational choice theory, Social capital, Relational view and contingency theory. From Table 2.10, it is evident that the most commonly used theories are the Resource Based View (RBV) and the related dynamic capabilities model. The RBV postulates that internal organisational resources that are valuable, inimitable, rare and non-substitutable are a source of competitive advantage (Barney, 1991). It suggests that a firm is comprised of both the tangible and intangible resources, which, for example, may combine to create capabilities that determine its reaction to several internal and external threats as well as to opportunities (Wernerfelt, 1984; Barney, 1991). In SCRES research, the RBV has been used to explain the resources and capabilities that are considered antecedents of resilience, such as logistics capabilities (Ponomarov & Holcomb, 2009), human, organisational and inter-organisational capital resources (Blackhurst et al., 2011), redundant resources and flexible capabilities (e.g. Park, 2011). Other studies (e.g. Ponomarov, 2012) have incorporated the related dynamic capabilities perspective, arguing that capabilities for

enhancing SCRES should be dynamic to match changes in the environment (e.g. Teece, 2007).

Beyond the RBV and the related dynamic capabilities model, Blackhurst et al. (2011) used systems theory to explain resilience as an inherent feature of a system composed of e.g. flexibility, agility and adaptive capacity. A supply chain has been seen as an open system that is vulnerable to disruption from environmental events, with the impact of disruption on such a system depending on its level of resilience (Blackhurst et al., 2011). Through the systems theory lens, Blackhurst et al. (2011) proposed that disruptions to a supply chain due, for example, to stringent security, customs regulations, product complexity or inadequate supplier capacity can reduce SCRES.

Few other theories beyond the above have been used in the SCRES literature, but most of these have been used by a single paper only (see Table 2.10, 6<sup>th</sup> column). For example, Brandon-Jones et al. (2014) used contingency theory, which stipulates that optimal decisions and actions depend on both internal and external factors. This theory considers strategies as necessary responses to the environment (Wagner & Bode, 2008). Applying this theory, Brandon-Jones et al. (2014) contended the relationship between supply chain visibility and SCRES is moderated by supply base complexity e.g. the geographical dispersion of the supply base.

#### *2.4.3.1. An Assessment of the Use of Theory in the SCRES Literature*

Table 2.10 shows that only six of the twenty one empirical papers explicitly used or referred to a theoretical lens. This limited application of theory in SCRES research was also acknowledged by Fang et al. (2012). The lack of theory application may have limited our ability to understand resilience and its related variables as well as the relationships between them. It also makes the generalisation of research findings from one context to another

difficult. It is therefore important that the SCRES research literature makes greater use of theory to improve our understanding of the phenomenon.

It is argued here that the main theories used so far are not sufficient for explaining SCRES. RBV, for example, which is the most often used theory in the SCRES literature, is premised on a firm's internal resources (Barney, 1991). Yet, SCRES is a system level phenomenon that occurs at the level of a supply chain rather than an individual firm, and it involves connections between firms. Thus, RBV does not particularly help us to understand SCRES as a network level phenomenon. Kim et al. (2015a) recently argued against the current firm level analysis of SCRES phenomena, suggesting that a more appropriate level of analysis would indeed be a supply network. Further, RBV assumes reasonably predictable environments where the future value of resources is determinable (Kraaijenbrink et al., 2010). But SCRES has emergent characteristics due to the non-linear, dynamic and unpredictable nature of the environment to which it is a response. RBV also focuses on the component level – on the value of individual and separable resources; and it ignores their synergies, making it reductionist (e.g. Kraaijenbrink et al., 2010). In contrast, SCRES is a system level pattern emerging from the collective, dynamic and non-linear interactions between firms along the supply chain. As such, it could be argued that it can neither be objectively measured nor appropriately described using reductionist approaches (e.g. Brownlee, 2007).

As with the RBV, both the dynamic capabilities model and contingency theory have a firm level focus and may not adequately explain the systemic nature of SCRES. For example, dynamic capability models consider market dynamism and firm evolution over time (e.g. Wang & Ahmed, 2007). Meanwhile, contingency theory focuses on the fit between an organisational structure and its contingencies. Most of the other theories used thus far have similar shortcomings for studying SCRES. Systems theory is more promising for it recognises resilience as a systemic phenomenon. However, today's supply chains go beyond

traditional systems – they are complex systems with elements that continuously interact with each other and with their environment in an adaptive way. This means supply chains are complex adaptive systems (Day, 2014; Carter et al., 2015) and their resilience is achieved through adaptive and co-evolving processes. Therefore, an alternative theoretical lens that takes these features into account is required to make further progress in understanding and building SCRES. This study suggests that Complex Adaptive System (CAS) theory provides such a lens. Recently, Day (2014) used CAS theory, to conceptually explain the resilience of disaster relief supply networks and acknowledged that disaster relief supply networks differ from commercial supply chains. These supply networks may, for example, be constructed to respond to high profile events for a discrete period of time. There are many other types of supply chains – including long-term supply chains that face continuous threats – that also need to be resilient, and to which features like adaptation and co-evolution may be even more relevant. Thus, CAS can offer more help in understanding and interpreting empirical work on SCRES in commercial supply networks such as that of manufacturing firms in Uganda. In the next section, the CAS framework is outlined as a candidate theoretical lens – justifying its choice as an appropriate theory for studying SCRES.

## **2.5. Complex Adaptive Systems: A Proposed Theory Lens for SCRES**

### **Research**

The term *Complex Adaptive System* (CAS) emerged from complexity theory (Nilsson, 2003; Burnes, 2004; Schneider & Somers, 2006; Brownlee, 2007) and was initially applied to living systems (Surana et al., 2005; Wycisk et al., 2008). Complexity theory focuses on the emergence of order in dynamic and non-linear systems that operate at the edge of chaos (Fuller & Moran 2001; Burnes, 2004; Urry, 2005). Since physical and social phenomena contain both chaos and order, complex nonlinear systems tend to be neither overly stable nor

unstable. This is achieved through their order-generating rules, which facilitate transformation and self-organisation in order to remain at the edge of chaos amidst environmental changes (Burnes, 2004). A CAS is regarded as a special kind of complex system due to the property of adaptation (Nilsson, 2003; Surana et al., 2005) and can exist in unstable, but not completely chaotic environments (Innes & Booher, 1999).

Holland (1995) defined a CAS as a kind of system that, over time, emerges into a coherent form through the aforementioned properties of adaptation and self-organisation. It consists of an interconnected network of multiple entities (or agents) that respond adaptively to changes in both the environment and the system of entities within it (Choi et al., 2001). In a CAS, adaptation implies that the system's agents or elements are responsive, flexible, reactive and often proactive in dealing with the inputs of other agents or elements that affect it (Nilsson, 2003). This means the CAS agents have the ability to develop or modify different responses to match the nature of the requirements of other agents or the environment. The agents that constitute a CAS are guided by order-generating rules, also known as schemas (e.g. McCarthy, 2003; Pathak et al., 2007; Hasgall, 2013), which determine how the CAS responds during the adaptation process. The CAS environment is rugged and dynamic; and CAS agents must adapt to maintain fit with the environment in a timely manner (Wycisk et al., 2008; Day, 2014). During the adaptation process, new changes in the CAS and its environment may arise through a process of co-evolution (Choi et al., 2001), which makes it necessary to learn, thereby making appropriate modifications to schemas to increase fitness (Wycisk et al., 2008; Day, 2014). But, equally, a CAS acts on and modifies its environment, and entities within the environment learn from the system's responses.

The process of co-evolution in a CAS is also influenced by its non-linearity (Choi et al., 2001), which together with self-organisation and emergence has been considered a core feature of a CAS (McCarthy, 2003, 2004; McCarthy et al., 2006). Non-linearity implies that

extreme events may yield disproportionately negative or positive effects (Wycisk et al., 2008). Non-linearity may be influenced by the number and type of connections and interactions between the CAS agents (McCarthy et al., 2006). The degree of connectivity may also influence the extent to which the CAS agents act autonomously such that the higher the connectivity, the lower the agents' autonomy, and *vice versa* (Pathak et al., 2007).

Non-linearity in a CAS also produces self-organisation and emergence (McCarthy et al., 2006). Self-organisation and emergence refer to the synergistic effect of the decisions and actions of individual agents in a CAS that can cause changes, including the development of new structures, patterns and properties (Pathak et al., 2007). These changes may also be facilitated by the feature of scalability, which implies that different entities at different levels of a CAS have the same concerns; for example, reducing costs, increasing delivery speed and adaptation (Surana et al., 2005; Wycisk et al., 2008). As such, individual agents strive to achieve their goals by addressing their concerns, but end up causing the emergence of similar collective patterns at the wider system level.

### **2.5.1. A CAS Theory Lens: Fit with Supply Chains and the Phenomenon of SCRES**

From the above, it follows that non-linearity, self-organization and emergence are core features of a CAS (McCarthy et al., 2006); and it is these features and a few others (outlined in Table 2.11) that explain why a supply chain has been considered a CAS (Pathak et al., 2007; Wycisk et al., 2008; Hearnshaw & Wilson, 2013; Day, 2014). Since resilience is inherent to a CAS (Tukamuhabwa et al., 2015), there is a logical fit between CAS theory and the study of SCRES. A supply chain as a CAS can be considered resilient if it is able to effectively adapt to threats in its environment without violating its integrity as a system – returning to its original (or attain a better) performance level. Such adaptation often involves modifying the environment meaning it inherently involves co-evolution. SCRES involves adapting to non-linear processes such as where minor changes in supply chain controls allow

for catastrophic events to potentially occur. The most obvious example of this is the bullwhip effect, where a small distortion in the flow of orders downstream may result in a disproportionately large distortion upstream – disrupting the entire supply chain (Mackelprang & Malhotra, 2015). The non-linearity of SCRES can also be demonstrated by the fire in 2000 that gutted Philips’ semiconductor plant – a key supplier of a critical cell phone component to both Nokia and Ericsson. This which was initially considered a small incident resulted in an unanticipated massive disruption to Nokia’s entire supply chain, and it emerged that Ericsson was less resilient to this than Nokia. As a result, Nokia prospered while Ericsson registered a \$1.7 billion loss for the year and eventually went out of business (Hopkins, 2005).

SCRES is manifested through the process of self-organisation – another property of a CAS – rather than as a result of being deliberately managed or controlled by a single firm. No single firm, however large it may be, can claim to manage and control the resilience of the entire supply chain. This is partly because a supply chain is complex to the extent that most of what happens therein is beyond the visibility and reach of a focal firm (Choi & Krause, 2006; Carter et al., 2015). Moreover, Carter et al. (2015) argued that what is perceived as a supply chain is relative and people can refer to different fragments of the supply chain as their supply chains depending, for example, on each individual firm’s level of visibility and knowledge – meaning different firms can have differing visibility and knowledge of the same supply chain. These differences in visibility are similarly confirmed by the survey by the Business Continuity Institute (2013), which found that 75% of respondents lacked visibility of their supply chains.

A structured comparison between the features of a CAS, a supply chain and SCRES is provided in Table 2.11. From this table, the features of a CAS – such as adaptation and co-evolution, nonlinearity, network connectivity/interaction, dimensionality, self-organisation

and emergence, and scalability – can be seen to be applicable to the notion of supply chains and, more specifically, to SCRES.

Table 2.11: Comparison between the Features of a Complex Adaptive System (CAS), a Supply Chain & SCRES

CAS Features	Description	Relevance to Supply Chains	Relevance to Supply Chain Resilience
<b>Adaptation and Co-evolution</b> (Choi et al. 2001; Schneider & Somers, 2006; Pathak et al., 2007; Wycisk et al., 2008; Day, 2014).	The CAS agents change so as to cope with changes in other agents and its environment through self-organisation. The CAS can also influence changes in other agents as well as its environment.	Due to environmental dynamism, the supply chain changes in order to adapt. The activities of individual firms may also influence the supply chain environment.	SCRES is an adaptive phenomenon (Ponomarov & Holcomb, 2009; Hearnshaw & Wilson, 2013; Aditya et al., 2014). Firms adapt to supply chain threats, but this may cause more changes in the environment.
<b>Multi scale/ heterogeneous agents</b> (e.g. Choi et al., 2001; Surana et al., 2005; Wycisk et al., 2008)	Agents refer to entities that form a CAS. They operate at different levels in the system. Agents may be individuals, teams, divisions or the entire organization. They are heterogeneous for they follow different schemas but aim to enhance their fitness within the entire system.	Agents in a supply chain may be the individual firms. These operate at different levels with different rules, functions and objectives, e.g. supplier, manufacturer, distributor, retailer and customer.	The resilience of a supply chain is a collective outcome from the interactions of different firms along the supply chain as they apply schema (strategies and rules) to increase fitness/survival (e.g. Day, 2014).
<b>Schema</b> (Choi et al., 2001; McCarthy, 2003; Surana et al., 2005; Pathak et al., 2007; Hasgall, 2013)	Schema refers to the norms, values, beliefs and assumptions that are shared by a group of individuals. It is a set of goal led rules that guide the decisions and operations of individual CAS agents. For example, schemas may include strategies or plans in an organisation.	Organisations within the supply chain have rules, visions, objectives, goals and strategies that guide their decisions and operations.	Schemas include strategies and plans (McCarthy, 2003) such as firms' supply chain resilience strategies, which enable firms to modify their operations and adapt to their supply chain threats.
<b>Environment, Dynamism and rugged landscape</b> (Choi et al., 2001;	The environment in which the CAS operates consists of other CASs and is more complex than the CAS itself. The environment is rugged and dynamic causing changes that the CAS agents must adapt to in order to achieve fitness.	In a supply chain environment, changes exist, e.g. in the supply base, statutory regulations, etc.	Environmental dynamism creates threats. SCRES involves adaptation to both internal and external threats.

Pathak et al., 2007)	This adaptation may also cause changes in the whole system as well as the environment.		
<b>Ability to learn</b> (Wycisk et al., 2008; Day, 2014)	Agents in a CAS learn by obtaining information from their relationships within the system and the surrounding environment. It is through their dynamic learning that they are able to make decisions on modifying their capabilities and changing their schema in order to improve their fitness and performance.	Organizational learning exists among firms/agents in the supply chain.	Organisational learning enhances SCRES (Ponomarov & Holcomb, 2009; Pettit, 2010; Ponis & Koronis, 2012). Learning helps in adaptation by facilitating the modification of resilience strategies.
<b>Nonlinearity</b> (Choi et al., 2001; Urry, 2005; Surana et al., 2005; Brownlee, 2007; Pathak et al., 2007; Wycisk et al., 2008; Day, 2014).	There is a non-linear relationship between the cause and effect of CAS events. For example, a seemingly small event may cause extremely large effects in the system (either positive or negative). Similarly, severe events may yield very trivial effects and at times no effect at all.	A small change in the downstream part of the supply chain can cause amplified and oscillating changes in the supply chain upstream, e.g. the bullwhip effect.	Due to non-linearity coupled with interdependence, seemingly small disturbances can result in massive supply chain threats. Survival depends on embracing SCRES strategies, such as increasing visibility and flexibility through multiple-sourcing (Hopkins, 2005).
<b>Network connectivity/ interaction</b> ( Choi et al., 2001; Pathak et al., 2007; Wycisk et al., 2008)	A CAS is composed of agents and their connections. The connectivity of these agents determines the complexity and the dimensionality of the CAS.	Agents in a supply network have physical connection that facilitates the flow of information, resources and materials. Such connections include telephone lines and the internet.	Supply network connectivity and clustering facilitated by information flows facilitate collaboration, reduce opportunistic behaviour and enhance resilience (Hearnshaw & Wilson, 2013).
<b>Dimensionality</b> (Choi et al., 2001; Surana et al., 2005)	Dimensionality refers to the degree of freedom an individual agent possesses in order to act somehow autonomously.	Supply chain entities have different objectives and constraints. They operate autonomously although their connectivity with other supply chain members causes some interdependence.	Individual firms have partial freedom to make decisions. This contributes to self- organisation, emergence and adaptation (e.g. McCarthy et al., 2006), which are crucial for SCRES.
<b>Self-Organization and emergence</b> (Choi et al., 2001; Surana et al.,	Decisions made by individual agents cause new structures, patterns and properties to emerge at the system level without being externally controlled or imposed by any single agent. Some agents may have greater influence on the system	There is no single firm that deliberately controls or organises the entire supply chain. It simply emerges in part because a firm cannot manage the entire extended supply chain. Each firm tries to achieve its	Resilience is an emergent feature of a supply chain (Day, 2014; Golgeci & Ponomarov, 2013). It is a result of self-organised processes that enhance adaptation (Palin, 2013). No single

<p>2005; Schneider &amp; Somers, 2006; Brownlee, 2007; Pathak et al., 2007; Wycisk et al., 2008; Nilsson &amp; Gammelgaard, 2012)</p>	<p>than others, but they cannot control it entirely.</p>	<p>goals but this in turn contributes to the collective behaviour of the entire network.</p>	<p>firm controls the resilience of the entire supply chain (Geng et al., 2014).</p>
<p><b>Scalability</b> (e.g. Surana et al., 2005; Wycisk et al., 2008)</p>	<p>The same causal dynamics in a CAS may apply across all of its levels.</p>	<p>Agents/ firms at different tiers in the supply chain may have similar concerns, e.g. improving quality, delivery speed and reducing cost.</p>	<p>Inter-relatedness within a supply chain and the presence of common schema shared by firms are vital for the adaptation and survival (resilience) of the entire supply chain (e.g. Schneider &amp; Somers, 2006).</p>

## **2.6. Conclusion and Summary of the Research Gaps**

To conclude, all the above observations in the SCRES literature remain very general and have not been substantiated to any great degree in the literature. There is still a need to understand how, for example, the strategies that firms use to try to attain supply chain resilience play out within the supply system. Based on the literature, it has been suggested that SCRES strategies interact with each other – an interaction that seems inevitable once we take a CAS perspective. However, there is still a lack of understanding of how they interact, with what consequences, and how resilience emerges (or fails to emerge) as a result. As indicated earlier in Chapter 1, it is also suspected that the context of the supply chain – particularly how it is situated in a more or less developed economy – will have an important influence on this process. Overall, therefore, three important gaps can be identified in the literature:

- First, there is a need for further empirical work on SCRES, particularly across a network of firms and in a developing country context. Developing countries are important players in global supply chains and also face supply chain disruptions that can become catastrophic – yet from the available literature analysed above, developing countries have been evidently ignored.
- Second, there is a need to understand the relationships between the various strategies proposed for building resilience. Strategies may reinforce or contradict each other, potentially affecting their implementation outcomes.
- Third, further research is needed in which appropriate theory frames are used to interpret and enhance understanding of empirical findings as it was found that there is limited use of theoretical frames in the current SCRES empirical work. This thesis

supports the suggestion that CAS is a potentially important theory frame for the study of SCRES as a systemic phenomenon.

Since CAS has been chosen as a guiding theoretical lens for this research, it becomes important to study resilience systemically, investigating the inter-relationships between threats, strategies and outcomes, rather than analysing them individually and separately as has been observed in the current SCRES literature. Building on the above gaps, this thesis seeks to firstly investigate the elements of SCRES in a developing country context by investigating what manufacturing firms in Uganda perceive to be the threats to their supply chains, what strategies they adopt to build resilience, and what the outcomes are of implementing these strategies. Secondly, there is need to investigate how threats and strategies are interrelated, and what such interrelatedness means for SCRES. These questions are already outlined in Chapter 1 of this thesis.

The next chapter (Chapter 3) seeks to make progress in addressing the above research questions by describing the methodological design adopted to answer the research questions, mainly elaborating how the case study data was collected and analysed, including the justifications for undertaking certain methodological choices.

## CHAPTER 3

### METHODOLOGY

#### 3.1. Introduction

This chapter presents the research methodology used in the study. The following sub-section (3.2) discusses the research design organised based on Saunders et al. (2009)'s research design framework. This entails: the research philosophy (3.2.1), research approach (3.2.2), research strategy and choice (3.2.3) and research techniques (3.2.4) which includes the selection of cases, case study protocol, ethical concerns, pilot study, data collection, the unit of analysis and data analysis. Finally the chapter concludes in (3.3) with the quality of the research design. A recap of the research questions earlier introduced in chapter 1 is provided here below – research questions are important in research design for they inform the choices of the research strategy, data collection techniques and analysis (Saunders et al., 2009).

#### ***Research questions***

RQ1: What are the elements of supply chain resilience in a developing country?

- a) What do manufacturing firms in Uganda perceive to be the threats to their supply chains?
- b) What strategies do they adopt to build resilience to these threats?
- c) What are the outcomes of implementing these strategies?

RQ2: How are threats and strategies interconnected with the outcomes?

- a) What does this interconnectedness mean for supply chain resilience?

### 3.2. Research Methodological Design

The research design is important to explain and justify the type of data to be collected, how and where it is to be collected, as well as how it is to be analysed, interpreted and presented (Yin, 2003). It links the data to be collected and the conclusions drawn to the research questions (Yin, 2009). There are several frameworks developed to guide research design. For example, Creswell (2009) highlights three broad components of the research design i.e. the philosophical positioning of the research (world view), the strategy of inquiry and the specific methods and procedures to be used. Similarly, Saunders et al. (2009) developed a research design framework which they labelled '*research onion*' with the following layers: philosophies, research approaches, research strategies, research choice, techniques and procedures. This framework which arguably provides clarity and comprehensiveness of the different issues involved in research methodology and has been adopted by previous doctoral researchers (e.g. Wedawatta, 2013) will be adapted for this research.

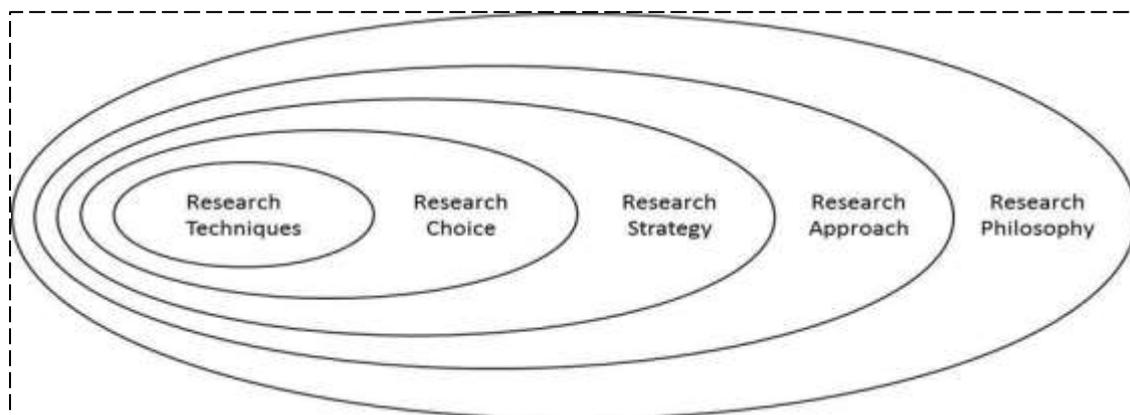


Figure 3.1: Aspects of the Research Design

Source: Saunders et al. (2009).

#### 3.2.1. Research Philosophy: Pragmatism

Amaratunga & Baldry (2001) contended that research, as a human action, is grounded on philosophical stances. Saunders et al. (2009) defines research philosophy as a comprehensive term related to the nature and development of knowledge. Research philosophy can be

classified into different research paradigms depending on the researchers' beliefs about the creation of knowledge (Johnson & Onwuegbuzie, 2004). The research paradigm refers to the shared belief systems that influence the kinds of knowledge researchers seek and how they interpret the evidence they collect (Morgan, 2007). According to the metaphysical paradigm, there is a linkage between ontology, epistemology, and methodology (Morgan, 2007). Likewise, Easterby-Smith et al. (2012) argued that both ontological and epistemological assumptions are crucial in guiding both scientist and social scientist research. Whereas ontology is a branch of philosophy that deals with the nature of the world and its existence, epistemology refers to how best the nature of the world can be investigated (Easterby-Smith et al., 2012). In other words, epistemology is about the best way of obtaining knowledge about the nature of reality – it is essentially about “how we know what we know” (Crotty, 2003). The link between researchers' ontological and epistemological assumptions suggests that the former takes precedence over the latter (Danermark et al., 2002).

There is an on-going debate regarding the most appropriate philosophical paradigm for social science and management research. The extreme contrast however, falls between positivism and social constructivism. Positivism generally assumes the existence of the social world, whose properties can be measured using objective methods rather than being subjectively inferred through sensation, intuition or reflection (Easterby-Smith et al., 2012). Its variant is post-positivism which represents the thinking after positivism – emphasising that researchers cannot be “positive” about knowledge claims when investigating the behaviour as well as actions of humans (Creswell, 2009). Social constructionism on the other hand builds on the assumption that reality is subjective, socially constructed and given meaning by people (e.g. Creswell, 2009). According to scholars (e.g. Burrell & Morgan, 1979), research may build on both positivism and anti-positivism. Such research should occupy a certain position along the continuum between the two approaches. Thus, borrowing

from this, and considering the nature of the research phenomenon at hand (i.e. SCRES), this research can be positioned between post-positivism and constructivism.

In terms of ontology for example, most supply chain research assumes that there are things we call 'supply chains' which exist irrespective of whether we happen to be analysing them at the time. They are supply chains not just because we call them that, but also because they behave in particular ways. Furthermore, it is argued here that we can measure objectively how well a supply chain performs in response to threats which we can also measure. However, this is always relative in the sense that what is a relevant measurement always depends on whose interests are at stake.

Moreover, some recent scholars have argued that a supply chain is a relative concept depending, for example, on what the focal firm perceives it to be (Carter et al., 2015). Also, while risk perception can be measured objectively, risk remains an interactive and culturally determined phenomenon (Dake, 1992). Thus, this study maintains that the interpretation and meanings attached to supply chain risk related issues such as threats and resilience may differ among different socio-cultural settings – depending on various interpretations and meanings people attach to them. Related to this, some scholars (e.g. Walker et al., 2004) have recognised that different groups of people interpret resilience according to how their interpretation fits their understanding and purpose. For example, whereas consumers in the developed world may interpret product counterfeiting as a risk, it may not be viewed as such in a developing country where customers look at it as an appropriate way of getting cheap products, which they could not otherwise afford. This is further supported by the findings from this study which revealed that customers in Uganda prefer buying counterfeits because they are mostly cheaper than genuine products. Some interviewees further revealed that the government can deliberately recommend the use of substandard products. Such findings indicate that there is no objective boundary between SCRES phenomena and the context –

and this is why it was necessary to adopt an embeddedness framework in this research to explain the interrelationships among threats, SCRES strategies and outcomes (see chapter 6). Therefore, given the nature of the research phenomenon at hand as explained above (i.e. occupying a position along the positivism-constructivism continuum), one of the alternative ontological assumptions that create a middle ground between these two philosophical positions can be “critical realism”. Critical realism suggests existence of a real world both separately to our knowledge of it and concurrently with our socially constructed knowledge about reality (Danermark et al., 2002). However, a related philosophical position but one that goes beyond “paradigm wars” is pragmatism – and it is the position adopted in this study.

Pragmatism recognises the existence of objective reality as well as that lodged in mind, and appreciates the importance of using multiple methods, different world views, assumptions, forms of data collection and analysis (Creswell 2009). Proponents of pragmatism reject the traditional dualisms such as objectivism and subjectivism – they recognise the existence and importance of both the natural or physical world and the emergent social and psychological world that entails language, culture, human institutions and subjective thoughts. Pragmatists believe that research is influenced by the social, historical, political as well as other contexts (Creswell, 2009). This is particularly relevant to this study that seeks to understand SCRES from a different context (i.e. from a developing country context) which is expected to influence the findings. Initially, pragmatism was consistently omitted from the list of other philosophical approaches due to its sharp contrast with the metaphysical paradigm’s foundational assumptions on the nature of reality and possibility of objective truth – pragmatism challenged why we have to believe in one versus the other or to act one way rather than another (Morgan, 2007). Pragmatism distorts the original top-down approach to the philosophy of knowledge i.e. ontology, epistemology, and methodology (Guba & Lincoln, 1994) but does not discount the relevance of such an

approach (Morgan, 2007). Proponents of pragmatism argue that paradigms as epistemological positions draw attention to the deeper assumptions that researchers make, but they convey limited information about more substantive decisions e.g. what to study – they also arguably pay limited attention to how the choice of certain paradigms influence the practical decisions researchers make (Morgan, 2007).

The Pragmatist core argument is that the research questions are the most important determinant of the philosophical stance the researcher adopts: different epistemology or ontology may be appropriate for answering particular questions in the same study (Saunders et al., 2009). Hence, pragmatists are free to study that which interests them in the way they deem fit (Tashakkori & Teddlie, 2003). Pragmatism therefore offers a middle position both philosophically and methodologically and facilitates the selection of methodological mixes that are appropriate in answering different research questions (Johnson & Onwuegbuzie 2004). This has been particularly relevant for this study because it involved different methods of data collection e.g. interviews, personal observation of company documents and factory tours. It is through the pragmatist philosophical position that this research takes advantage of such flexibilities during the research process as it does not require researchers to be committed to any of the traditional dualisms (e.g. Creswell, 2009).

### **3.2.2. Research Approach**

According to Saunders et al. (2009), research approach refers to whether the research is inductive or deductive. Combining both approaches in a single study is also possible and productive (Saunders et al. 2009). Whereas deductive research begins with the theoretical framework developed from the prior literature and formulates the hypotheses or propositions that should be tested empirically, a purely inductive research process begins with empirical observations prior to any theoretical framework and aims at theory building (Kovács & Spens, 2005). Whether there is a need to develop theory prior to empirical data collection is

still debatable. For example, scholars (e.g. Koulikoff-Souvion & Harrison, 2005) argue that prior theory limits flexibility in data collection because it leads to a predetermined mind-set, but others (e.g. Eisenhardt, 1989; Yin, 2003; Yin, 2009) encourage researchers to develop prior constructs in order to have a clear focus during data collection and avoid being overwhelmed by voluminous data. Moreover, Eisenhardt (1989) argues that the requirement for theory-building research to begin as close as possible to the idea of no theory under consideration is impossible to achieve. Nevertheless, to gain more valuable results, it is advised that researchers should allow room for flexibility in order to change positions between a strong theoretical background and a loose inductive design (Koulikoff-Souvion & Harrison, 2005).

In line with the above argument, this research began with a deductive approach by reviewing the literature in order to identify the knowledge gaps and develop research questions to guide the data collection. Thereafter, an inductive approach was used during the interview data collection and analysis via in-depth examination of issues relating to the research questions in order to understand how people interpret their social world (i.e. without being restricted by prior theory). To some authors, this approach of combining both deductive and inductive approaches in one study is also referred to as an abductive approach (e.g. Dubois & Gadde, 2002). This research did not only aim to describe what is happening, but also why and how it is happening (e.g. Saunders et al., 2009). More generally, this study adopted a largely inductive approach where the aim was to generate explanation from analysis as there was no commitment to a preconceived general theory. Rather, CAS theory lens was used as a guiding framework that was expected to contribute to interpretation and understanding of the empirical data, but one that would also allow the development of a particular line of theorising about SCRES that was not confined to the ideas contained in CAS (e.g. Ketokivi & Choi, 2014).

### **3.2.3. Research Strategy and Choice: Case Study**

Following Saunders et al. (2009)'s research design framework, research strategy can be in the form of survey, case study, grounded theory, ethnography, action research, experiment or archival research. Research choice on the other hand can be mono-methods, multiple methods or mixed methods (Saunders et al., 2009). The choice of a research strategy can be determined by the research question(s), the extent of existing knowledge, the available time and other resources as well as the researcher's philosophical underpinnings (Saunders et al., 2009). The literature review in Chapter 2 shows that SCRES researchers have made limited use of empirical approaches e.g. case studies. This makes it difficult to understand how and why SCRES is gained or lost in practice. More generally, empirical work has recently been encouraged in purchasing and supply chain management to enhance theory development and to provide strong and grounded examples (Dubois & Araujo, 2007). Certain research strategies may not fully explain the nature of supply chain phenomena such as resilience. For example, research based on modelling and simulation, which forms a significant part of the current SCRES literature, is usually prescriptive and aims to provide solutions to well-structured problems with the assumption of well-defined conditions. On the contrary, supply chains are viewed as partly social systems involving complex interrelated behavioural phenomena: implying that human behavioural factors influence supply chain decisions and behaviours and these can be best understood by strategies that embrace holistic and inductive approaches (Stuart et al., 2002; Randal & Mello, 2012). Prior researchers have called for increased use of qualitative case studies in supply chain management research (e.g. Seuring, 2008; Kähkönen, 2011). Thus, a case study approach is adopted in this study on the premise that there is no distinct boundary between the phenomenon and the context (Yin, 2009). This became especially clear when after using CAS to interpret the data in Chapter 5, it was

evidently important to adopt an embeddedness perspective to enhance understanding and derive more insights about SCRES.

The case study approach has been acknowledged as effective for building theory especially when the study phenomenon is still at its infancy (Voss et al., 2002; Voss, 2009; Yin, 2009) thereby needing to appropriately answer the how and why questions (Yin, 2009). From the literature review (in Chapter 2), it was evident that SCRES is a contemporary phenomenon that involves complex interrelated behavioural elements, lacks sufficient theory, and is not well understood in a developing country context. These are favourable conditions for adopting a case study approach (Stuart et al., 2002). The interest was to investigate how actors in a developing country setting understand and interpret threats to the resilience of their supply chains and what strategies they apply. Thus a qualitative case study approach was adopted where the aim was to generate explanation from analysis. It is acknowledged that qualitative data through in-depth interviews is important so as to get more detailed explanations to enhance understanding (Dubois & Araujo, 2007). And unlike, for example surveys, a case study approach is inherently flexible in that it enables the elicitation of rich data using a variety of data gathering techniques, such as interviews, personal observation and document analysis – this facilitates cross-validation of the findings (Seuring, 2008; Yin, 2009).

One of the prominent debates is about the different weaknesses of case studies relative to surveys. For example there is a common critique pertaining to the trade-off between the depth of information and potential for generalisability of the findings. While the case study approach enables the examination of a problem in a greater depth (Boyer & Swink, 2008), it is mainly criticised for a lack of generalisability. Nevertheless, some scholars (e.g. Meredith, 1998; Stuart et al., 2002; Yin, 2009) have discounted this criticism and argued that case studies can be generalised to theoretical propositions – case studies expand and generalise on

theories (analytical generalisation) rather than on populations (statistical generalisation) (Stuart et al., 2002; Ketokivi & Choi, 2014). Survey research is credited for its potential to provide generalisable findings (e.g. Christopher et al., 2011), but is mainly criticised for lacking in-depth information about the phenomenon. And given the nature of the study phenomenon as already explained above, case study using in-depth interviews can help in improving our understanding of how and why firms construct particular influences as threats to SCRES and particular responses as good and bad ways of dealing with them, especially in the context of a developing country – where such research has not been done before. And considering that SCRES is a feature of a system that is partially social, qualitative data will help to effectively understand the personal experiences, obtain information that is difficult to acquire through quantitative methods, understand underlying meanings in human interactions and get empirical insights in this under-researched area (Naslund, 2002).

### **3.2.4. Techniques and Procedures**

This subsection mainly explains how the data was collected and analysed. It highlights the choice of the cases, interview protocol, ethical concerns, pilot study, main data collection, data analysis and the quality of the research design.

#### *3.2.4.1. Selection of the Cases*

In qualitative research, the researcher's judgment in selecting appropriate respondents is arguably more effective than the use of probability sampling (Malhotra & Birks, 2007). From the SCRES literature, there was a clear need to conduct research on the resilience of supply chains in the developing world, using a network as the unit of analysis. Thus based on the principles of theoretical sampling, where cases should be selected based on their theoretical relevance, while allowing for flexibility to change cases during the research process (Eisenhardt, 1989; Stuart et al., 2002; Dubois & Araujo, 2007), the first criterion was to study

firms in the developing country context (Uganda). Secondly, only firms that formed a supply network were to be chosen, and these firms must have experienced supply chain problems. Further, these firms were to be located in Kampala (the capital of Uganda) and the surrounding industrial areas of Wakiso and Mukono – where the majority of Uganda’s manufacturing firms are located (Uganda Bureau of Statistics Report, 2011). Also, the network to be started was to include both local and multinational firms, which had been operating in the Ugandan context for at least 5 years.

Access began with JU, a beer manufacturing company where I had previously worked and where it was known several supply chain disruptions had been encountered. This company was also known to be connected in a supply network of many other local firms. Employees from JU later facilitated access to three of their suppliers: two sugar manufacturers (FU & GU) and one packaging materials producer (DU). Subsequent relevant firms were later added based on the data from the previous ones, in line with theoretical sampling. For example, it was decided that competitor firms and part-government-owned firms should be incorporated to reflect the recurring interview themes of unfair competition and corruption.

The arguments concerning the most appropriate number of cases for case study research are still inconclusive. For example, there is an ongoing debate on single versus multiple case studies. While some researchers (e.g. Dyer & Wilkins, 1991) advocate the use of single case studies on the ground that they provide rich theoretical insights, others (e.g. Yin, 2003) prefer multiple cases and in fact proceed to warn that researchers who opt to use single cases need to strongly justify their decisions. Multiple cases are credited for enabling analytical generalisation: they arguably enable replication of findings within cases (Eisenhardt, 1989; Dubois & Araujo, 2007), and they thus enhance the external validity of findings and minimise observer bias (e.g. Barratt et al., 2011). Based on the aforementioned argument, this study used an embedded case study design of a supply network of multiple firms (Eisenhardt,

1989; Yin, 2009) – this supply network consisted of 20 manufacturing firms. One of the gaps identified in the current SCRES literature is the predominant use of a firm as the unit of analysis. Kim et al. (2015a) recently argued against the current firm level analysis of SCRES phenomena, suggesting that a supply network would be the appropriate level of analysis.

Furthermore, there is no agreement on the most ideal number of cases to use in a multiple case research. For example, Lewis (1998) recommends between twenty and thirty cases as the most appropriate to increase case diversity and enhance iterative triangulation, while Eisenhardt (1989) argued that a number between four and ten cases is suitable. While it is clear that there is no consensus on the ideal number of cases that should be predetermined prior to data collection, theoretical saturation – a point of beginning to realise that marginal information has tremendously diminished (Eisenhardt 1989; Kaufmann & Denk 2011) has been suggested as the determinant for the appropriate number of cases. In other words, data collection should continue until when no new categories or dimensions emerge from additional data (Idrees et al., 2011; Manuj & Pohlen, 2012). In this study, data collection was valuable until seventeen firms when theoretical saturation was reached. Thereafter, three more firms were added in order to confirm that theoretical saturation was indeed attained as recommended by (Eisenhardt & Graebner, 2007). Thus, twenty companies were enough to meet the requirements of the study.

The table below provides a summary of the twenty firms in the network studied (which have been anonymized and are referred to as AU, BU, and so on through to TU) including the complete list of interviewees, year of establishment, sizes and their products. Ten of these companies were locally based and the remaining ten were multinational corporations. These firms are of different sizes and years of existence. The biggest company in terms of employees has 7000 staff while the smallest employs 85. The oldest firm was

established in 1921 while the youngest was established in 2008. The table that follows provides a more detailed profile of these firms.

Table 3.1: Profiles of Case Companies in the Network

	Firm	No. of Interviewees	Job title & (years spent in the firm)	Established (year)	No. of employees	Products	Annual sales (million Ugandan shillings)
Locally Based	DU	1	MAOF (7years)	1997	400	Packaging materials	160,000
	FU	1	CMGR (13 years)	1930	7000	Sugar	240,000
	GU	1	SAME (13 years )	1969	1900	Sugar	200,000
	HU	2	POMG (5 years), MKTG (10 years)	2002	115	Concrete products	2,000
	JU	6	PLMO (6 years), PROM (6 years) , TMKG (5 years), MAND (6 years), SMKT(4), RESG (3 years)	2008	250	Alcohol (Beer)	4,000
	KU	2	MKTG (8 years), GENL (10 years)	2001	300	Alcohol (Spirits)	-
	OU	1	SMKT (1 year)	1994	200	Steel products raw materials	100,000
	PU	3	PROM (3 years), PROC (12 years), BRMG (3 years)	2003	-	Foods & Beverages	60,000
	RU	2	LASS (5 years), SMGR (8 years)	2002	500	Steel products	2,500
SU	2	APRO (2 years), FACE (12 years)	1967	85	Car batteries	22,000	
Multinational corporations	AU	1	MKTG (10 years)	1921	2000	Hair products	20,000
	BU	5	SSUP (2 years), DWMG (4 years), EXMG (22 years), SMGR (2 years), MERG (4years)	1966	200	Foot wear	27,000
	CU	2	PSCO (15 years), MKTG (11 years)	1960	230	Steel & Aluminium & glass	10,000
	EU	2	PROM (3 years), DESU (7 years)	1991	250	Cement	50,000
	IU	3	BRMG (6 years), FING (4 years), BRMG (12 years)	1951	700	Alcohol (Beer)	627,800
	LU	4	ASMG (8 years), PROC (5 years), WARG( 5 years), ASDG (5 years)	1981	500	Paper products	30,000
	MU	2	COMP (6 years), SCMG (1 years)	2007	250	Pharmaceuticals	87,500
	NU	2	INVG (8 years), MKTG (1 years)	2006	200	Paints	500,000
	TU	1	CSMG (4 years)	1950	600	Alcohol (Beer)	1,000,000
QU	2	PROC (6 years), PROM (8 years)	2006	300	Dairy products	-	

**Interviewees' titles:** Marketing manager (MKTG), Marketing officer (MAOF), Corporate Marketing manager (CMGR), Sales & Marketing executive (SAME), Production & Operations manager (POMG), Procurement & Logistics officer (PLMO), Procurement manager (PROM), Managing director (MAND), Sales & Marketing manager (SMKT), Regional Sales manager (RESG), Trade marketing manager (TMKG), General manager (GENL), Brand manager (BRMG), Procurement officer (PROC), Logistics assistant (LASS), Sales manager (SMGR), Assistant procurement manager (APRO), Factory Engineer (FACE), Sales Coordinator (SSUP), Distribution & Ware house manager (DWMG), Export manager (EXMG), Merchandise manager (MERG), Production & Site coordinator (PSCO), Depot supervisor (DESU), Finance manager (FING), Warehouse manager (WARG), Assistant Distribution manager (ASMG), Assistant Sales manager (ASDG), Company Pharmacist (COMP), Supply chain manager (SCMG), Inventory manager (INVG), Route to consumer supply manager (CSMG)

From table 3.1, it is shown that the studied firms were in diverse industries. These firms are interlinked in a network as either suppliers or buyers e.g. of raw materials and packaging materials. Figure 3.2 shows that companies DU and LU which manufacture packaging materials and other paper products supply many of the other companies – DU is the largest manufacturer of packaging materials in Uganda. Companies FU and GU are the largest sugar manufacturers and they supply sugar as a raw material to beer manufacturing firms IU, JU and TU. Also notable were the informal linkages between some of the firms which also facilitated access during data collection whereby employees in the already interviewed firms facilitated connection to their friends as potential interviewees in other firms. These informal networks were indeed very significant because “*informal networking*” later emerged in the data as one of the strategies for building SCRES as will be discussed in detail in Chapter 4.

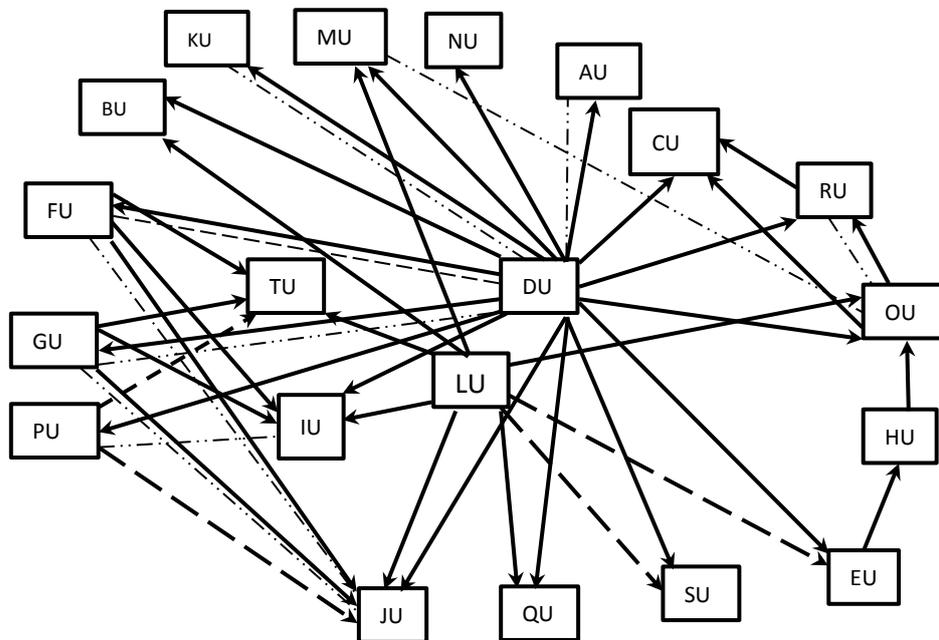
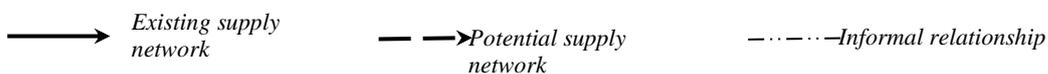


Figure 3.2: Formal and Informal Networks of the Firms Studied



#### *3.2.4.2. The Case Study/Interview Protocol*

The case study protocol refers mainly to the interview questions (Yin, 2003). According to Eisenhardt (1989), archival records, interviews and direct observation are the most common sources of case study evidence. Open-ended questions (for semi-structured interviews) were formulated. The aim was to probe new areas that would emerge in the course of data collection, as suggested by Manuj & Pohlen (2012). The first theme concerned what manufacturing firms in Uganda perceived to be the threats to their supply chains. This probed different categories of threats, e.g. supply-side threats, demand-side threats, firm-level threats, and threats external to the supply chain. The interest was also in the corresponding strategies adopted to build resilience and, for each strategy, questions were asked about the outcome of its implementation, i.e. whether a strategy was successful or had adverse effects. The second theme concerned the relationships between threats and strategies, and what such interrelatedness meant for SCRES. The interview protocol was meant for guidance but more probing was made where interesting findings emerged. For example, one of the interesting findings was co-opetition as a SCRES strategy and more probing was done to ascertain how competitors could collaborate to mitigate threats to their supply chains. The protocol was piloted to ensure appropriateness for the main data collection as will be clarified later (in section 3.2.4.4).

#### *3.2.4.3. Ethical Concerns*

Research ethics relate to the conduct of research in a moral and responsible way in relation to the rights of those who become the subject of the study and/or are affected by it (Saunders et al., 2009). Yin (2009) advises researchers to consider ethical issues that may arise as a result of the nature of the study as well as method used to obtain data especially when studying a contemporary phenomenon in a real life context. Examples of such ethical issues include: protecting human subjects from any harm or deception, gaining informed consent from

potential respondents, protecting vulnerable groups, protecting privacy and confidentiality of information. Although this study was considered relatively “low risk” with regard to ethical issues as per Lancaster University assessment of code of practice for ethical research, it is important for any study to abide by some ethical standards (Saunders et al., 2009). This study was guided by Lancaster University code of practice where the proposal together with the participant information sheet (to provide participants with information about the research) and the consent form (to enable participants make voluntary and informed consent) were assessed and approved by the university ethics committee. Ethics clearance was provided as required by the Lancaster University regulations. Thereafter, the participant information sheets and consent forms were sent to potential participants prior to data collection to enable them to make informed decisions regarding participation.

#### *3.2.4.4. The Pilot Study*

Several scholars have suggested reasons for conducting a pilot study prior to the main data collection. For example, Yin (2003) indicated that a pilot study is important to test and refine the interview protocol, develop the required research skills and to get an idea of the potential case firms for the main study. Christopher et al. (2011) argued that pilot studies can help to ensure clarity in the case study protocol and to gauge the actual time required to respond to questions in the main study. Furthermore, pilot studies arguably help to assess the potential willingness of interviewees to follow the case study protocol and to enable researchers prepare to handle unanticipated responses (Foster, 2013).

A pilot study was conducted in the UK using face-to-face interviews with three professional managers who had occupied senior positions in manufacturing firms (a Senior Merchandise Manager, Process Engineer, and a Director of Manufacturing & Quality Systems) in firms whose manufacturing facilities were located in different countries (e.g. Turkey, the UK, India, China, Bangladesh & Brazil). These interviewees represented three

distinct manufacturing sectors i.e. Garments, Motor vehicle components and Mineral processing. As stated by Yin (2009), pilot studies may be conducted for reasons not related to the criteria for selecting the final cases, such as accessibility and geographical convenience of the informants as well as their knowledge of the study phenomena. Pilot interview data was collected through both digital voice recording and handwritten notes which were later transcribed and analysed. The pilot data collection process was helpful for improving interviewing skills in different aspects such as how to phrase questions so as to get the required information. It further provided an opportunity to get feedback from the respondents – this helped to adjust the questions that were deemed unclear and to estimate the likely minimum time of one hour for each interview for the main study.

Pilot data analysis helped to assess the validity of the research protocol by ascertaining whether the data represented the content of the protocol – whether there could be other important variables that were not included in the case study protocol – or variables that needed further probing and also to develop qualitative data analysis skills for the main study as analysis would begin during data collection in line with theoretical sampling. For example, some threats to SCRES were not well represented in the literature such as limited supply market, lack of internal coordination, dishonest customers and suppliers and power asymmetries but emerged in the pilot data. Further, the emergence from the data, of conditions that produce threats such as limited supply market helped to realise the need to include, in the main study, cases where many manufacturing firms have a limited supply base (e.g. many foods and beverages manufacturing firms in Uganda source sugar from a limited number of local sugar manufacturing firms. These sugar manufacturing firms also source their raw materials from limited sugarcane suppliers). Also the finding on power asymmetries indicated a need to include some firms which supply bigger customers (e.g. corporate customers or governments) and where such customers have many other alternative suppliers. Other than the aforementioned purpose, the pilot data is not used any further in the thesis.

#### *3.2.4.5. Data Collection*

Data was collected through a cross sectional approach, beginning in the first week of January, 2014 through to April, 2014. The strategy was to begin with the companies that had earlier accepted during the preliminary visits in August, 2013 and later to request for more connections to their relevant suppliers and/or customers. The use of the current respondents to connect to potential companies worked for most of the cases and gaining entry became a bit easier – this was mainly facilitated by both formal and informal networks between firms and employees (as earlier shown in Figure 4.3). Generally, gaining entry was facilitated by several factors including: having studied and worked in Makerere University – the oldest and biggest University in Uganda. In most of the companies, it was easy to find my former school mates, former colleagues, former or even current students at Makerere University. Most of these would be willing to provide any assistance including connection to other companies e.g. where their colleagues were working.

Although prior connections would be secured hitherto visiting most of the companies, it was sometimes challenging to pass some of the companies' gates. The gatekeeping staff especially security guards would demand signing the visitors' books indicating the department of interest and the reasons for the visit – and whenever I would give research as the reason, most of these gatekeepers would be reluctant and some would completely deny entry. Having bypassed the gate, the next challenge was the front office desk staff. In the Ugandan firms, most of these employees have relatively limited education and do not understand why people should do research. Moreover, the research culture in Uganda is still poor and most of the front office desk employees are instructed not to accept researchers to go beyond the reception. Beyond this, it was a bit easier because higher level managers were more receptive than the low level staff as most of them had done research before – some would even indicate they were enjoying being involved in research at a PhD level.

Another interesting observation was that employees in marketing and sales were more receptive than those in other functional areas such as procurement. Although interest was also in the marketing staff, the first priority was procurement and/or supply chain. But after visiting a few companies, I realised that it would be easier to gain entry by mentioning marketing or sales rather than procurement. Hence I changed the strategy – to enter through marketing and sales in most of the cases and thereafter connect to other functions and it worked out well. A staff in marketing would easily provide connection to fellow staff in other departments. This is probably because since most were private companies with profit motives, they regarded people who visit marketing and sales as potential or current customers who deserved care. But they consider those who visit procurement as either current suppliers looking for business, demanding payments (since in the data, some companies revealed a problem of delayed payment to their suppliers) or potential suppliers looking for business. Data collection had initially been estimated to last only eight weeks, but by the end of the first month, it became clear that this target could not be attainable as few interviews had been conducted but with so many scheduled appointments.

Data was mainly collected using interviews, which were supplemented with factory tours, viewing company websites and direct observation of documents, e.g. meeting minutes and delivery schedules – these helped in triangulating and supporting interview data. For example, direct observation of delivery schedules and disciplinary committee meeting minutes in some firms helped to further confirm the existence of threats like raw material delays and shortages and dishonest employees respectively. Further, viewing company websites and direct observation of documents helped in establishing profiles of the study firms that were later illustrated in Table 3.1. In total, 45 semi-structured, audio-recorded face-to-face interviews lasting between 30 and 80 minutes were conducted with managers and other key personnel knowledgeable in supply chain related functions. All the 45 interviewees accepted to be audio-recorded. In fifteen companies, multiple respondents from each were

separately interviewed to minimise bias. But five companies were each represented by only one interviewee as getting more in the limited time proved difficult. Interviewees were chosen from different authority levels, providing different perspectives on the phenomenon of interest (see Table 3.1 for firm and interviewee details). For example, while factors such as labour disputes and payment delays (both suppliers and staff) were mostly revealed by e.g. procurement and logistics officers, Managing Directors and General Managers referred to threats such as dishonest employees. This approach has been encouraged in inductive research by Randal & Mello (2012).

Most of the interviews were conducted in quiet places such as meeting rooms and interviewees' offices. However, five interviewees preferred the outside work environment but we would again look for relatively quiet venues. Initially, a second year Bachelor of Business Administration student at Makerere University was employed to assist in locating potential study firms. Most of the data was transcribed as soon as possible – mostly on the same day it was collected but there were instances where it was not possible e.g. where an average of three interviews per day were conducted in different locations for three consecutive days. But these would be transcribed during some of the days when there were no scheduled appointments. By transcribing the interviews as soon as possible, it would help to highlight interesting findings that would require more probing as recommended by Morse et al. (2002). This would guide the next interviews in terms of e.g. the questions to be emphasised, potential respondents and companies, thus supporting theoretical sampling.

#### *3.2.4.6. The Unit of Analysis*

The unit of analysis was a fragment of a supply network, i.e. some portion of the supply network that respondents referred to as their supply chains. The supply network fragments referred to were either part of the network illustrated in Figure 3.2 or outside it. Although the respondents were managers and other staff representing manufacturing firms, the data that

was collected and analysed was not about individual firms in isolation, but about their relationships with their upstream or downstream partners at different tiers. Thus, the network fragments analysed were at different levels and scales i.e. dyads or beyond dyads.

The difficulty of defining the unit of analysis in supply chain research has been previously acknowledged due to the subjective nature of what people in different firms refer to as their supply networks (e.g. Carter et al., 2015). And many of the previous SCRES researchers highlighted in Chapter 2 have not explicitly indicated their units of analysis (e.g. Blackhurst et al., 2011; Jüttner & Maklan, 2011; Mandal, 2012; Leat & Revoredo, 2013; Johnson et al., 2013; Scholten et al., 2014). Those who have highlighted their units of analysis (e.g. Wieland & Wallenburg, 2013; Brandon-Jones et al., 2014; Gölgeci & Ponomarov, 2014; Scholten & Schilder, 2015) have not attempted to justify their choices. Moreover, some of the units of analysis highlighted can be confusing. For example, Brandon-Jones et al. (2014) stated that their unit of analysis was a firm and its upstream suppliers. This is not clear as to whether or not there were multiple units of analysis (e.g. a firm, tier 1 suppliers, tier 2 suppliers etc.). A similar ambiguity is observed in Wieland & Wallenburg (2013) who considered their unit of analysis as a firm and its interface with suppliers and customers.

In this particular study, data collection focussed on how threats affect the supply chains and not how individual firms are affected by supply chain threats. Thus, in Chapter 4, the analysis was focussed on relationships between firms and their suppliers and/or customers at different scales and levels/tiers.

#### *3.2.4.7. Data Analysis*

Data was analysed inductively – generally following grounded analysis principles. Grounded analysis, which is closely linked to grounded theory, is considered appropriate for theory development where the structure develops from the data rather than forcing the data to fit into predetermined categories (Walker & Myrick, 2006). The use of grounded theory concepts is

encouraged in developing theory in supply chain research (Randal & Mello, 2012). A rigorous analysis was conducted and themes, patterns and categories were developed out of the data as recommended by Easterby-Smith et al. (2008). The aim was to avoid being constrained by prior theory, to remain open to being surprised by the data, and to make sense of the emerging surprises (Kaufmann & Denk 2011; Ketokivi & Choi, 2014). Repeated readings of the transcripts were first conducted in order to understand the data and identify data fragments that referred in some way to certain aspects of the research questions. Then tables were drawn in which segregated fragments of data were recorded and assigned codes which were continuously re-evaluated and modified where necessary through an iterative process as recommended by (Miles et al., 2014).

Data was then undertaken at two levels. First, a reductionist analysis to develop a category structure for the data. This structure was developed based on the prior knowledge of the literature (referred to as theoretical sensitivity), which is important in grounded analysis in order to understand and interpret the data and to differentiate between relevant and non-relevant data (Glaser 1978; Mello & Flint, 2009; Charmaz, 2012). There were three high-level categories: supply chain threats, SCRES strategies and strategy outcomes. A lower level set of categories was also developed through cross-case analysis (Barratt et al., 2011), comparing different instances of the same code. The category structure was refined by identifying differences and similarities among the categories (Strauss & Corbin, 1990), followed by merging and eliminating to reach consistency, as recommended by Miles et al. (2014). It was found at this stage, for example, that a whole set of conditions produced or compounded threats without actually being threats in their own right.

The second, integrative level of analysis involved the use of CAS to further understand and interpret the data through the identification of patterns in which threats (and conditions that lead to threats), strategies and outcomes were inter-related. The transcripts were used to identify links between the threats (and conditions that lead to threats); strategies and

outcomes that had been established by the interviewees (see Appendix 2). This produced a second network – not of firms but of conditions/threats/strategies/outcomes. Each node in this network is a condition, threat, strategy, or outcome with incoming and outgoing links. In other words, it is caused by a certain factor or set of factors and/or leads to an outcome or set of outcomes (positive or negative). The emergent network was then constructed, but it became too densely populated to enable the labelling of nodes and links; and can be used only to visualise the emergent complex network. In Chapter 5, a table (Table 5.1), histogram (Figure 5.1) and a network map (Figure 5.2) that summarise the data will be presented, and two distinct fragments of this network will be analysed. It was at this point in the analysis that it was found that many of the inter-relations themselves needed explanation – and the importance of context in explaining these inter-relations resulted in supplementing CAS with an embeddedness view. For example, threats or threatening conditions such as corruption, product counterfeiting, unfair competition, and dishonest employees originated from the supply network's embeddedness in a developing country characterised by weak political and legal controls.

### **3.3. Quality of the research design**

In order to ensure rigorous qualitative case study research, scholars have suggested different criteria – some contradicting each other depending on the different philosophical paradigms of researchers. For example, Yin (2003) suggested the criteria for ensuring quality of case study research and how such criteria could be followed and this has been generally adopted by other researchers in operations management (e.g. Stuart et al., 2002; Stevenson & Spring, 2007; Christopher et al., 2011). These quality measures include construct validity – which seeks to establish the correctness of operational measures for the study constructs. In this research for example, this was achieved through developing an interview protocol based on

the literature, piloting the protocol with informants who had occupied relevant positions in three distinct manufacturing firms, using multiple firms as sources of data, triangulation of data sources e.g. interviews, observation and company records, sending back a summary of the report to the interviewees for validation and using multiple respondents in most of the firms; Internal validity – which seeks to establish causal relationships and to distinguish them from spurious ones was ensured through using pattern matching through cross-case analysis; external validity – which concerns the generalisation of findings was achieved through using multiple cases and theoretical sampling to enhance analytical generalisation while reliability – which aims to ensure that the study can be repeated with the same results was achieved through adequate description of the study setting/context, using a documented and validated case study protocol and maintaining a case study database that provides an audit trail of the entire research process including the justifications for undertaking certain decisions.

Although Yin (2003)'s quality criteria has been generally adopted in operations management, some other researchers (e.g. Kaufmann & Denk, 2011) have maintained that the concepts used e.g. validity are based on positivism. They instead advocated the adoption of Lincoln and Guba (1985)'s interpretive equivalents i.e. credibility, dependability, confirmability and transferability. Nevertheless, some of these contradictions are a matter of different interpretations of the concepts. For example, Kaufmann & Denk (2011) mentioned that transferability is a substitute for external validity and further argued that the former contradicts credibility. Other quality measures applied in this research included:

- Ensuring fair dealing by incorporating different perspectives; attention to negative cases by explaining information that seemed to contradict the phenomena under study and reflexivity (being sensitive to the ways the research process and the researcher have influenced the data collected considering the role of assumptions and prior experience) (Mays & Pope 2000).

- Iterative interaction between data and analysis; by beginning analysis during data collection so that ideas emerging from data are reconfirmed in new data leading to new ideas that are further confirmed by the already collected data and verification by moving back and forth to ensure alignment between research questions, literature, recruitment, data collection strategies, analysis (Morse et al., 2002).
- Choosing the right participants and allowing for flexibility to change the research questions and methods as suggested by Morse et al. (2002).

In the next chapter (Chapter 4), the first level analysis of data will be presented to develop a category structure for the data, where the findings will be organised under three high-level categories: supply chain threats, SCRES strategies and strategy outcomes; as well as corresponding lower level set of categories developed through cross-case analysis. It is this analysis that will provide a springboard for the second more integrative level of analysis in Chapter 5.

## **CHAPTER 4**

### **FIRST LEVEL ANALYSIS OF DATA**

#### **4.1. Introduction**

This chapter presents the first level analysis of the study data – a somewhat reductionist analysis to develop a category structure from the data. This chapter provides a detailed account showing the richness of the data – thus it will be fairly extensive. The findings from this data analysis will be categorised under three higher level classes i.e. supply chain threats, supply chain resilience (SCRES) strategies and outcomes, and the sub-categories of these classes – presented in the form of text, tables and figures. This level of analysis will show that some threats and strategies identified from the data have not been acknowledged in SCRES literature before; and some of those which have been acknowledged are explained differently using empirical evidence unique to a developing country context. The chapter begins with a taxonomy of supply chain threats derived from the data, which are later on individually discussed (including the conditions leading to or compounding their occurrence) (4.2). This is followed by the taxonomy of resilience strategies (4.3), and outcomes of implementing particular SCRES strategies (4.4). Finally, concluding remarks are given in section 4.5, which points to further systemic investigation of the relationships among threats, strategies and outcomes in the following chapter.

#### **4.2. Supply Chain Threats**

Supply chain threats were first categorised into two broad types, as summarised in Table 4.1.

1. Endogenous threats originating from within the supply chain, which were further divided into three categories (with corresponding lower level categories): supply-side

threats originating from upstream, firm-level threats originating from within the focal firm and demand-side threats originating from downstream.

2. Exogenous threats originating from outside the supply chain, which were further divided into geopolitical threats and economic threats (with corresponding lower level categories).

From the interview data on threats, it became clear that interviewees had a broad understanding of the term ‘threat’. Some responses referred to threatening events e.g. supplier delivery failure and others to threatening conditions that produced or compounded a threat e.g. long distance sourcing. According to the aim of this study, it was the informants’ construction of ‘threat’ that was instrumental.

Table 4.1: Taxonomy of Exogenous & Endogenous Threats to the Supply Chain

<b>Exogenous Supply Chain Threats</b>				
<b>Geopolitical Threats</b>		<b>Economic Threats</b>		
Political instabilities, Geographical location (landlockedness), National politics, Government policy, Weak legal system, Corruption, Product counterfeiting, In-transit raw material theft, Communication barriers, Natural disasters		Informal sector, Unfair competition, Poor transport infrastructure, Unstable taxation, Exchange rate fluctuations, Power shortages		
↓				
<b>Endogenous Supply Chain Threats</b>				
<b>Upstream Supply Chain</b>		<b>Focal Company</b>	<b>Downstream Supply Chain</b>	
<i>Supply-Side Threats</i>		<i>Firm Level Threats</i>	<i>Demand-Side Threats</i>	
<ul style="list-style-type: none"> <li>-Power asymmetries related threats (stronger suppliers)</li> <li>-Long distance sourcing triggered threats</li> <li>-Limited local supply market</li> <li>- Product counterfeiting</li> <li>-Poor quality raw materials</li> <li>- Dishonest suppliers</li> <li>- Raw material delays and shortages</li> <li>- Financial difficulties of suppliers</li> <li>-Supplier delivery failure</li> <li>-Reputational risk</li> </ul>	↔	<ul style="list-style-type: none"> <li>Machine breakdowns</li> <li>-Product characteristics</li> <li>-Owner management behaviour</li> <li>-Dishonest employees</li> <li>-Insufficient skilled manpower</li> <li>-Poor internal coordination</li> <li>-Poor quality products</li> <li>-Payment threat (to suppliers/labour)</li> <li>-Financial difficulties (focal firm)</li> <li>-Procurement risk</li> <li>-Industrial disputes</li> <li>-Poor customer delivery performance</li> </ul>	↔	<ul style="list-style-type: none"> <li>-Power asymmetries related threats (stronger customers)</li> <li>-Dishonest customers/ distributors</li> <li>-Payment threat (from customers)</li> <li>-Financial difficulties of customers</li> <li>-Order cancellations</li> <li>-Demand variations</li> <li>-Customer characteristics</li> <li>-Reputational risk</li> </ul>

## 4.2.1. Exogenous Supply Chain Threats

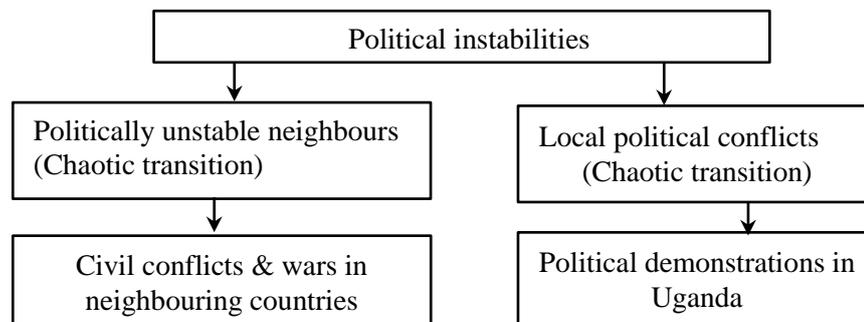
### 4.2.1.1. Geopolitical Threats

These can be described as potential governmental, natural and societal disruptions of supply chain operations across different geographical locations. The data revealed ten geopolitical threats highlighted in table 4.1, and discussed below:

- **Political Instabilities**

All of the 20 companies highlighted political instabilities as a threat to their supply chains. One of the reported causes of this threat was the chaotic political transitions in some African countries. The Route-to-Consumer Supply Manager for firm TU commented: *“Whenever there is a political change, the business is affected. For example wars in Southern Sudan and Congo deter us from exportation. The political factor affects business in Africa.”* It was indicated that demonstrations, civil conflicts and wars that characterise these political transitions disrupt transport routes and cause shortages and delays of raw materials; and other utilities like fuel. The seriousness of these disruptions to the supply chains can be manifested in the closure of some companies as reported by KU’s Marketing Manager: *“Delay of raw materials is sometimes caused by political conflicts e.g. in Kenya. Our vehicles cannot move in politically unstable countries, so we do not produce and our market is affected...during the Kenya post-election violence, it was hard to import raw materials and some companies closed down.”* The political conflicts in Uganda were also highlighted as a supply chain threat as stated by KU’s Marketing Manager: *“Even in Uganda when there are political demonstrations, there is police crackdown, tear gas etc. which affect our marketing and distribution.”*

Interestingly, all 20 firms emphasised political instabilities in the neighbouring countries e.g. Kenya, Congo, Southern Sudan, Rwanda and Burundi as a major threat both to the upstream (by constraining raw material flows) and downstream (by disrupting delivery of products to customers). For example, GU’s Sales & Marketing Executive noted: *“Sudan has been one of our main destinations and the war has affected our supply chain. Instabilities in Congo, Rwanda and Burundi affect our supply chain.”* The different kinds of political instabilities identified from the data are summarised in Figure 4.1. The threat of political instabilities analysed above shows that the geographical context of a (part of a) supply chain is important for its resilience.



*Figure 4.1: Kinds of Political Instabilities Revealed in the Data*

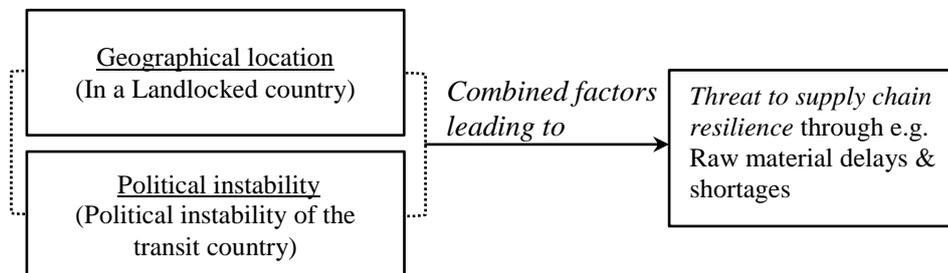
- **Geographical Location (Landlockedness)**

Firms revealed that the geographical location of Uganda as a landlocked country makes them vulnerable to certain supply chain threats. Six companies (TU, FU, JU, PU, MU, LU) indicated that when there is political chaos in Kenya, the flow of raw materials is disrupted resulting in delays and production stoppages. LU’s Assistant Sales Manager commented: *“Being a landlocked country, most of our imported raw materials pass through Kenya. During the post-election violence we lacked raw materials, which constrained production.”* This was further reiterated by PU’s Procurement Manager: *“When there was political violence in Kenya, all manufacturing companies in Uganda ran out of stocks of raw materials...Our raw materials could not be delivered via Mombasa. By the nature of our*

*location in Uganda, whenever there are elections in Kenya, we expect violence...because we are a landlocked country.”*

The interviewees further argued that the geographical location – being in a landlocked country – makes them vulnerable to other threats like poor road transport infrastructure in the transit country, resulting in or compounding raw material delays and high transportation costs. MU’s Supply Chain Manager revealed: *“Uganda, being a landlocked country, most of the raw materials come from Europe by sea, and air is not cost- effective. There are delays because we need to transport them from Mombasa by road. The road infrastructure is also poor... It takes around fifteen days from the seaport to Uganda. Transporting from Mombasa to Uganda is costly.”* The above findings demonstrate that political instabilities and poor transport infrastructure in the neighbouring country can be a threat to SCRES of firms in Uganda due to its geographical location (being landlocked) coupled with the fact that Kenya is the transit route.

The general observation here is that certain factors (e.g. political instabilities of the neighbouring country) can become threats to SCRES only if combined with certain conditions (e.g. being situated in a landlocked country, with the politically unstable neighbour being the only transit route). This also shows how threats can reinforce each other to constrain SCRES as shown in Figure 4.2.



*Figure 4.2: Combined Factors Form Threat to SCRES*

- **National Politics**

Two companies reported national politics as a threat to their supply chains. Interviewees from BU and PU argued that the delivery of products to customers is disrupted by frequent political demonstrations in Uganda led by opposition politicians purportedly against bad governance. They further argued that national politics perpetuates corruption where business success in Uganda largely depends on political connections and patronages; and politicians support the informal businesses instead of regulating them, which creates unfair competition – informal actors do not pay taxes and offer lower prices. It was reported that this is done as a means to achieve political capital in the form of support so as to maintain grip on power. PU's Procurement Manager explained: “ *...due to corruption, most of our competitors do not pay taxes on some materials...you know in Uganda things are handled with political influence and less professionalism...Some companies have closed due to the informal sector. Informal actors are favoured by politicians looking for votes.* ”

Company BU, which is in the fashion industry, indicated that the recently adopted multiparty system of governance has disrupted their supply chains – that political parties have adopted different colours as differentiating/branding features and this has greatly influenced customer choices. This has reportedly resulted in demand variations and subsequent demand-supply mismatch risk – customers have become colour sensitive and increasingly unpredictable as claimed by BU's Sales Manager: “ *One time we bought shoes in yellow colour which relates to one of the political parties [the ruling party]. Some people refused to buy...we are now colour sensitive. We aim to mix the colours but this is unpredictable and hard to sustain. Ensuring we have all colours full time is difficult. People also keep moving from one political party to another and demand becomes volatile.* ” This suggests there is a link between the system of political governance in a certain territory and the resilience of supply chains situated there.

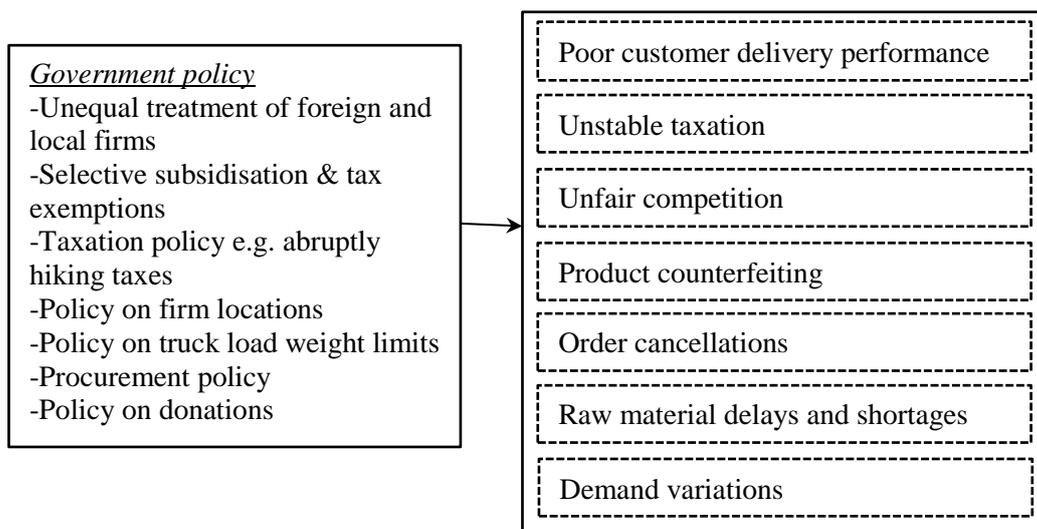
- **Government Policy**

Eight companies (BU, DU, JU, RU, IU, FU, HU, MU) highlighted government policy as a threat to their supply chains. This includes supporting foreign investors and not protecting indigenous firms coupled with a discriminatory policy of selective subsidisation and tax exemptions, which facilitates unfair competition. BU's Merchandise Manager commented: *"The government policy of subsidising some investors selectively has affected us. The subsidised out-compete us on price. This may be due to corruption or political connections because some firms are given more years of tax exemptions than others."* Besides the consistently unpredictable tax increases, companies blamed the government policy on firm locations especially those that use the same agricultural raw materials. It was indicated that such policy contributes to the shortage of raw materials as stated by FU's Corporate Marketing Manager: *"The government policy of licensing new sugar companies and having them close to each other should be checked. The more we are close, the more we have to compete with few suppliers in that locality."*

Others like RU attributed distribution cost escalations and product delivery delays to the policy on truck load weight limits, while HU blamed the government for encouraging the use of counterfeit raw materials. HU and MU, whose main customer is the government, attributed late approvals, delayed deliveries and order cancellations to the government's procurement policy that is time consuming and too bureaucratic. The Marketing Manager for HU, which manufactures concrete products, explained that by the time the government completes the procurement approval process, there is limited time left in which to manufacture and deliver the products. Yet, most of the government's procurements are made for special occasions like celebrating independence anniversaries which are difficult to postpone. MU (the pharmaceutical manufacturing firm), which must order their expensive raw materials after government approval, also highlighted the government bureaucratic procedures as causing raw material delays and shortages. MU further argued that the government policy of allowing

donations to interfere with their operations poses threat to their supply chains. MU's Company Pharmacist commented: *"Donations affect us e.g. National Medical Stores [government entity] gives you forecast for raw materials and you purchase them. But donors e.g. Global Fund donates part of that, but you already have raw materials. So these donations suffocate local firms. They disrupt the supply chain."*

From the data analysis above, it has been found that the different components of government policy can disrupt both the downstream supply chain (e.g. the bureaucratic procurement policy that affects production and delivery to customers), and the upstream supply chain (e.g. by producing other threats like raw material delays and shortages). The relevant components and consequences of government policy identified from the data are summarised in Figure 4.3.



*Figure 4.3: Government Policy and its Consequences*

- **Weak Legal System**

Three companies (CU, TU, LU) indicated that a weak legal system characterised by weak laws and judicial corruption results in supply chain threats like product counterfeiting. CU's Production and Site Coordinator observed: *"Our laws are still weak and there are no specific*

*laws against counterfeits.*” Companies argued that a lack of copyright laws in Uganda is responsible for increased copy right infringement. TU’s Route-to-Consumer Supply Manager commented: *“Our original label/logo was copied and because of the weak Ugandan law compounded by corruption, it will take a long time to have copy right laws.”* Company LU indicated that their customers exploit a weak legal system and a corrupt judiciary to default payment for goods offered on credit, leading to financial difficulties. LU’s Assistant Sales Manager argued: *“After entrusting the distributor with goods worth millions, they disappear, refuse to pay or switch to competitors. We forward to the legal department to handle such cases. But sometimes these cases vanish due to corruption [bribery]”*.

The above analysis shows that the absence or weakness of legal controls in the context where the supply chain is situated can disrupt the supply chain especially through failure to mitigate intentional threats like product counterfeiting and payment defaults by customers.

- **Corruption**

Eleven firms (TU, FU, BU, HU, LU, CU, PU, JU, GU, KU, MU) revealed that corruption in the form of bribery, conflict of interest, connivance, political favouritism and lack of transparency caused various supply chain disruptions. For example, JU’s Procurement Manager stated: *“This poor road network should be attributed to a lack of political will and corruption in African countries including Uganda. Imagine, instead of constructing long-lasting roads, money allocated is embezzled by employees...Corruption has now become part of the government and our daily activities. No bribe, no service, no survival.”* It was highlighted that the need to pay bribes to customs officials during clearance leads to raw material delays and shortages. BU’s Sales Manager noted: *“...By the time you deliver late, you miss the seasons and fashion changes...clearance at the boarder increases our lead time. Sometimes, we delay because others bribe customs officials in order to be cleared fast...”* It was further reported that firms connive with government staff and dodge taxes leading to

unfair competitive practices such as price wars. JU's Procurement & Logistics Officer stated: *"Some competitors lobby the government and dodge or pay low taxes. There is corruption in government where beneficiaries pay less or no tax and end up charging a lower price which affects our customer base."* Bribery and conflict of interest was also reported as a cause of product counterfeiting as noted by BU's Export Manager: *"We are in touch with government and Uganda Revenue Authority [government body] to handle counterfeiters. They [counterfeiters] may be part of the investigators. They get a lot of profit and can bribe Uganda Revenue Authority and other government staff."*

Firms revealed that corruption is a source of ten other threats as illustrated in Figure 4.4. The fact that many threats originate from corruption reveals the interrelatedness of threats to SCRES and how some threats can play a more central role than others in causing disruptions. The seriousness of the threat of corruption can be revealed in the comment by PU's Procurement Manager: *"Five different companies have closed or sold in the last one year due to a fight on corruption...If Uganda Revenue Authority became serious with tax collections, some of them which depend on corruption and fraud will close."* The fact that some firms thrive on corruption which is a threat to others suggests that some factors can be perceived as threats only to those whose interests are at stake – suggesting resilience may be difficult to generalise.

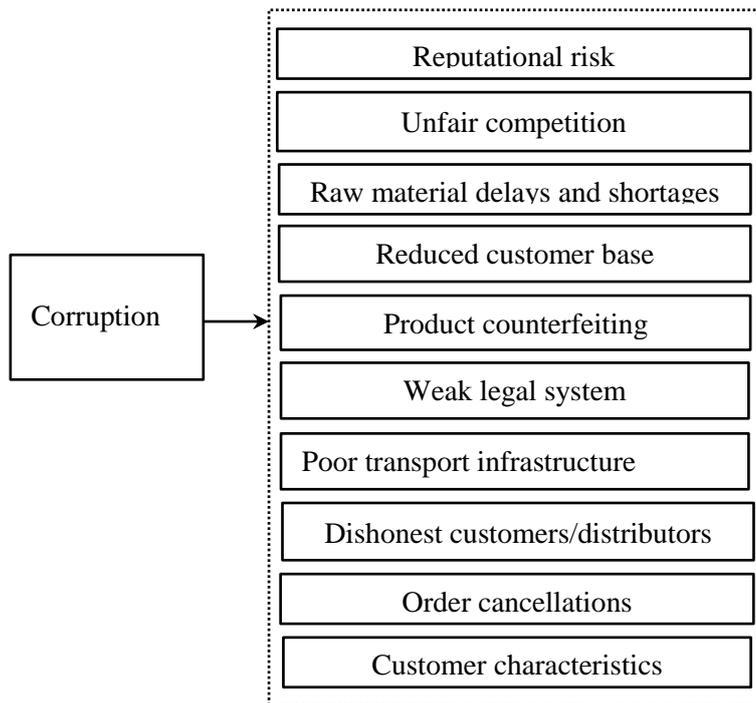


Figure 4.4: Corruption and its Effects

- **Product Counterfeiting**

All firms argued that product counterfeiting was a threat to their supply chains in that it reduced their customer base, led to poor quality raw materials, caused reputational risk and rendered their products relatively expensive. It was reported that some customers have limited product knowledge and cannot differentiate counterfeits from genuine products. But, it was also acknowledged that some choose counterfeits deliberately as long they are cheaper than genuine products. BU’s Sales Manager stated: *“We sensitise our customers to know the quality of our products. But the customers buy counterfeit when they are aware.”* A similar observation was made by OU’s Sales and Marketing manager, who argued that Ugandan customers are price sensitive – they buy counterfeit products deliberately as long as they are relatively cheap. Product counterfeiting was attributed to several other factors such as the presence of a weak legal system and lack of copyright laws as reported by company TU. Due to corruption, the anti-counterfeit officials are part of the counterfeit problem. LU’s Assistant

Sales Manager commented: “...*Uganda National Bureau of Standards* [government body] is sometimes compromised due to corruption in Uganda. They keep telling you that they are working on the problem but they are compromised by bribes...counterfeiters confuse our customers.” Some firms blamed the government policy for encouraging counterfeit products as revealed in the comment by HU’s Marketing Manager: “*Everything in Uganda has been adulterated e.g. the kind of tensile or reinforcement is not the one recommended but this is what is in the market. Uganda National Bureau of Standards has recommended it so we use it knowing it is not on standard because it’s what is available locally. Importation means high price and it makes it hard to retain customers and compete.*” Other firms attributed the counterfeit problem to sourcing from dishonest local suppliers and the growth of the informal sector as explained by HU’s Production and Operations Manager: “*We have a problem of people who produce fake products. Our government is not yet strict on people who produce concrete. They cannot certify people who produce concrete and they do not oversee them. Some are not registered and nothing is known on how they work...no clear standards are set yet.*”

Besides showing that threats can originate from other threats and produce other threats (see figure 4.5), the counterfeit threat also shows that customers can produce or compound threats to SCRES – the downstream part of the supply chain can thus be a potential source of threats to SCRES. The antecedents of product counterfeiting e.g. corruption, a weak legal system and local sourcing further show the role of context in building SCRES – the findings revealed that the government and customers in a developing country for example can support the use of a counterfeit product.

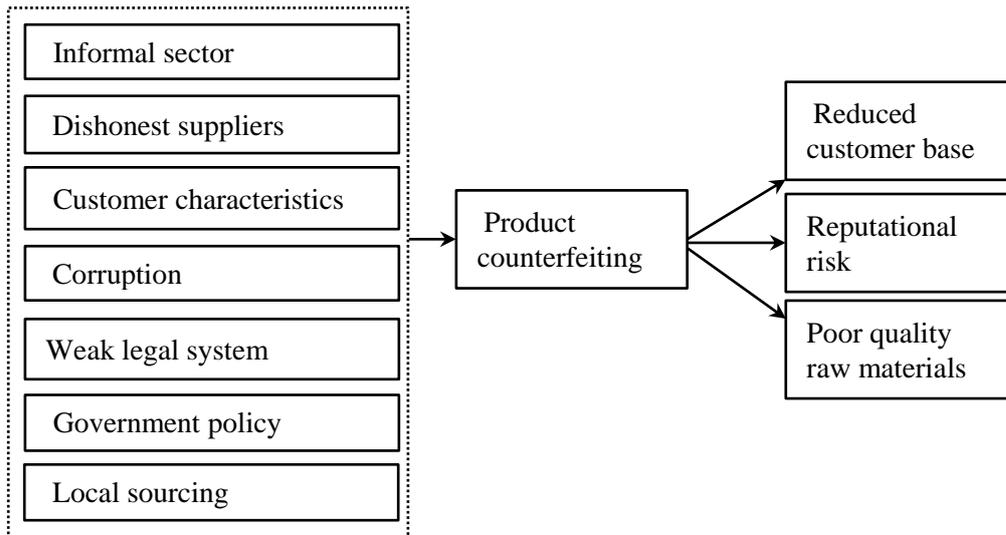


Figure 4.5: Antecedents and Consequences of Product Counterfeiting

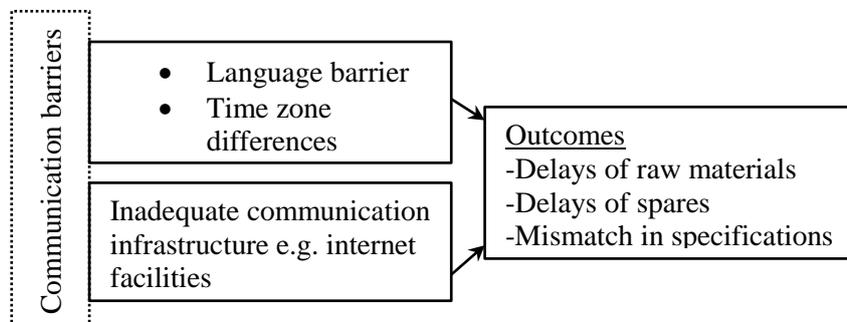
- **In-transit Raw Material Theft**

Five companies (BU, RU, GU, KU, PU) highlighted a theft of in-bound raw materials that disrupts production and delivery to customers. KU’s Marketing Manager noted: *“There is also a problem of robbers who steal our raw materials especially in Tanzania when our spirit is coming from Malawi...and during the process, we do not produce as expected and this affects our market.”* Companies RU and GU argued that due to overseas sourcing, bulky raw materials have to be transported by sea which creates vulnerability to sea piracy. Further, due to poor transport infrastructure, loaded trucks get accidents along the way and thieves utilise the opportunity – sometimes thieves connive with company employees. LU’s Logistics Assistant commented: *“Our raw materials are bulky and we have problems with transportation. We use water and we are affected by weather and piracy...”*

- **Communication Barriers**

Five companies (PU, NU, HU, EU, KU) argued that their supply chains are disrupted by communication barriers. They contended that communication problems cause delays of materials and spares, coupled with a mismatch in specifications. PU’s Procurement Manager noted: *“We have a communication challenge; sometimes Chinese suppliers do not know*

*English...But communication problems cause delays and delivery of the wrong specification. The communication problem is also due to changing time zones, it becomes hard to communicate with the suppliers.” Besides language barriers, the interviewees reported a deficiency in communication infrastructure such as internet facilities as explained by HU’s Production and Operations Manager: “Another threat is that there are communication barriers. We use telephone and we can’t use internet. Sometimes I drive there myself. They do not have internet and it’s a big problem.” From this analysis, the different communication barriers and their outcomes are summarised in Figure 4.6.*



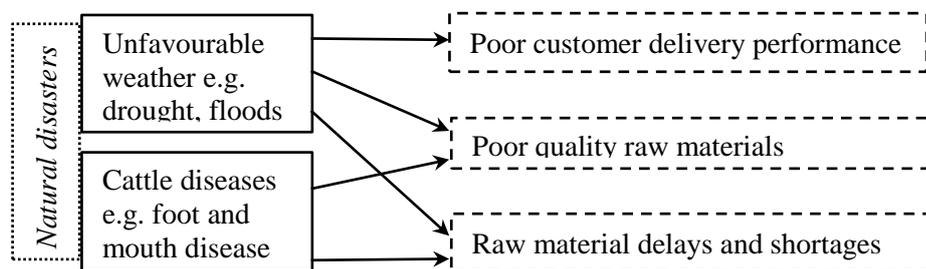
*Figure 4.6: The Threat of Communication Barriers and its Consequences*

- **Natural Disasters**

Five companies (QU, IU, FU, TU, GU) which mainly use agricultural raw materials pointed to unfavourable weather as a threat to their supply chains. This weather leads to scarcity of raw materials and production stoppages as explained by FU’s Corporate Marketing Manager: *“Due to drought, the sugarcane was not mature enough. There was crop failure and the sugarcane had low juice content and the scarcity of raw materials led to production stoppages...The crop failure of 2011 started small but became too big and spread to the whole region and destabilized many supply chains.”* TU revealed that unpredictable weather patterns not only affect their suppliers but also their customers – the majority of TU’s customers depend on income from agricultural products. The Route to Consumer Supply Manager commented: *“Most raw materials e.g. maize, sorghum, cassava are locally grown.*

*The weather pattern of Uganda is unpredictable. These are grown in specific areas. For example during dry spells, there is a scramble for raw materials with our competitors...Our customers in the rural areas who are the majority depend on agriculture – implying that in case of bad weather e.g. dry season, their disposable income is very low and this affects our supply chain downstream.”*

Firms blamed both drought and too much rainfall as causes of shortages and poor quality raw materials. GU’s Sales and Marketing Executive revealed: “... *In 2011, there was drought which affected sugarcane yields and the sugar prices shot up since we did not have raw material...Quality problems; sometimes the quality of sugar is not good due to the quality of sugarcane. This could be due to natural factors such as too much rain which destroys the sugar quality.*” QU, which manufactures dairy products, highlighted a threat of disease outbreaks as leading to shortages and poor quality raw materials. QU’s Procurement Manager commented: “*We have a problem of cattle diseases such as foot and mouth disease. During such a disaster, milk yields are low and at times of poor quality. These diseases break up unexpectedly and you already have orders.*” IU highlighted a threat of floods in some parts of Uganda which hinder proximity to markets. The forms of natural disasters highlighted in the data and their consequences are summarised in Figure 4.7.



*Figure 4.7: Natural Disasters and their Consequences*

#### 4.2.1.2 Economic Threats

- **Informal Sector**

Three companies (PU, HU, QU) indicated that the presence of a large informal sector was a threat to their supply chains – it was reported that informal actors do not keep records, are not formally registered and information about their activities is limited. Thus, they are not easy to regulate or assess for taxation purposes. By evading or avoiding taxes, they are better placed to sell at lower prices than formal firms and this causes unfair competition in the form of price wars. HU blamed informal actors for perpetuating product counterfeiting. It was further reported that the informal actors produce other threats like unfair competition, financial difficulties, raw material delays and shortages; and a reduced customer base.

The informal sector in Uganda dominates most of the industries. For example, information from the dairy sector revealed that it comprises approximately 80% of the market share. QU, which relies on milk from local farmers as a raw material, indicated that their supply chain is affected both in the upstream and downstream by informal actors. QU's Procurement Manager noted: *“Our major threat is the informal market. In this industry, the informal market is bigger than the formal one. These [informal actors] sell quite cheaply since they do not pay tax and since the majority of Ugandans are poor, we lose the market. But we also lose milk raw material because the informal market takes the largest portion.”* The presence of a large informal sector was blamed on a lax government that survives on political patronage and unfavourable government policy e.g. on taxation. PU's Procurement Manager observed: *“Corruption is a big problem...Some companies have closed due to the informal sector where the government, due to donors withdrawing, has focused on squeezing the formal sector. The informal sectors do not keep records and taxes are assessed by estimation. So they squeeze us and this affects our revenues and financial stability.”* The above analysis

reveals that the disruption caused by the informal sector originates from other threats and also causes other threats as Figure 4.8 illustrates.

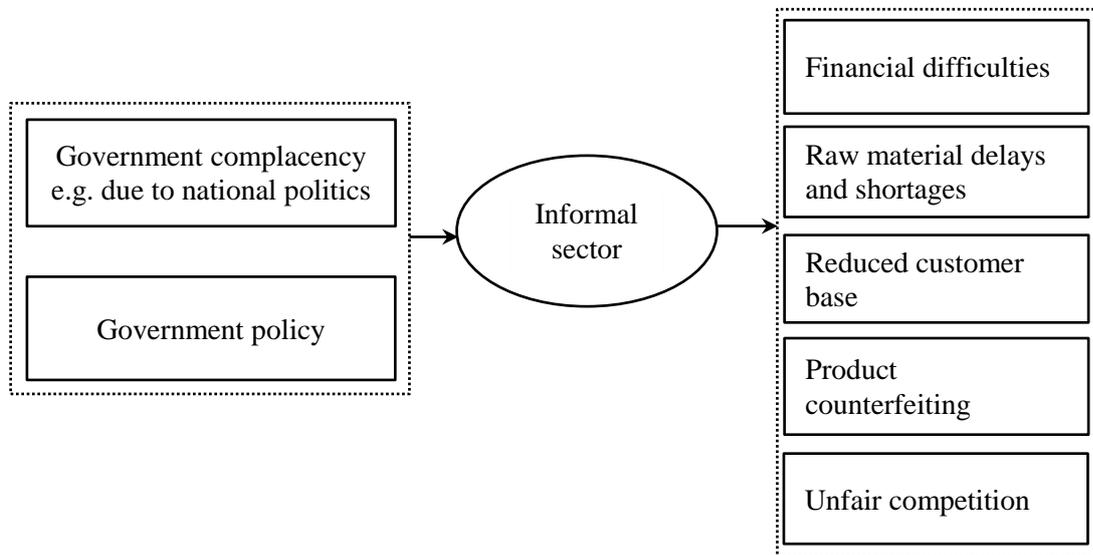


Figure 4.8: Antecedents and Consequences of Informal Sector

- **Unfair Competition**

Fifteen companies (AU, TU, DU, OU, GU, BU, CU, HU, KU, JU, PU, LU, IU, RU, QU) highlighted unfair competition as a threat to their supply chains. OU, PU, JU, BU and KU indicated that their competitors engage in price wars because they evade taxes due to corruption either by bribing tax officials or manipulating their political connections. PU's Procurement Manager commented: *"We don't have a level playing field...we declare truthfully to government...due to corruption, most of our competitors do not pay taxes on some materials. Hence our competitors beat us on price and this affects our sales [we experience] price wars where our competitors undercut us. We lose customers to our competitors."* Some firms complained that their competitors collude with suppliers to sabotage them through delayed raw material deliveries or total delivery failure. JU's Sales and Marketing Manager stated: *"Our competitors set aside a lot of money and bought our empties so that we fail to produce due to a lack of packaging materials. There is an instance where we wanted shells [packaging materials] and they were supplied by the chairman of our*

competitor company. So because he was related to our competitor, they delayed to supply us... We spent some time without production and this adversely affected our market”

Firms like HU blamed competitors for deliberately buying raw materials stolen from them by dishonest employees. AU, JU and CU complained of sabotage by rivals through negative publicity and bad mouthing which affect their customer base. JU’s Trade marketing manager noted: “There are also sabotages from our competitors e.g. there is one time when our competitors went on saying that we were about to close down and this affected our reputation and customer confidence. It was hard to recover and regain our market share”

The above discussion about the threat of unfair competition can confirm how global systems are interlinked – it shows systems compete for limited resources and that attempts to build resilience in one system may affect another. The data shows that unfair competition can originate from other threats and also cause other threats as illustrated in Figure 4.9.

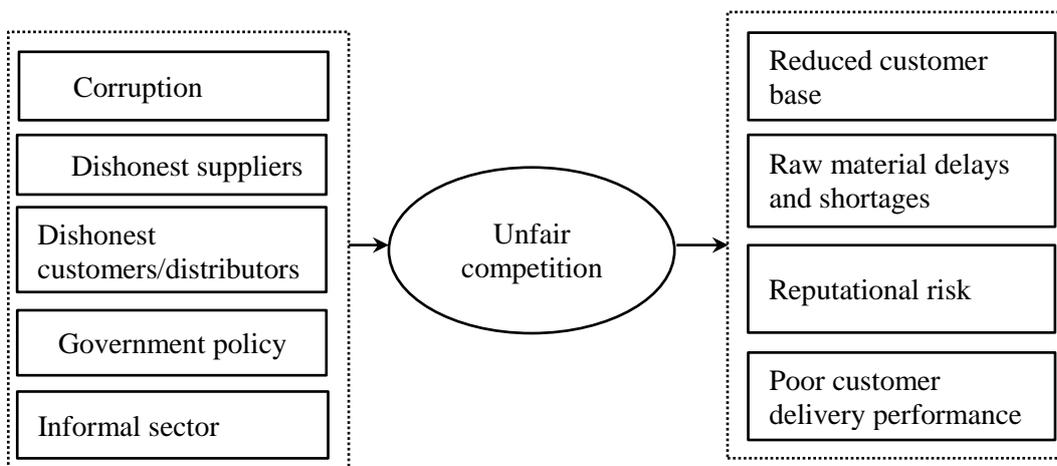


Figure 4.9: Antecedents and Consequences of Unfair Competition

- **Poor Transport Infrastructure**

Seventeen companies (DU, OU, GU, BU, CU, EU, FU, HU, KU, JU, NU, PU, QU, MU, LU, IU, RU) reported that poor transport infrastructure causes supply chain disruptions. They argued that the road transport route particularly from the Kenyan ports of Mombasa to Uganda is dilapidated, causing raw material delays, quality problems, accidents and theft of

materials in-transit. PU’s Procurement Manager noted: “...driving long distances, trucks take forty five days from Mombasa to Kampala. Some of the roads are dilapidated and poorly lighted. We had a recent incidence of accident of a truck. If the raw materials are portable and there is an accident they get stolen.” Firms like JU attributed the problem of poor road infrastructure to government complacency and corruption. JU’s Procurement Manager also explained how poor transport infrastructure affects both the upstream and downstream supply chain: “We generally have a problem of a poor road network during raw material transit and distribution of the finished products. This delays our production and at the same time affects our distribution and market activities.” The Procurement officer for QU, which relies on local farmers for raw material (milk), indicated that due to poor road network in Uganda; most of the farmers are not accessible and this results in delays and sometimes milk quality deterioration during transit.

The above finding shows that certain categories of threats can produce others that emerge at different points of the supply chain – poor transport infrastructure as an exogenous threat leading to endogenous threats e.g. poor quality, delays and shortages of raw materials. This is developed further in the next chapter. It also shows that the geographical location (being in a landlocked country where Kenya is the main transit route) creates vulnerability to certain external threats (e.g. poor transport infrastructure in Kenya) as illustrated in Figure 4.10 below.

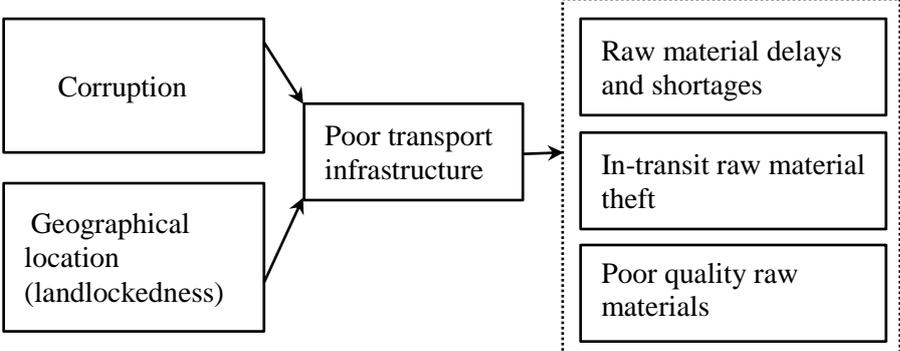


Figure 4.10: Antecedents and Consequences of Poor Transport Infrastructure

- **Unstable Taxation**

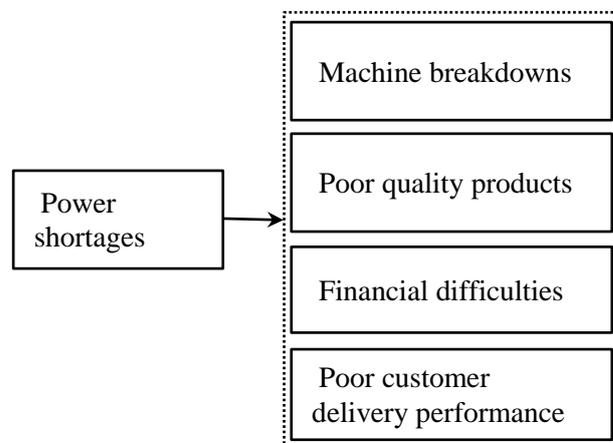
Six companies (DU, GU, TU, JU, IU, PU) argued that an unstable taxation system disrupts their supply chain activities. Respondents explained that a persistent increase in taxes implies increasing prices to the advantage of the informal actors who dodge taxes – respondents revealed that this reduces their customer base. It was reported that there are instances when developed country donors withdraw or suspend financial donations due to corruption reports. And in a bid to compensate for the lost revenue, the government abruptly increases taxes on manufacturing firms. PU's Procurement Manager observed: *“Some companies have closed...the government due to donors withdrawing has focused on squeezing the formal sector... most of our competitors do not pay taxes on some materials... So they squeeze us and this affects our revenues and financial stability.”*

- **Exchange Rate Fluctuations**

Five companies (BU, HU, JU, IU, RU) highlighted foreign exchange rate fluctuations as a threat to their supply chains. It was revealed that exchange rate fluctuations constrain planning, especially for raw materials whose prices sometimes escalate. This also leads to increased import taxes and subsequent burden transfer to consumers in the form of price increases – the downstream supply chain is affected in the form of reduced customer base due to inconsistent pricing. BU's Export Manager stated: *“When we import at a high rate, then the prices are affected and our market share reduces. Some of our competitors dodge these taxes by conniving with Uganda Revenue Authority staff because of corruption and reduce their prices.”* Company IU argued that fluctuating exchange rates lead to raw material delays because high exchange rates result in delays – company officials take a long time to approve the amount for customs clearance as they wait for rates to stabilise/reduce.

- **Power Shortages**

Eleven firms (JU, AU, BU, CU, LU, MU, RU, HU, IU, NU, KU) highlighted the presence of power fluctuations and outages which affect their production operations. Power shortages also cause machine breakdowns leading to production stoppages and poor customer delivery performance. NU’s Inventory Manager stated: *“Power goes off and you have an order but the generator can run only one machine. This means delaying the customer: sometimes there is no power for a full week.”* Power shortages also lead to quality problems as reported by JU’s Procurement and Logistics Officer: *“...we send products in the market and they are found to be of poor quality due to poor processing. In brewing, sometimes power goes off, it affects the product and after bottling there are problems.”* Further, companies e.g. AU and CU explained that power failures result in financial difficulties. AU’s Marketing Manager stated: *“We have power shortages but we try to use our generator. This is however expensive. If we use a generator, we use almost 500 litres of diesel per day - approximately 1.5 million Ugandan shillings, putting us in a bad financial situation.”* This threat of power shortages also shows how certain conditions specific to a developing country context can produce threats to SCRES as further summarised in Figure 4.11.



*Figure 4.11: Power Shortages and Associated Threats*

The foregoing section has shown that that threats and conditions external to the supply chain, not only disrupt the supply chain, but can also cause or compound other threats both internal and external to the supply chain. This shows how threats are interrelated. The next section analyses the endogenous threats (originating from within the supply chain) – categorised under supply-side threats, firm level threats and demand-side threats.

## **4.2.2. Endogenous Threats**

### **4.2.2.1. Supply-Side Threats**

These threats originate from the upstream part of the supply chain (from suppliers). Ten supply-side threats were revealed by the data: power asymmetries related threats/stronger suppliers, long distance sourcing triggered threats, product counterfeiting, poor quality raw materials, dishonest suppliers, raw material delays and shortages, financial difficulties of suppliers, supplier delivery failure, reputational risk and limited local supply market.

- **Power Asymmetries (Stronger Suppliers)**

Four companies (EU, IU, MU, KU) argued they did not enjoy a level playing field during negotiations because their suppliers had stronger bargaining power. EU's Procurement Manager argued: *"We have a problem of monopolies, for example our major supplier of fuels has monopolized the local market...they can dictate terms and price. Our foreign suppliers who deal in laboratory equipment – they are strong and there is a win-lose negotiation. They dictate terms and demand advance payments."* It was found that power asymmetries influence the implementation of SCRES strategies to increase visibility, proximity and information flow: strategies such as co-location where suppliers and buyers are expected to establish facilities near each other and hence reduce distance between them can be constrained by the buyer's weaker power position. MU's Company Pharmacist noted:

“...Those suppliers with high bargaining power may be complacent. Sometimes, they delay delivery and there is nothing we can do. We decided to deal with them through our parent company which has higher bargaining power...Due to high bargaining power of our parent company; some of the suppliers establish their facilities near it.”

The effect of power asymmetries discussed above shows that certain conditions affect SCRES in different ways e.g. by both producing threats and impeding the implementation of strategies to create resilience against threats. For example, power asymmetry can lead to supplier complacency and raw material delays; and also constrain co-location which would mitigate other threats e.g. from long distance sourcing like in-transit raw material theft as illustrated in Figure 4.12.

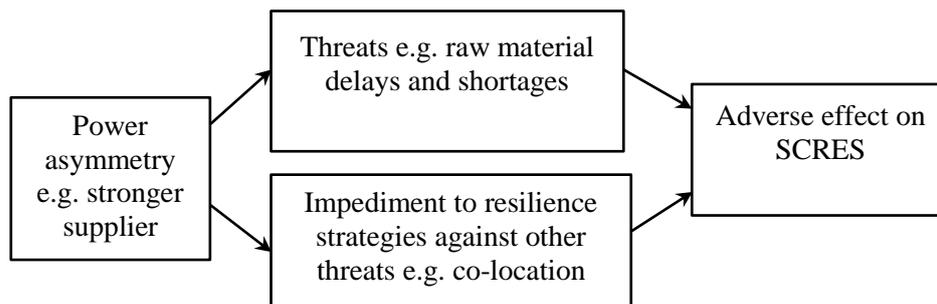


Figure 4.12: Consequences of Power Asymmetries (Stronger Suppliers)

- **Long Distance Sourcing**

Fourteen firms (AU, EU, FU, BU, CU, KU, JU, PU, SU, MU, RU, LU, HU, NU) argued that a long distance from suppliers due to overseas sourcing disrupts their supply chains by e.g. causing raw material delays and shortages. JU’s Sales and Marketing Manager argued: “Raw materials can take a long time to reach us because of long distance sourcing and we exhaust the buffers. In fact as I speak, due to the exhaustion of our buffers, we are now on standstill. We cannot produce due to delayed raw materials and yet customers have already paid in advance.” It was reported that long lead times due to long distance sourcing creates a need to maintain huge stocks of raw materials for a relatively long period of time e.g. five months. Besides delivery delays, long distance sourcing also makes it difficult for firms to maintain

collaborative relationships with suppliers due to communication barriers and poor information flow. CU's Production and Site Coordinator noted: *"There is a breakdown of information and unreliable information due to the long distance from where we source our raw materials and it is difficult to establish collaborative relationships with suppliers ..."*

Firms like KU attributed the problem of a reduced customer base to long distance sourcing which causes raw material shortages and constrains production for a long period. KU's Marketing Manager explained: *"There is a delay in getting spirit, hungover remover and flavour. Sometimes we have one of the three and we cannot produce since they are used concurrently... The shortage of quality raw materials makes our customers shift to our competitors."* Firms like SU attributed the problem of long distance sourcing to a limited local supply market characterised by poor quality products.

The above finding shows how a threat to SCRES results from the context of a developing country. For example, a limited local supply market due to a low level of economic development can create conditions like long distance sourcing that in turns produce other threats e.g. raw material delays and shortages. This further shows that a threat can create conditions that produce another threat at the same point of the supply chain (upstream).

- **Limited Local Supply Market**

Sixteen firms (AU, CU, FU, KU, SU, LU, EU, HU, JU, MU, NU, RU, PU, IU, QU, TU) contended that a limited local supply market was a threat to their supply chains. It was found that even the available suppliers have quality problems. As a result, firms go for long distance/overseas sourcing. SU's Factory Engineer argued: *"There is a shortage of raw materials locally and the limited options are poor quality. We end up importing but again this causes delays due to distance and other uncertainties."* Firms like EU, HU and PU revealed that some of the few available local suppliers are monopolists who sometimes run out of stock of raw materials and fail to deliver thereby disrupting production. PU's

Procurement Officer noted: *“Sometimes, we request the items and find they are not there. This affects our production schedules. As a result, we have to go for international sourcing but again there are uncertainties and delays. You can’t coordinate easily.”* A limited local supply market with poor quality products is also an example of how the context of a developing country that is less industrialised can particularly affect SCRES.

- **Product Counterfeiting**

The threat of product counterfeiting has already been discussed under the geo-political category as largely exogenous. However, it was also interesting to find that some firms considered counterfeiting as an endogenous threat. It was reported that some suppliers – mainly locally based – are dishonest and are partly responsible for perpetuating product counterfeiting. Some suppliers produce counterfeits and supply them as genuine raw materials. EU’s Procurement Manager explained: *“They [suppliers] mix stones in our raw materials and this requires inspecting all the trucks. Counterfeiting is becoming a disaster in our supply chain...sometimes our raw materials are mixed with stones. In the last few months, we found people with a large inventory of sand mixed with cement packaged in our packages.”* This example again shows the role of context in building SCRES where for example there is a culture of dishonesty and generally a lack of trust in buyer-supplier relationships that result in threats to SCRES.

- **Poor Quality Raw Materials**

All companies except AU and FU indicated that poor quality raw materials disrupted their supply chains. This threat was linked to other threats like natural disasters, limited local supply market, procurement risk, owner management behaviour, communication barriers, dishonest suppliers, poor transport infrastructure, product counterfeiting and product characteristics. For example, QU’s Procurement Manager stated: *“We face a problem of poor*

quality raw materials and finished products due to the poor hygiene and handling practices of the farmers [suppliers] and distributors. Due to the nature of our products, appropriate handling and preservation are required...The situation is compounded by our poor transport infrastructure because dairy products need fast transportation.” Others blamed poor quality on dishonest suppliers who deliberately adulterate raw materials to increase the quantity as revealed by EU’s Procurement Manager. Further, it was reported that poor quality raw materials result in poor quality products and a loss of reputation. HU’s Production and Operations Manager for example explained: “Suppliers do not grade the materials...This leads to poor quality products...customers complain over poor quality and sometimes run to competitors. We have variations in sizes when it comes to raw materials e.g. stones...This [poor quality product threat] also damages our reputation.”

The threat of poor quality raw materials discussed above has further shown the specific conditions in a developing country e.g. poor transport infrastructural development can produce threats to SCRES. From Figure 4.13, it can further be seen that an exogenous threat like poor transport infrastructure can produce threats internal to the supply chain.

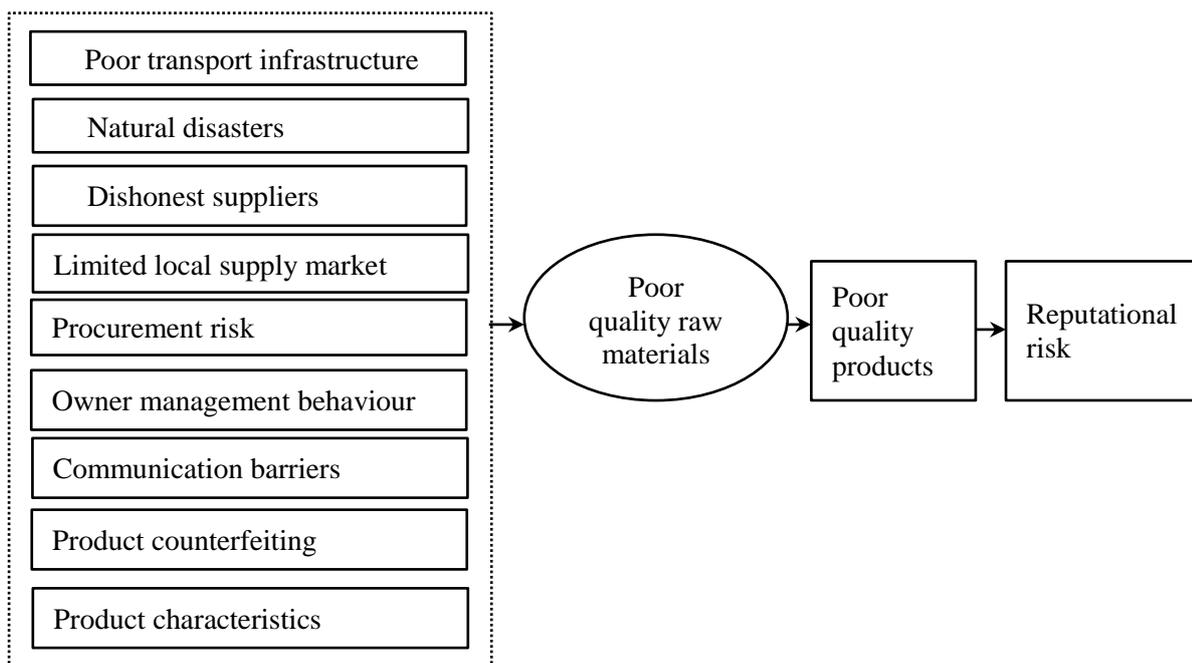


Figure 4.13: Antecedents and Consequences of Poor Quality Raw Materials

- **Dishonest Suppliers**

Ten firms (CU, EU, JU, BU, LU, OU, QU, RU, IU, KU) revealed that dishonest suppliers (especially the locally based) cause disruptions to their supply chains, through for example, delivery failures, late deliveries, poor quality raw materials, connivance and supplying less quantity; and releasing confidential information to competitors. Firms like QU and JU revealed that some suppliers accept business even if they are aware they do not have the products or capacity to deliver. JU's Procurement Manager noted: *"Some suppliers take on orders they cannot manage. This is a problem because when they supply less, we run machines and produce less. This is costly at the firm level but it also affects our customers. When the beer gets finished, they [customers] order and when we fail to supply they shift to competitors."* The interviewees reported that dishonest suppliers cause unfair competition by conniving with their (interviewees') suppliers and causing problems e.g. failure to supply, supplying late, supplying poor quality and revealing confidential information. CU's Marketing Manager explained: *"Sometimes the competitors connive with our suppliers to make sure that we are not supplied, supplied late or receive poor quality...We have this problem of deep relationship between our competitors and the suppliers. It is difficult to trust some of the suppliers we share with our competitors. This affects our production and delivery schedules."*

Some suppliers also inflate the costs of raw materials and deliver wrong specifications through connivance with firms' employees. This results in financial difficulties, poor quality and shortages of raw materials. JU's Procurement Manager stated: *"They bring things below specification e.g. less quantity and quality and connive with our employees...If you receive less material, you end up miscalculating and you run out of raw materials unexpectedly."*

The threat of dishonest suppliers again shows how SCRES can be influenced by the context of a developing country characterised by dishonest practices. This threat further

shows that exogenous factors e.g. socially acceptable misbehaviour can cause an upstream threat of dishonest suppliers that cause other threats e.g. raw materials and shortages at the same point of the network, financial difficulties at the firm level and a reduced customer base in the downstream. The various consequences of dishonest suppliers identified from the data are summarised in Figure 4.14.

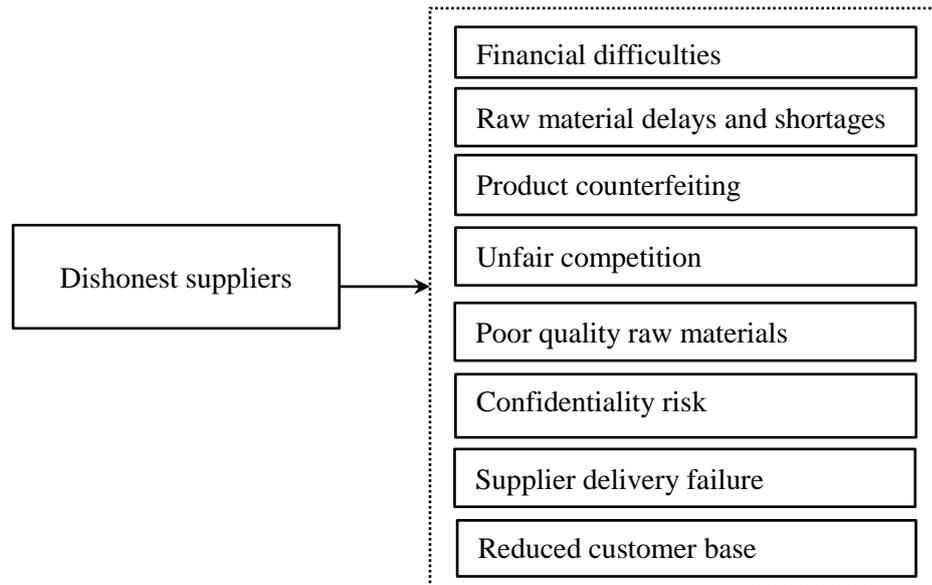


Figure 4.14: Consequences of Dishonest Suppliers

- **Raw Material Delays and Shortages**

All firms reported a threat of raw material delays and shortages – some arguing that it causes production stoppages and customer delivery delays which reduced their customer base. JU’s Procurement Manager stated: *“We cannot produce due to delayed raw materials and yet customers have already paid in advance.”* Others like BU attributed material delays to poor transport infrastructure and corruption – arguing that delays and shortages create vulnerability to demand variations and order cancellations. BU’s Sales Manager stated: *“In the fashion industry, time is paramount. By the time you deliver late, you miss the seasons and fashion changes...”*

Companies like RU, MU and KU reported that materials can be delayed for more than six months which disrupts production and affects the downstream. KU’s Regional Marketing Manager stated: “... *We ran out of malt at the time when the beer was picking [when sales had started to grow]. We stayed without stock in the market for two months and it has taken us years to regain the market share we lost...we couldn’t know it would cause such long term impact.*” FU, GU and QU, whose raw materials are mainly agricultural products, attributed raw material shortages to bad weather and an unfavourable government policy. FU’s Corporate Marketing Manager explained: “*Inadequate supply of sugarcane causes disruption in the supply chain. There is a problem of sugarcane availability...The government policy of licensing new sugar companies and having them close to each other means stiff competition for few suppliers...Due to drought, there was crop failure...and scarcity of raw materials led to production stoppages.*”

Other reported causes of raw material delays and shortages are other threats like financial difficulties, the informal sector, procurement deficiencies, poor internal coordination, and delayed payment to suppliers, power asymmetries (stronger suppliers), communication barriers, dishonest suppliers, unfair competition, exchange rate fluctuations, political instabilities and product characteristics as summarised in Figure 4.15.

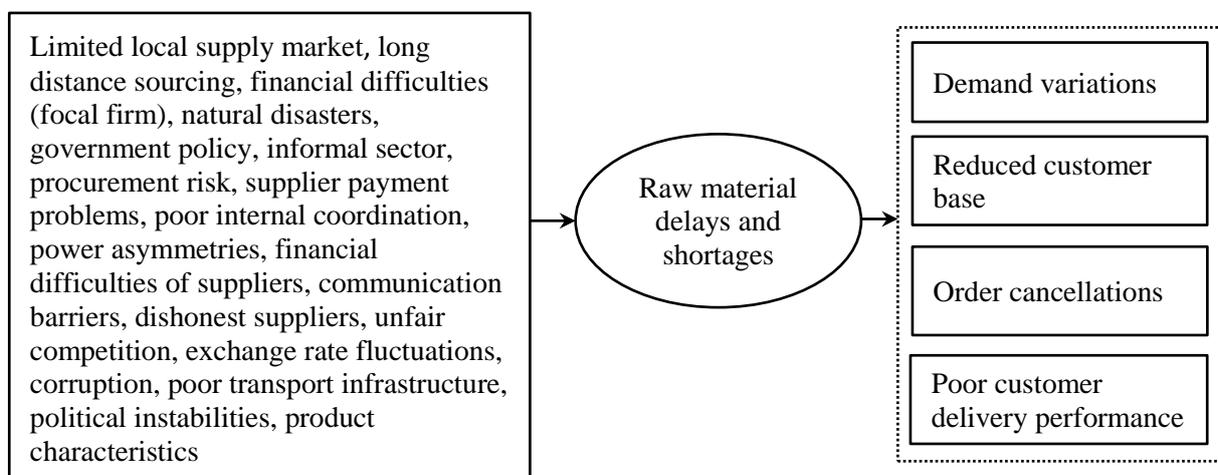


Figure 4.15: Antecedents and Consequences of Raw Material Delays and Shortages

Ten companies (FU, EU, KU, JU, NU, HU, IU, QU, LU, PU) argued that their supply chains are disrupted by the financial instability of their suppliers who sometimes deliver late, fail to deliver or close down. Financial difficulties of suppliers were highlighted as one of the causes of supplier delivery failures as reported by LU's Assistant Sales Manager: *"Supplier bankruptcy – some suppliers are dishonest and do not openly tell you whether they are in financial difficulty. So they take up orders and fail to supply"* Some suppliers have closed down due to financial difficulties as revealed by KU's Marketing Manager: *"Sometimes companies that manufacture spirit and paper are forced to close down due to failure to pay taxes. Sometimes, suppliers run out of finances or raw materials and stop production even when we have already placed the orders."* However, others attributed suppliers' financial problems to their own (buying firms') payment policies. IU's Finance Manager stated: *"At the company level, we have harsh policies on payment where we do not pay our suppliers early and they face financial problems. We can take about 4 – 5 months to pay suppliers and sometimes they have loan obligations."* From the above analysis, it can be observed that one of the causes of the threat of financial difficulties of suppliers is the dishonest behaviour of the suppliers which is a reflection of the Ugandan context earlier highlighted in chapter 3.

- **Supplier Delivery Failure**

Thirteen firms (GU, EU, NU, RU, LU, CU, HU, IU, KU, JU, MU, FU, TU) indicated that they face a threat of supplier delivery failure which disrupts production and reduces the customer base. This was partly attributed to the financial problems of the suppliers as noted by EU's Depot Supervisor: *"Suppliers do not meet demand. When a lot of projects crop up, we face a challenge of a failure to meet demand...Sometimes suppliers are given orders and fail to deliver...Some suppliers have financial challenges and they fail to deliver."* RU attributed supplier delivery failure to overseas sourcing of raw materials. RU's Sales Manager stated: *"Some of our suppliers get raw materials from companies abroad and they*

*face problems of shortage of raw materials. So they sometimes supply in bits or completely fail.”* LU attributed supplier delivery failure to dishonest suppliers who overestimate their capacity in a bid to win business. Some other firms argued that supplier delivery failure is caused by poor quality materials. MU’s Supply Chain Manager noted: *“Our suppliers also face raw material quality problems. Because they know we are strict on quality assurance, when they receive poor quality raw materials from their suppliers, they reject them and in the process, they do not fulfil our orders.”*

- **Reputational Risk (From Suppliers)**

Companies PU and CU argued that they face reputational risk from suppliers due to, for example, financial and payment problems. PU’s Procurement Manager stated: *“At times, we have a financial problem ... The suppliers complain [about payment] ... We used to get raw materials but due to late payment...Our relationship and reputation were adversely affected.”* PU further revealed that overseas suppliers generally have a negative perception of firms in Africa because they consider companies in Africa as not suitable to receive credit. This negative perception was attributed to African countries’ contextual factors such as corruption, political conflicts as well as the high rate at which firms collapse. PU’s Procurement Officer explained: *“Most of the foreign suppliers do not consider African companies as creditworthy. Before they dispatch your containers you must pay in full...overseas suppliers have such negative perceptions...It might be due to wars, political conflicts, corruption or the high rate of collapse of companies.”* CU attributed reputational problems to unfair practices by their rivals who spread negative publicity to the suppliers. This again shows how the context of a developing country can affect firms’ SCRES.

#### 4.2.2.2. Firm Level Threats

The interviewees highlighted several threats which occur in the focal firm but are seen as threats to either the downstream or upstream supply chain, as discussed below:

- **Machine Breakdowns**

Seventeen firms (PU, HU, FU, SU, LU, AU, DU, OU, GU, CU, KU, JU, NU, QU, MU, IU, RU) identified machine breakdowns as one of the threats to their supply chains. These breakdowns are mostly caused by power shortages, poor maintenance and the use of second hand equipment. Surprisingly, misbehaving employees could deliberately destroy machines. JU's Procurement Manager stated: *"Machine breakdowns are caused by the rampant power outages, the workers and bad fuels...But it becomes hard when the breakdown is due to employees' intentional actions due to late payment."* Firms reported that machine breakdowns disrupt production and cause poor customer delivery performance – some of the spares have to be sourced from overseas such as China, yet they are expensive and storing them ties up capital. SU's Assistant Procurement Manager observed: *"Machines breakdown and we stop production and run out of stock and this makes some of our customers shift to competitors. The problem is that with spares, it is sometimes hard to anticipate which parts will be needed and this makes it hard to keep inventory of spares. And given that they are mostly sourced overseas, it sometimes takes a long time to receive them and this affects our production and the entire supply chain."* Some firms revealed that machine breakdowns can disrupt production for a long period of time. For example, GU's Sales and Marketing executive observed that their company could stop production for two months.

Firms such as HU, LU and JU indicated that machine breakdowns cause process variations, poor quality products and order cancellations. JU's Procurement Manager commented: *"Breakdown of machines...This also delays the production during repair of machines for instance a full week without production. It creates crisis where you have beer in*

tanks and you don't bottle and sometimes there are no products in the market. Sometimes this causes poor quality beer in the market because the process is disorganised." The seriousness of the threat of machine breakdowns was emphasised by SU's Factory Engineer: "A small machine breakdown here at the company led to stoppage of production and consequently loss of a big number of customers. The delivery of spares took a long lead time and this cost the company a lot of resources." This statement shows that seemingly small events can cause significant effects on a supply chain's resilience.

From the above analysis, it has been shown that machine breakdowns can be a cause of other threats as well as a consequence of other threats as summarised in Figure 4.16.

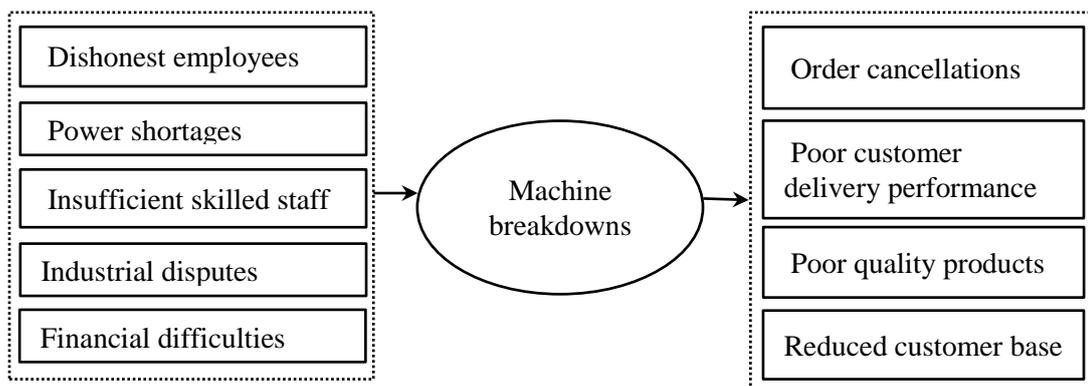


Figure 4.16: Antecedents and Consequences of Machine Breakdowns

- **Product Characteristics**

Six companies (BU, CU, HU, MU, RU, QU) indicated that the nature of their products was itself a source of supply chain disruptions. The Production and Site Coordinator for CU, which manufactures glass, aluminium and steel products observed: "Our products are fragile...storage is difficult and some of them are damaged during transportation. We also incur a lot of insurance costs and a small accident can cause a lot of damage...there is a poor road network between Kampala and Mombasa." RU and HU, that produce steel and concrete products respectively, identified the bulkiness of their products as a supply chain threat. They contended, for example, that this bulkiness coupled with poor road transport

infrastructure causes excessive delays. Also, the bulkiness of raw materials makes it difficult to use alternative transportation modes such as air in the case of an emergency. LU’s Logistics Assistant noted: *“Our raw materials are bulky and we have problems with transportation. We have to use water and we are affected by weather and piracy.”*

BU argued that the short life cycle of their products was a threat because it affects planning and creates a backlog of unsold items, resulting in liquidity problems. BU’s Sales Manager commented: *“In the fashion industry, time is paramount. By the time you deliver late, you miss the seasons and fashion changes...There are constant changes in customer demands and some products end up taking more than one year before being sold. We dispose them off cheaply and this affects our cash flows.”* QU and MU identified the perishable nature of their products as a threat. QU’s Procurement Officer stated: *“...because our products are perishable...a lot go bad. The life span of our products is a big threat.”*

The threat of product characteristics demonstrates how threats to SCRES are interconnected and how they reinforce each other. For example, it was found that the perishability and bulkiness of the product could be compounded by another threat – that of poor transportation infrastructure. Figure 4.17 summarises many other threats that originate from the threat of product characteristics.

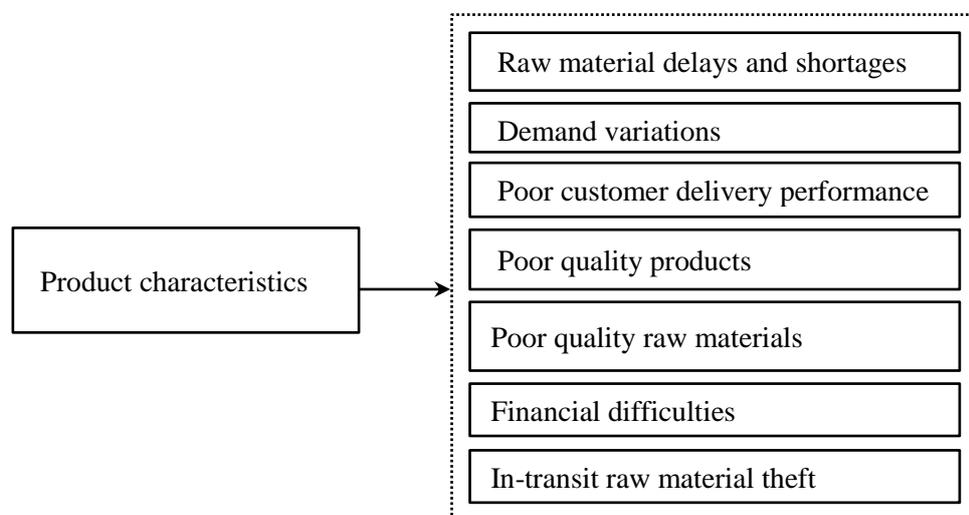


Figure 4.17: Consequences of Product Characteristics

- **Owner Management Behaviour**

Four companies (CU, KU, JU, LU) argued that owner managers fail to separate the companies' operations from their own private affairs, which disrupts their supply chain activities. It was reported that the owners use a dictatorial management style and make unprofessional decisions regarding e.g. labour recruitment and the allocation of resources. CU's Production and Site Coordinator noted: *"This Company operates informally; it is like sole proprietorship, allocating resources depends on owners without consultation. Sometimes they over expand and we face financial difficulties and fail to pay our suppliers...there is no board of directors and the owners use the money the way they like...we fail to fulfil customers' orders and customers defect to competitors. This also affects the deadlines...You get jobs from clients but there is no money to fulfil the order."*

Most of these owner managers are not professionals but they perform responsibilities of professional staff causing financial losses. The owners' behaviour was also blamed for causing a lack of internal coordination and procurement problems. JU's Regional Sales Manager commented: *"The owner makes decisions alone. There are purchases made without the knowledge of the procurement department. Last week the chairman [owner] told me there is a consignment of raw materials in transit but the procurement department is not aware. This kind of arrangement leads to the purchase of poor quality raw materials and demotivation of employees."* JU reported unfair treatment of employees where some are rewarded more than others unjustifiably, reducing employee cohesion. JU's Procurement and Logistics Officer observed: *"There is also a problem of lack of employee cohesion which is brought about by inequality in treatment of employees by the owners, for instance some get more salaries than others without justification..."* The consequences of the threat of owner management behaviour analysed above are summarised in Figure 4.18.

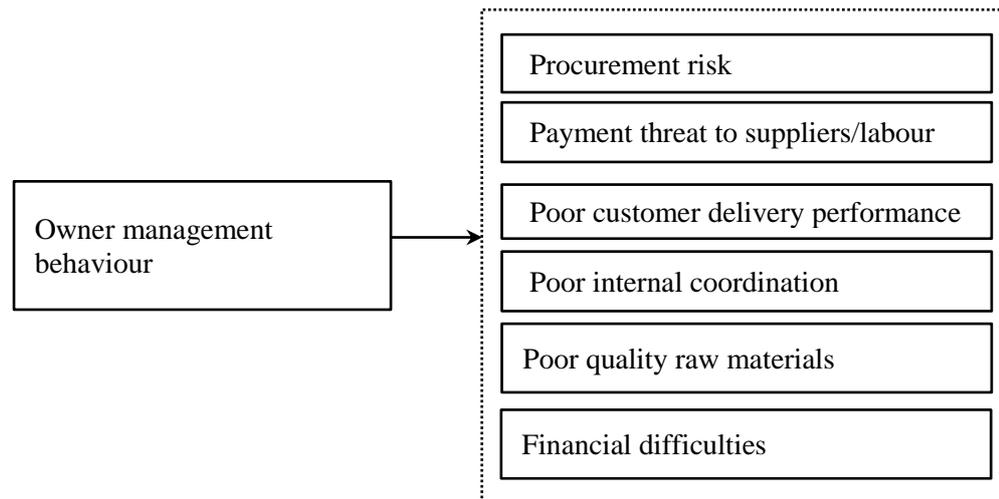


Figure 4.18: Consequences of Owner Management Behaviour

- **Dishonest Employees**

Twelve companies (GU, LU, IU, TU, JU, KU, EU, HU, BU, AU, NU, PU) reported a threat of dishonest employees. This involves employees conniving and stealing finished products and raw materials either while in transit or when stored within the company premises. HU's Marketing Manager stated: *"...we have thieves [employees] who steal cement...sometimes we would run out of stock unexpectedly affecting the clients and the company ... we could not fulfil the orders, which reduces our cash flows. The sales staffs connive with clients and they know the base line price but they show you a different price and they share. Even internally, in stores the loading clerk would connive with the storekeeper, the sales person and the client so they would balance the stock but the physical stock would not exist."* There are also situations where employees connive with suppliers and record more quantity of raw materials than actually received, as stated by EU's Procurement Manager: *"When materials come in, staffs collude with suppliers e.g. they can deliver twenty tonnes and record twenty five tonnes."*

Some employees connive with suppliers and inflate the cost of raw materials, causing financial problems as reported by BU's Export Manager: *"Some managers would connive with the suppliers and they inflate the cost of raw materials or record more than what was*

actually delivered. This would increase our production costs, prices and eventually scare away our customers.” Other employee misbehaviours reported included stealing company money, deceiving customers, deliberately producing poor quality products/product adulteration and destroying machines. JU’s Procurement Manager explained: “...The [employees] destroy machines, destabilize the processes and produce poor quality beer intentionally. Sometimes we are unable to supply or we supply spoilt beer...But it becomes hard when the breakdown is due to employees’ intentional actions.”

The threat of dishonest employees shows the importance of the cultural context in building SCRES – a culture where misbehaviour is socially acceptable among employees and where retaliation is considered as a way of resolving employee grievances rather than the rule of law. Another observation is the cyclic nature of relationships between threats where for instance dishonest behaviour of employees originates from the firms’ financial difficulties (causing payment problems) and causes more financial difficulties to the firm. Figure 4.19 shows the cause and effects of dishonest employees.

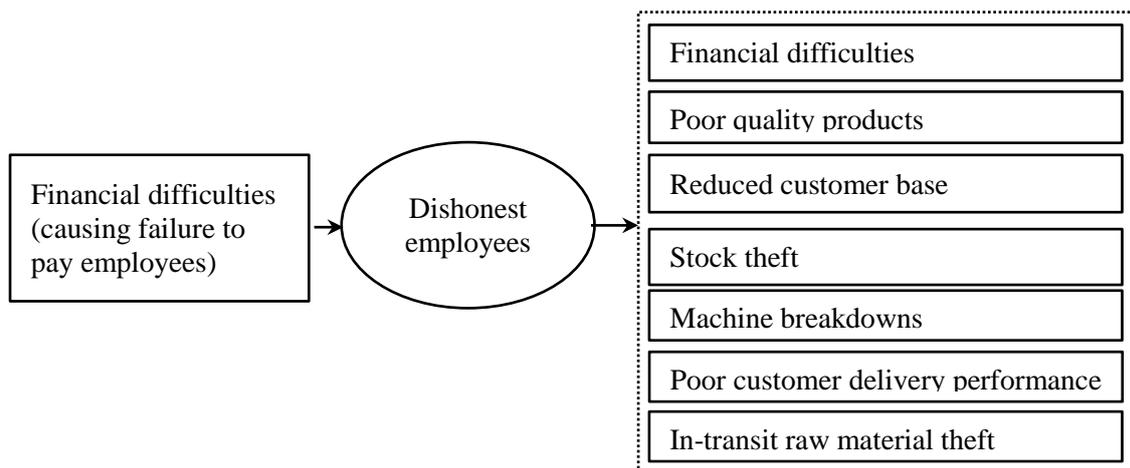
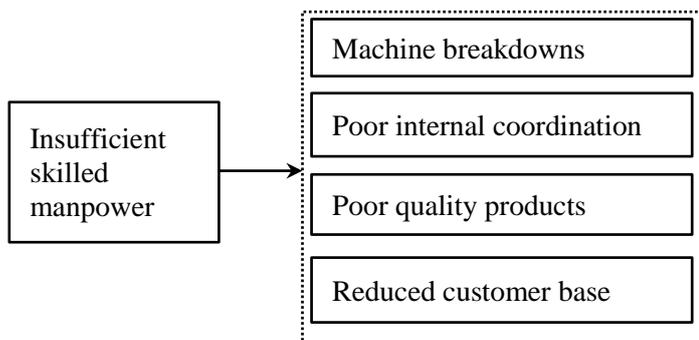


Figure 4.19: Antecedents and Consequences of Dishonest Employees

- **Insufficient Skilled Manpower**

Eleven companies (GU, MU, SU, JU, KU, CU, LU, PU, HU, EU, NU) highlighted a threat of insufficient skilled manpower. Disruptive events such as machine breakdowns, poor quality

products, accidents, poor customer care and reduced customer base were partly attributed to a deficiency in employee skills. KU’s Marketing Manager commented: “...*We have unskilled staff that end up causing machine breakdown through for instance overloading...Using unskilled labour looks a small problem initially but it can lead to machine breakdowns, poor quality, accidents, production shortages, poor customer service and care; and generally the collapse of the entire supply chain.*” EU and NU argued that employees do not efficiently handle customer complaints because it is difficult to get employees with sufficient skills. NU’s Inventory Manager stated: “...*They fail to effectively address customer complaints and our customers end up shifting to our competitors.*” Further, unskilled employees indulge in malicious activities such as intentional destruction of machines thereby disrupting the production schedules. JU’s Procurement Manager noted: “...*Lack of highly skilled employees...That is why they can damage or destroy machines intentionally.*” Thus, from the analysis, it is observed that a lack of sufficiently skilled manpower can cause more threats as summarised in Figure 4.20.



*Figure 4.20: Consequences of Insufficient Skilled Manpower*

- **Poor Internal Coordination**

Ten companies (BU, JU, GU, CU, HU, IU, KU, NU, PU, LU) identified a deficiency in internal coordination as one of the sources of disruptions to their supply chains. This poor coordination is characterised by functional silos and a mismatch in goals. PU’s Brand Manager argued: “*There is poor communication and lack of understanding between*

*departments e.g. procurement and marketing. There is a mismatch between what we [marketing] aim at and what they [procurement] aim at.”* Some problems like raw material delays and shortages, procurement risk and misallocation of resources (causing financial difficulties) were partly attributed to a lack of coordination. JU’s Procurement Manager for example argued that an order of the same raw material can be made by finance, procurement and the owner concurrently and without each other’s knowledge. This is reiterated by PU’s Procurement Manager who observed: *“We have a problem of internal coordination...There is a problem of information flow where people bypass the information hierarchy. Your subordinate needs something but instead communicates to the wrong departments...as an example, there are certain spares the user wanted, instead of communicating to procurement directly, he communicated to the technical manager...but this caused a lot of delay and idle machines. So we cannot produce and this affects our forecasts. This affects our buffers and may lead to shortage.”*

Companies like CU and JU reported that poor internal coordination was responsible for the managers’ wrong decisions that lead to supply chain disruptions. JU’s Trade Marketing Manager argued: *“For example production should get orders from marketing. Instead orders are got from somewhere else and sometimes a new brand is introduced without the approval of marketing. Due to limited capacity, the production of the brand required by customers is reduced and, instead, the newly produced brand is not preferred by the customers. This leads to a shortage in the market... thus affecting our revenue.”* The antecedents and consequences of poor internal coordination are summarised in Figure 4.21.

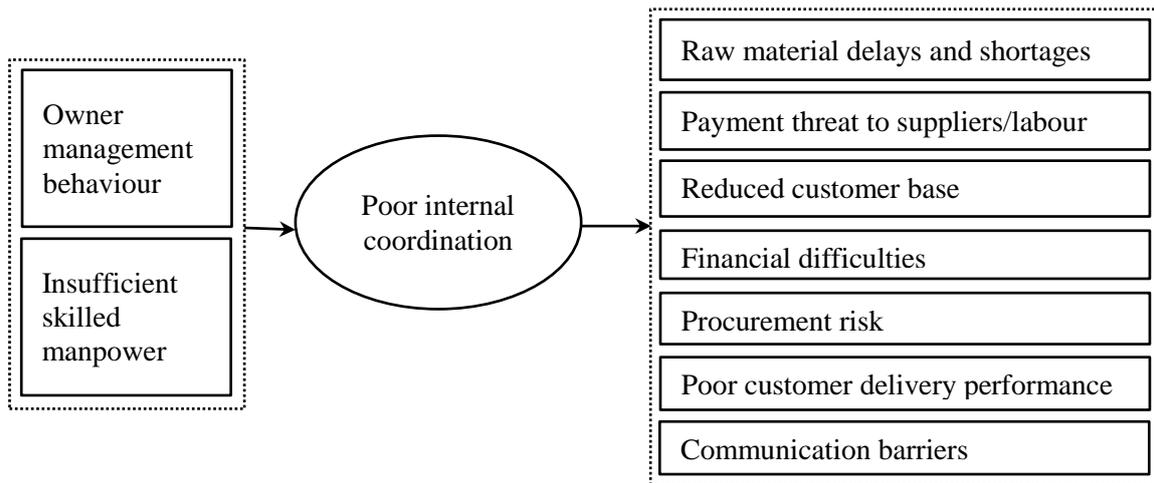


Figure 4.21: Antecedents and Consequences of Poor Internal Coordination

- **Poor Quality Products**

Fifteen firms (HU, BU, LU, QU, JU, DU, KU, PU, IU, NU, FU, TU, RU, GU, OU) reported poor quality products as a threat to their supply chains. GU’s Sales and Marketing Executive argued: *“Quality problems, sometimes the quality of sugar is not good due to the quality of sugarcane. This could be due to natural factors such as too much rain which destroys the sugarcane quality...poor quality leads to customer complaints.”* One of the causes of poor quality products is power shortages, as explained by JU’s Procurement and Logistics Officer: *“Quality problems, we send products in the market and they are found to be of poor quality due to poor processing. In brewing, sometimes power goes off, it affects the product and after bottling there are problems. Sometimes...we buy poor quality caustic soda...”* Companies e.g. KU attributed the quality threat to insufficient skilled manpower while others e.g. JU and HU attributed it to poor quality raw materials and process variations due to machine breakdowns. HU’s Production and Operations Manager asserted: *“We have variations in sizes when it comes to raw materials. We produce different product sizes and this is due to the equipment used by our suppliers. Customers complain about the sizes of the products but this is also due to machine breakdowns. Fixing machines after repair to the right positions is a problem.”* But what appeared more interesting is that dishonest employees deliberately produce poor

quality products as noted by JU’s Regional Sales Manager: “*Quality issues...sometimes, there are inconsistencies...poor quality sometimes in the production department. This could be due to dissatisfaction of employees with the salaries, they sometimes sabotage.*” This further reinforces the role of the context in building resilience. Figure 4.22 shows that poor quality products can originate from other threats and also cause other threats.

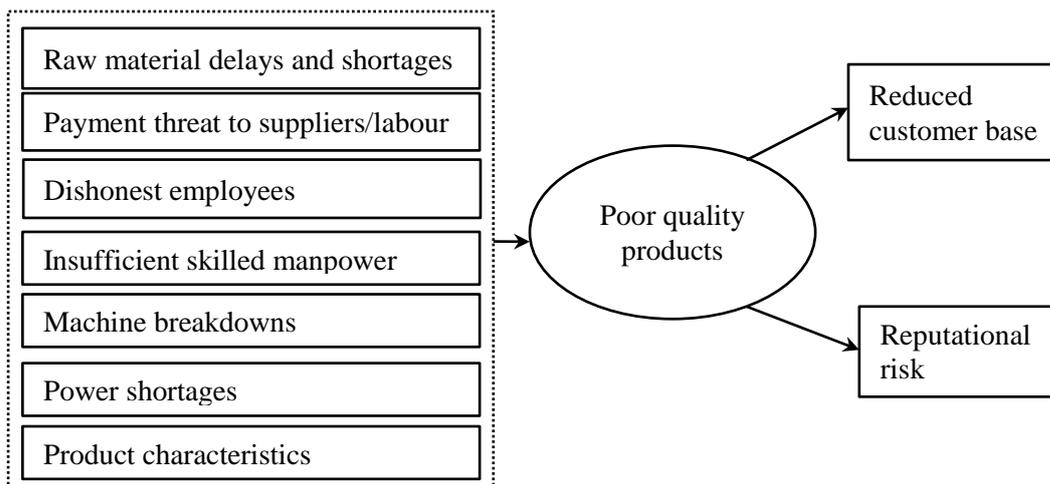


Figure 4.22: Antecedents and Consequences of Poor Quality Products

- **Payment Threat (To Suppliers/Labour)**

Thirteen companies (AU, CU, BU, GU, JU, LU, PU, MU, KU, NU, IU, RU, HU) indicated that their supply chains are disrupted by late payment to suppliers / labour. This leads to raw material delays and shortages, machine breakdowns, poor quality products, failure to fulfil customers’ orders, loss of supplier confidence and trust, and suppliers’ refusal to advance credit. Interviewees attributed delayed payment to several factors such as inefficiency, company policies, delayed payment by customers, order cancellations and financial difficulties. For example, the Procurement Manager for PU noted that due to financial problems, they fail to pay suppliers on time. As a result, they lose reputation and suppliers do not deliver raw materials on time.

Firms like JU indicated that the payment problem, which may result from financial difficulties, also applies to employees – late payment of employees’ salaries can disrupt

production through reduced employee productivity, intentional destruction of machines and the production of poor quality products. JU and LU, for example, indicated how payment problems can result in financial difficulties and employee strikes that can disrupt the entire supply chain. JU's Trade Marketing Manager explained: *“Late payment of employees makes them less motivated and production is affected. This is a big problem since it also affects our revenues and may be a cause of failure to pay suppliers on time. Late staff payment is a problem that started small but has eventually affected the whole supply chain. Production is affected, the market is affected and we fail to get cash inflows to pay our suppliers.”*

The above discussion shows how the payment threat originated, partly, from financial difficulties of the focal firm and produced other threats that again led to the original threat of financial difficulties as illustrated in Figure 4.23.

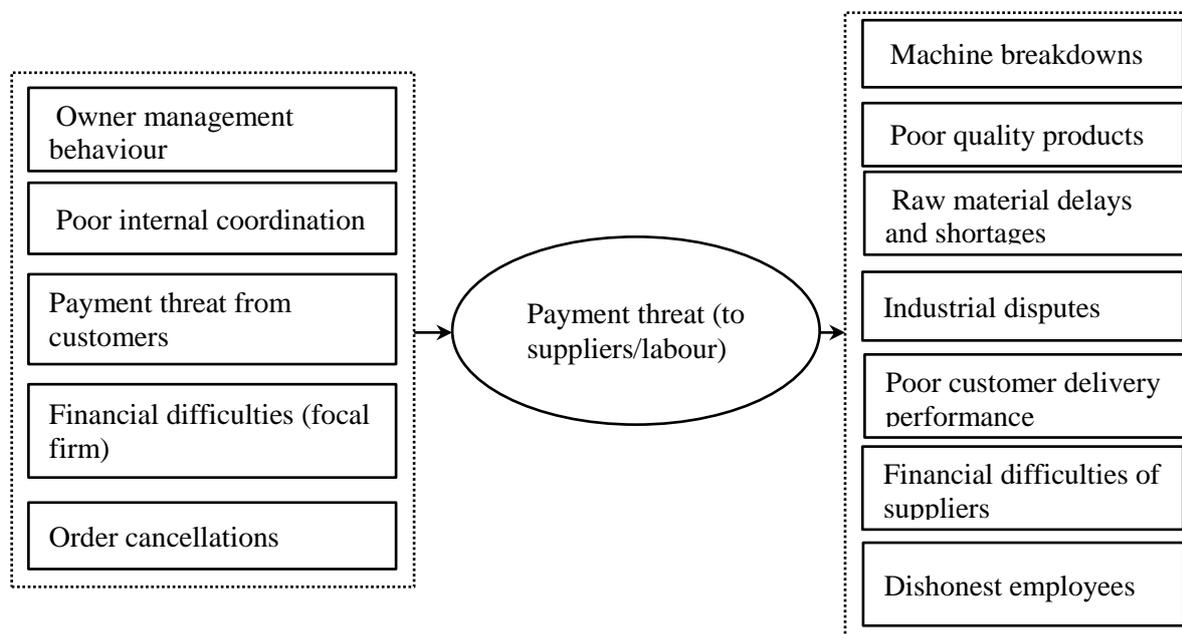


Figure 4.23: Antecedents and Consequences of Payment Threat (to Suppliers/Labour)

- **Financial Difficulties (Focal Firm)**

Seventeen companies (AU, DU, PU, KU, JU, IU, FU, MU, LU, GU, EU, CU, BU, SU, NU, OU, HU) revealed that their supply chains are disrupted due to financial problems which for

example result in failure to pay their suppliers on time, leading to raw material delays, production disruptions and poor customer delivery performance. Dishonest employees and suppliers were listed among the causes of financial problems, as noted by BU's Export Manager: "*...Delays in raw materials. This is due to failure to pay suppliers on time. We are not financially stable...We could not have products to supply to our customers. We had a financial problem but this was due to mismanagement. Suppliers would connive with employees and inflate the cost of raw materials.*" Others like CU attributed their financial difficulties to the behaviour of owner managers who make wrong financial decisions such as over expansion or diverting company money to their private use, leading to failure to fulfil customers' orders.

Other causes of financial difficulties highlighted include political instabilities, order cancellations, poor internal coordination, procurement risk, demand variations, dishonest customers/distributors, power shortages and exchange rate fluctuations (these are separately discussed as threats in their own right). It was also found that financial difficulties lead to a failure to pay employees and suppliers; and employees retaliate by e.g. destroying machines, while suppliers refuse to advance goods on credit. For example, the Managing Director for JU observed: "*We have a cash flow challenge. We do not pay suppliers on time and sometimes we completely fail to pay. We lose supplier confidence and they abandon us or demand advance payment, which we cannot afford.*" In figure 4.24, it can be observed that the threat of financial difficulties originates from many other threats and causes other threats at different points of the supply chain.

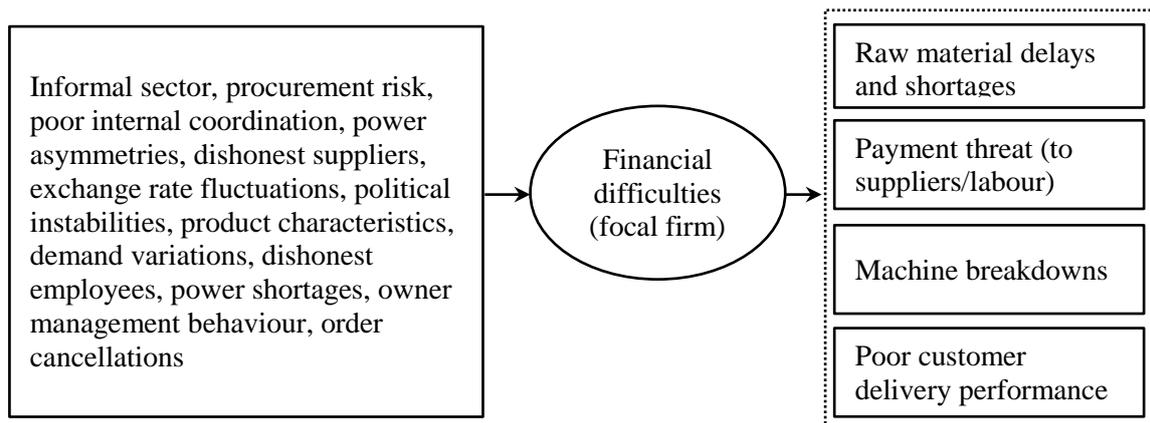


Figure 4.24: Antecedents and Consequences of Financial Difficulties (Focal Firm)

- **Procurement Risk**

Six companies (BU, EU, IU, MU, JU, PU) indicated that procurement related problems disrupt their supply chains. BU, MU and EU pointed to a centralised procurement system where orders have to be approved by their parent companies located in different countries causing late approvals and delays. It was reported that such procurement system increases raw material path length and constrains visibility. MU’s Company Pharmacist noted: “... some of the materials were to be sourced through the parent company which made us fail to have direct contact with the suppliers. This would cause delays. Some materials were manufactured in USA and China but had to pass via India...” Companies further pointed to the problem of uncoordinated procurement systems that lead to duplication, excessive purchases and capital tied-up; and shortages of raw materials as explained by JU’s Procurement Manager: “You find the same order is placed by both finance and procurement. Here everyone can be a buyer... Also we buy more of one raw material and very less of the other, thus shortage of one and excess of the other yet they are needed concurrently. This leads to expiry and loss. It also leads to less supply of the product in the market.”

Companies like JU highlighted a lack of procurement planning. JU’s Procurement and Logistics Officer stated: “Late placing of orders. Most of our raw materials are from abroad.

The user departments place orders when it is late. So they do not consider the lead time. Hence there is delay in delivering raw materials and this affects production and delivery to the customers. In the long run there is financial distress leading to late payment to employees.” Other firms attributed procurement risk to owner management behaviour and poor internal coordination. For example, JU’s Regional Marketing Manager revealed that the owner makes purchasing decisions alone and delivery is made without involving the procurement department, which leads to poor quality raw material purchases. This shows that the threat caused by procurement originates from other threats and also causes other threats as shown in Figure 4.25.

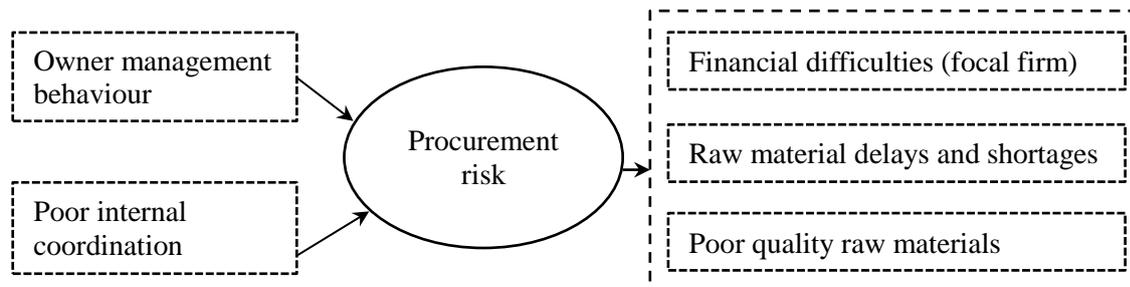
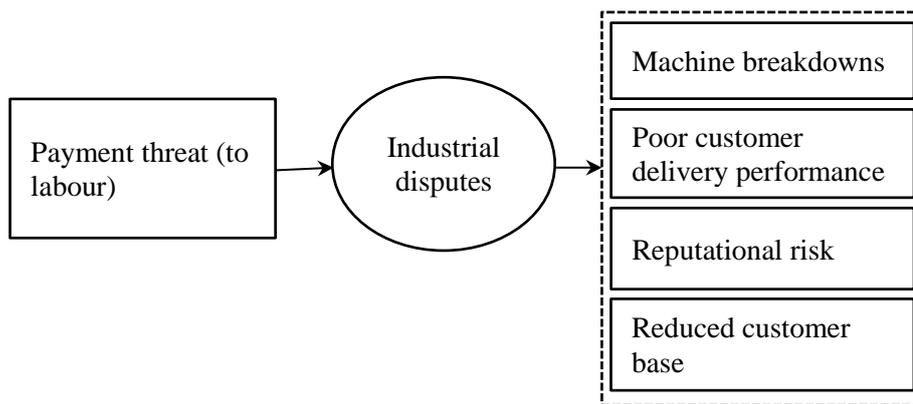


Figure 4.25: Antecedents and Consequences of Procurement Risk

- **Industrial Disputes**

Six companies (KU, RU, GU, LU, AU, JU) highlighted industrial disputes especially employee strikes as an obstacle to their supply chains. Employee strikes are caused by late or low salary payments and generally poor working conditions. GU’s Sales and Marketing Executive explained: *“We use both skilled and unskilled labour. They strike over working conditions and sometimes late payments and this leads to temporary closure and reduced output, which affects our market. This also leads to machine breakdowns. Sometimes...we stop production for about two months.”* KU indicated that employee strikes not only disrupt production but also damage their corporate image. KU’s Marketing Manager commented: *“Employee strikes due to late payments...There is no production and our image is damaged.*

*When there is a strike, we do not produce and other companies take over our customers.*” RU revealed that employee disputes affect the downstream supply chain. RU’s Sales Manager stated: *“Strikes affect production, loading products and delivery to the market...Employees are not motivated due to low salaries that are even delayed. This reduces productivity and customers are affected.”* The threats associated with industrial disputes are illustrated in Figure 4.26.



*Figure 4.26: Antecedents and Consequences of Industrial Disputes*

- **Poor Customer Delivery Performance**

All the twenty firms highlighted a threat of poor customer delivery performance especially in the form of late deliveries to customers. Delivery delays create customer complaints, loss of trust and customer confidence thereby reducing the customer base. LU’s Assistant Sales Manager noted: *“Late deliveries to customers – this is due to the lack of enough resources or lack of raw materials. Due to this, some of our customers defect to our competitors and end up not coming back. Late delivery brings mistrust because you are causing loses to customers”* Companies attributed poor customer delivery performance to factors like machine breakdowns, financial difficulties, raw material delays and shortages, poor transportation infrastructure and government policy. For example, RU’s Sales Manager explained: *“We do not have enough trucks and this delays delivery and increases*

cost...There are also road accidents due to e.g. poor roads... the government policy on the weight of trucks is unfavourable.”

Poor customer delivery performance is also caused by industrial disputes, natural disasters, owner management behaviour, poor internal coordination, demand variations, machine breakdowns, dishonest employees, stock theft, power shortages, product characteristics and customer characteristics. On demand variations for example, FU’s Corporate Marketing Manager stated: “...Sudden demand variations and we fail to meet customer orders. It is a natural phenomenon in our business...” And on poor internal coordination and dishonest employees, NU’s Inventory Manager explained: “Sometimes salespeople get orders when they are not aware whether we have raw materials. There is a lack of coordination between sales and production or stores. Sales people do not tell the truth to the customers about when we will deliver and sometimes we deliver late or fail completely.”

The threat of poor customer delivery performance shows how threats external to the supply chain, supply-side and firm-level threats can cause downstream threats. As observed from Figure 4.27, many other threats which have already been discussed, can cause poor customer delivery performance.

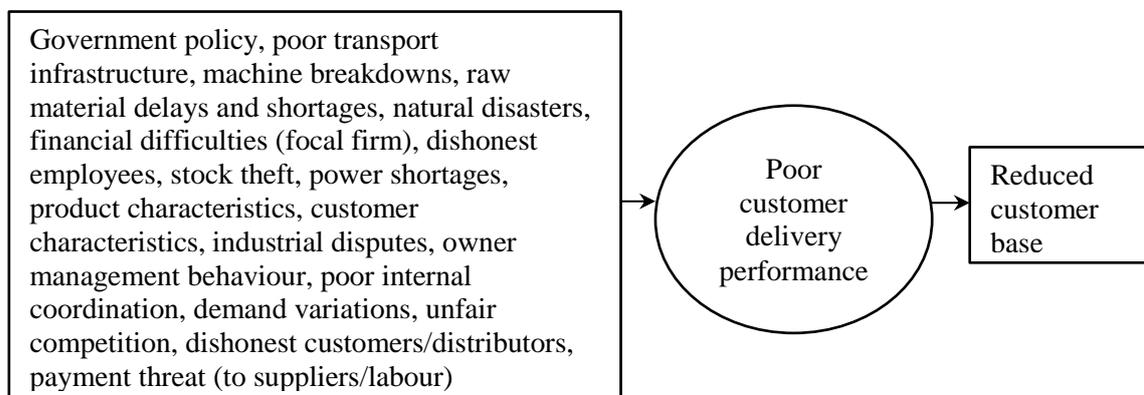


Figure 4.27: Antecedents and Consequences of Poor Customer Delivery Performance

### 4.2.2.3 Demand-Side Threats

From the data, the demand-side threats (i.e. threats originating from the downstream part of the supply chain) as summarised in Table 4.1 at the beginning of this chapter include power asymmetries (stronger customers), dishonest customers/ distributors, payment threat (from customers), financial difficulties of customers, order cancellations, demand variations, customer characteristics and reputational risk. These threats are discussed below.

- **Power Asymmetries (Stronger Customers)**

Eleven companies (DU, OU, CU, EU, JU, HU, LU, GU, MU, NU, RU) reported a threat of high bargaining power of their customers. It was reported that stronger customers use their power to exploit e.g. by influencing negotiations to gain more favourable terms with the threat to switch to competitors if their demands were not met. Some firms like MU, HU, RU and LU argued that powerful buyers are habitually known for excessively delaying payments. According to LU's Assistant Sales Manager, the same customers continue to push for more credit before paying the amount outstanding or else they divert to other suppliers. An example was the Southern Sudanese government which was a customer to some of the firms but could delay payments for more than a year, causing financial difficulties. MU's Company Pharmacist noted: *"Our customers are mainly government and global companies that have higher bargaining power than us. Sometimes they use this advantage and delay payments affecting our operations like purchasing raw materials."* It was revealed that some stronger buyers prefer a win-lose situation by manipulating terms in their favour causing financial problems. For example, EU's Deport Manager commented: *"There are big customers who become threat...they influence negotiations and in most cases to our disadvantage and sometimes we run into financial problems as a result."* This shows power asymmetries – where customers are stronger than the focal firm – are mainly perceived as causing financial difficulties to the focal firms.

- **Dishonest Customers/ Distributors**

Fourteen firms (LU, DU, JU, KU, CU, PU, BU, GU, FU, RU, HU, IU, SU, TU) indicated that their customers/distributors pose threats to their supply chains. Such threats include financial difficulties, as revealed by LU's Assistant Sales Manager: *"There are unpredictable customers who keep on dodging payment. So they keep defecting from one company to the other. After entrusting the distributor with goods worth millions, they disappear, refuse to pay or switch to competitors."* GU and JU reported that some customers deliberately issue bouncing cheques while CU argued that some use political connections and corruption to abscond from payments.

Firms further reported misbehaving customers or distributors who connive with their (study firms') employees and either manipulate the prices or load more quantity than was bought. HU's Marketing Manager noted: *"The sales staff connive with clients and they show you a different price and they share. We lose a lot of money...Even internally in stores, the loading clerk would connive with the storekeeper, the sales person and the client so they would balance the stock but the physical stock would not exist...we could not fulfil the orders."* Some distributors violate the companies' pricing policies and set higher prices which reduce the customer base. DU indicated that some distributors deliberately accumulate debts and close down their businesses in order to dodge paying back. Others are compromised by competitors as reported by TU's Route to Consumer Supply Manager: *"Some distributors keep our stock and they distribute to the competitors'. Our market share is affected. Ugandans are not honest business people...our customers/distributors are not stable: they can any time withdraw from the business and begin a different one."* Figure 4.28 shows other threats associated with dishonest customers/ distributors as identified from the data.

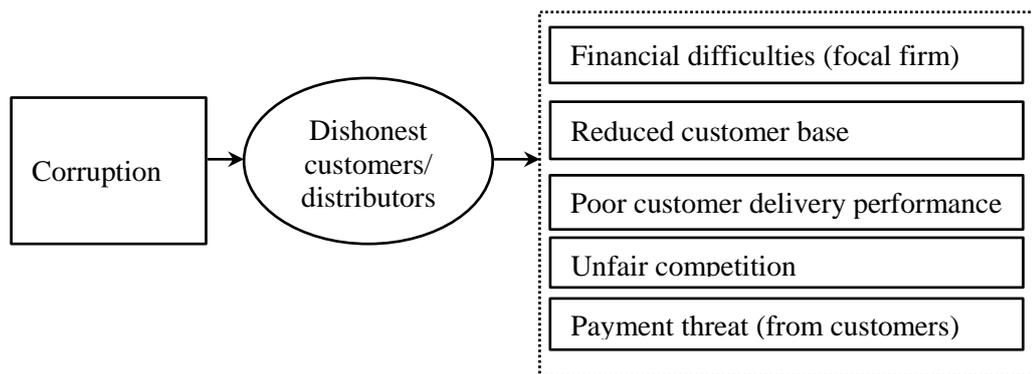


Figure 4.28: Antecedents and Consequences of Dishonest Customers/Distributors

- **Payment Threat (From Customers)**

Sixteen firms (AU, BU, CU, DU, FU, GU, HU, IU, JU, KU, LU, MU, NU, PU, RU, SU) highlighted a threat of payment from customers. This was attributed to power asymmetries (stronger customers), financial difficulties of customers and dishonest behaviour of customers. Firms like MU, HU, RU and LU argued that some customers delay payments excessively and this creates financial difficulties – customers with high bargaining power such as governments can exceed a year without paying. It was argued that this cripples operations and leads to failure to pay creditors such as suppliers on time. HU’s Marketing Manager commented: “...We deal with contract companies; they follow the procurement procedures, which delay the process. The government procurement procedure is bureaucratic and sometimes you get money after six months or even a year, so we do not get the anticipated revenue and we can’t manufacture and supply other clients.” Some dishonest customers take advantage of their political connections, corruption and a weak legal system to default payment as reported by CU’s Production and Site Coordinator: “There are customers who fail to pay and we declare them ‘bad debts’. Some deliberate and you move to the building and find soldiers camped there.” The causes and effects of the payment threat identified from the data are illustrated in Figure 4.29.

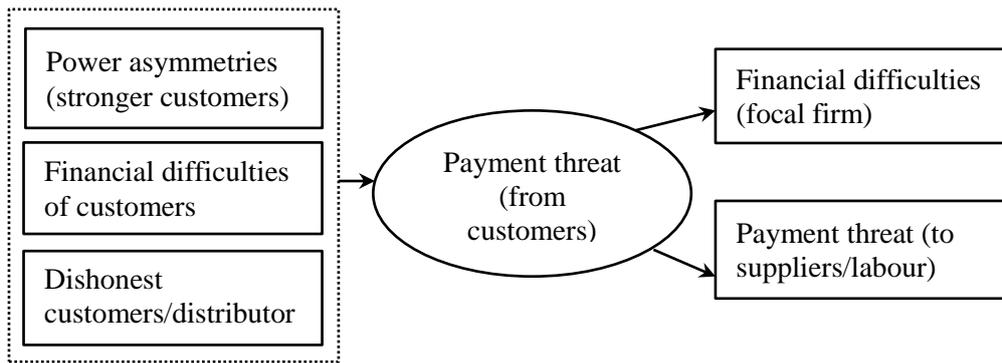


Figure 4.29: Antecedents and Consequences of Payment Threat (From Customers)

- **Financial Difficulties of Customers**

Four companies (EU, FU, RU, JU) indicated that the financial instability of their customers was a threat to their supply chains. Due to financial constraints, some customers do not pay on time and some completely fail to pay causing financial distress. JU indicated that some of their distributors close down their operations before paying the amount owing which leads to financial difficulties. JU's Procurement Manager stated: *"Some of our distributors completely run out of money and close shop before paying us. This affects us financially. We had such a distributor in Mbarara city and we lost billions of shillings."* Some attributed order cancellations to the financial difficulties of customers, as stated by FU's Corporate Marketing Manager: *"Order cancellations happen due to financial problems on the part of customers. After placing orders, customers realise they cannot raise money to pay and yet we have already invested in production. This puts us in a difficult financial situation."*

- **Order Cancellations**

Eleven companies (LU, HU, AU, CU, DU, OU, FU, BU, NU, MU, JU) highlighted a threat of order cancellations. These originate from machine breakdowns, financial difficulties of customers, government policy, corruption, raw material delays and shortages; and customer characteristics. Companies like BU, NU and HU argued that order cancellations occur due to customers' lack of product knowledge and giving wrong specifications. HU's Marketing

Manager observed: *“...Even with the big parastatals and corporations, they order wrong items and in due process they realise it’s not what they wanted and they later cancel the order.”* MU attributed order cancellations to the government policies e.g. on donations, which makes customers cancel the orders. MU’s Company Pharmacist argued: *“Sometimes, they cancel and say we have received donations...Donations affect us ...we deal in high value items which are not easy to store due to tying up capital. These raw materials have an expiry date of only two years and are hard to hold for a long time.”* Some companies revealed that order cancellations lead to wastage and deterioration of items. The Distribution manager for NU noted: *“Distributors order excess of what they need and the paint is stored for so long and they end up returning it and you find it has expired.”*

Order cancellations were reported as a cause of financial problems and a failure to pay suppliers, as AU’s Marketing Manager noted: *“...sometimes clients order and later withdraw. This distorts our revenue forecasts and yet we need money to pay for raw materials. In some cases, you find we had already ordered based on the projected revenue. So, we fail to pay suppliers on time and this is a big problem because they also need to pay their suppliers.”* The antecedents and consequences of order cancellations are summarised in Figure 4.30.

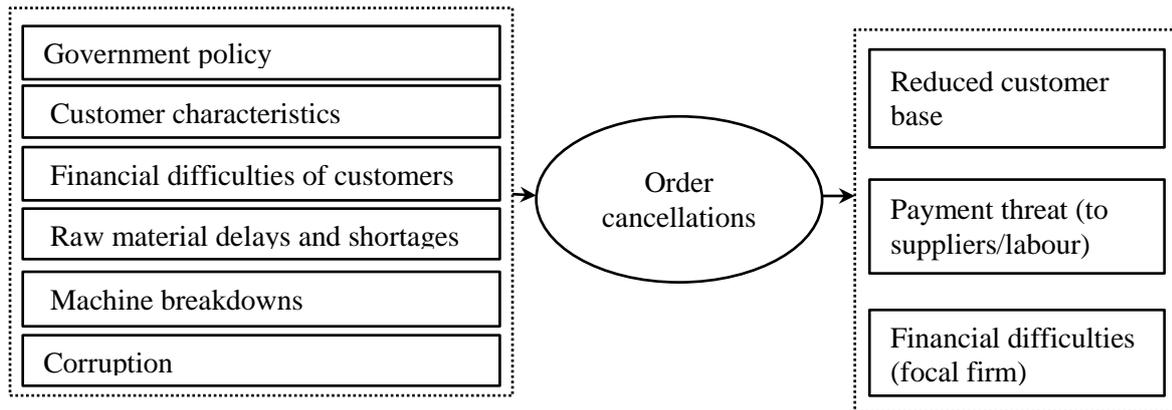


Figure 4.30: Antecedents and Consequences of Order Cancellations

- **Demand Variations**

Fourteen companies (TU, DU, FU, GU, BU, EU, HU, JU, NU, PU, MU, RU, CU, OU) highlighted demand variations as a supply chain threat. Some, like NU, argued that demand variations result in unexpected orders which cannot be fulfilled given raw materials and general capacity limitations. Others like TU observed that demand variations can be caused by special political events or other seasonal events. But BU and FU maintained that demand variations are frequent and mostly unpredictable. Demand variations mean some of their products remain unsold causing a financial crisis, as reported by BU’s Sales Coordinator: *“There are constant changes in customer demand and some products end up taking more than a year before being sold. We dispose them off cheaply and this affects our cash flows.”* HU indicated that sudden demand increases may require extra raw materials which may be difficult to source given their suppliers’ capacity limitations.

Some other firms (mainly those using agricultural raw materials) attributed sudden demand variations to natural disasters (causing raw material shortages). For example, unfavourable weather, as reported by GU’s Sales and Marketing Executive: *“There are instances of sudden increase in demand that exceeds capacity like the 2011 sugar crisis caused by drought that affected sugarcane yields.”* MU, which manufactures pharmaceutical products, attributed demand variation to unstable government policy, especially regarding the

donation of drugs. MU's Company Pharmacist argued that, after purchasing raw materials based on forecasts provided by the government, donors deliver drugs, prompting the government to cancel some of the orders – making demand unpredictable. The causes and outcomes of demand variations identified from the data are shown in Figure 4.31.

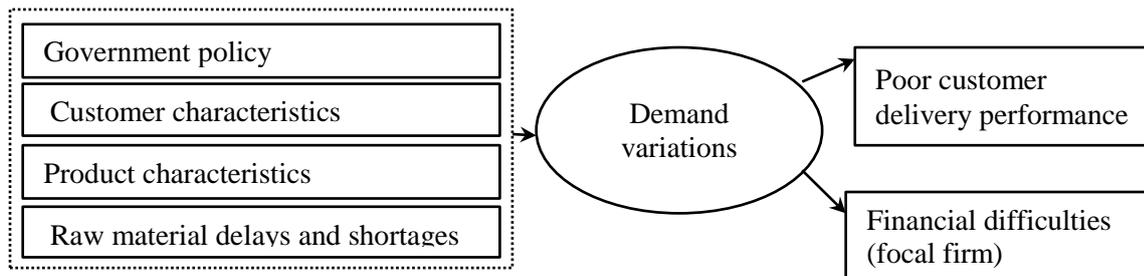


Figure 4.31: Antecedents and Consequences of Demand Variations

- **Customer Characteristics**

Seven companies (TU, FU, OU, QU, BU, HU, NU) indicated that the nature of their customers poses a threat to their supply chains. Some indicated that their customers have limited product knowledge, low purchasing power and are price sensitive. OU's Sales and Marketing Manager for example noted: *"Customers do not know enough about the product and are price sensitive. They end up moving for competitors or importers from China which is relatively cheaper but of low quality...There is a problem of counterfeit especially from China. Customers do not mind quality but price."* Other firms like BU attributed the counterfeit problem to the nature of their customers, who buy counterfeit products knowingly. However, other firms like NU argued that customers have limited product knowledge which results in order cancellations, compounding financial problems. TU indicated that the nature of the economic activity of their customers makes them vulnerable to natural disasters e.g. prolonged drought which reduces their disposable income. TU's Route-to-Consumer Supply Manager argued: *"Our customers in the rural areas, who are the majority, depend on agriculture – implying that in the case of bad weather like a prolonged*

*dry season, their disposable income is very low and this affects our supply chain downstream.*” FU and HU attributed the low purchasing power of customers, on corruption, as FU’s Corporate Marketing Manager commented: *“Corruption would be a cause for the low purchasing power because money goes in the hands of few people. There are a lot of income disparities”*. The antecedents and outcomes of the threat of customer characteristics are summarised in Figure 4.32.

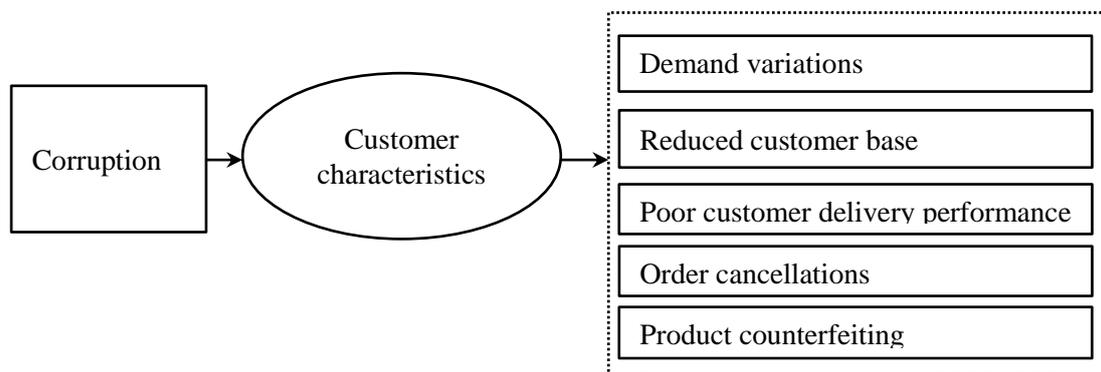


Figure 4.32: Antecedents and Consequences of Customer Characteristics

- **Reputational Risk**

Four companies (BU, KU, HU, QU) revealed a threat of loss of corporate reputation in the downstream caused by e.g. product counterfeiting, poor quality products, strikes and product withdrawals/ recalls. HU’s Production and Operations Manager commented: *“Suppliers do not grade the materials...These lead to poor quality products... We withdraw the product but we incur a lot of transport costs of withdrawal from customers. This [withdrawal] also damages our reputation.”* On reputational risk from product counterfeiting, BU’s Sales Coordinator argued: *“There are counterfeiters who sell products using our labels, customers complain and this reduces trust. This loss of reputation is hard to regain and it affects our performance in the market.”* This finding shows that threats in the upstream (e.g. product counterfeiting) and those at a firm level (e.g. industrial disputes) can cause other threats that disrupt the downstream part of the supply chain.

The above section (4.2) has analysed both the exogenous and endogenous threats to the supply chain, as claimed by respondents. Exogenous threats have been categorised under geopolitical threats and economic threats, while endogenous threats were categorised under supply-side threats, firm level threats and demand-side threats. This section has revealed that most of the perceived threats are endogenous events, some of which are caused by conditions of continuous possibilities. Also observed was the very close connection between threats. It was found that some threats either cause other threats or originate from other threats, making it increasingly difficult to discuss each in isolation. Further, the role of the context of Uganda in either causing or compounding supply chain threats was evident. The next section (4.3) analyses the data on the strategies for creating resilience.

### **4.3. Supply Chain Resilience (SCRES) Strategies**

The SCRES strategies identified from the data were broadly grouped into seven higher level categories (i.e. relationship management, supply management, demand management, information management, product management, financial management and human resource management) and respective lower level categories as illustrated in Table 4.2.

Table 4.2: Taxonomy of SCRES Strategies (Higher & Lower Level Categories)

SCRES Strategies	
Higher Level Categories	Lower Level Categories
Relationship management	Co-opetition, collaboration with government, collaboration with customers, collaboration with suppliers, Informal networking
Supply management	Backward integration, outsourcing, appropriate supplier selection, alternative transportation, multiple sourcing, supplier development, maintaining strategic stocks, buying instead of making (temporarily), effective contracting, local sourcing, order splitting, enhancing proximity to suppliers, procurement management, quality management, exclusive sourcing, inter-branch stock transfer
Demand management	Creating customer flexibility, customer incentives, inventory management, product recalls, demand forecasting
Information management	Risk communication, market intelligence, increasing product knowledge, improving visibility, using information communication technology
Product management	Manufacturing flexibility, ensuring product security
Financial management	Borrowing from customers, effective credit management, insurance
Human resource management	Employee training

The following sub-sections will analyse, in detail, each of the resilience strategies outlined in table 4.2.

#### 4.3.1. Relationship Management Strategies

- **Co-opetition**

Five companies (PU, IU, RU, LU, HU) indicated that they collaborate with their competitors (co-opetition) to build resilience against disruptions caused by e.g. raw material delays and shortages, unfavourable government policy, unfair competition, machine breakdowns, dishonest customers/distributors and poor quality products. On dishonest customers/distributors for example, LU’s Assistant Sales Manager noted: *“There is a need for good working relationships, especially between competing firms, in order to identify unethical customers...they [customers/distributors] disappear, refuse to pay or switch to competitors.”* In some cases, buying firms encourage rival suppliers to collaborate by forming associations (triads) in order to enhance supplier efficiency and reliability through supplier development and other synergies, as stated by IU’s Brand manager: *“We have arranged the*

*farmers to form groups so that they can benefit...By forming groups,... they can negotiate with the government for favourable terms which can also benefit us. We also facilitate them with finance or seeds.”*

Co-opetition also helps companies to buy raw materials for emergencies from competitors, as explained by RU’s Logistics Assistant: *“You order but you are delayed...we have a collaborative relationship with our competitors from whom we buy raw materials for emergencies.”* Firms like LU argued that co-opetition also helps to overcome disruptions from machine breakdowns. In the case of machine breakdowns, either they request their suppliers to split the order between them and competitors, or subcontract their friendly competitors to process the entire customers’ orders on their behalf. Interestingly some firms revealed that co-opetition helps them to mitigate disruptions caused by raw material delays and shortages by borrowing raw materials from their competitors (without interest) and replacing the goods when their consignment arrives. PU’s Procurement Manager stated: *“We work together with our competitors by getting raw materials from them and replacing them when ours are delivered ... This kind of arrangement is facilitated by our networks as managers. We know each other and we communicate during crises to bail each other out. When they also face a crisis, they come to us for help.”*

The co-opetition strategy explained above indicates that SCRES can emerge from a mutual interaction between the system and other independent, rival systems within the environment. And it is observed that co-opetition strategy is facilitated by another strategy of informal networking.

- **Collaboration with Government**

Eleven companies ( BU, EU, FU, IU, JU, RU, MU, KU, OU, PU, QU) indicated that they collaborate with the government to manage disruptions from threats like product counterfeiting, unfair competition, poor transport infrastructure, corruption, unstable taxation,

government policy, political instabilities, informal sector, payment threat (from customers) and raw material delays and shortages. On fighting product counterfeiting for example, OU's Marketing Manager stated: *"We work closely with Uganda National Bureau of Standards and Uganda Revenue Authority [government bodies]. We need protection from the government...lobbying to ensure the government helps us fight counterfeits, poor quality etc."* On natural disasters, shortages of raw materials and taxation, FU's Corporate Marketing manager explained: *"The drought... and the scarcity of raw materials led to scarcity of sugar...but we collaborated with the government of Uganda which gave us a duty free license to import sugar...to maintain the supply chain"*.

Some firms, however, argued that collaboration with the government involving informal networks and lobbying is likely to facilitate threats such as corruption and product counterfeiting (the threat it is meant to mitigate). Further, PU's Procurement Manager argued that their collaboration with the government to mitigate unfair competition by revealing tax defaulters and evaders can lead to a closedown of some of their competitors. Thus, it was found that a strategy can affect two firms differently. For example, collaboration with the government helps MU to mitigate financial difficulties as MU's Supply chain Manager noted: *"We collaborate with the government so that we can operate better. The government supports us by paying us in time."* Yet some of the companies complained of late payment by the same government, leading to financial difficulties. HU's Marketing Manager commented: *"Sometimes, you get money after six months or even a year, so we do not get the anticipated revenue and we can't manufacture and supply other clients."* Thus, while MU perceives the government as a source of resilience against the threat of financial difficulties, HU perceives it as source of the same threat. This further confirms that it is difficult to generalise SCRES – a strategy for one firm can be seen as a threat for another.

- **Collaboration with Suppliers**

Fourteen companies (AU, BU, CU, JU, PU, SU, QU, IU, OU, EU, LU, MU, NU, TU) stated that they collaborate with their suppliers to manage disruptions caused by e.g. a limited local supply market, long distance sourcing, raw materials delays and shortages, poor quality raw materials, financial difficulties, unfair competition and delayed payment to suppliers. JU indicated that they maintain few suppliers in order to effectively build and maintain collaborative relationships with them to mitigate raw material shortages. Firms like NU revealed that collaboration helps them to be prioritised over competitors; and others argue that long term collaborative suppliers are more responsive and able to bail them out during a crisis. PU's Procurement Manager commented: *"We also collaborate with local suppliers, they buy from overseas, we don't buy from them regularly but we buy from them once in a while to keep them in business. If the overseas suppliers face a problem, we tell them to bail us out."* Collaboration with suppliers is also necessary given the supply market is limited to avoid material shortages, as stated by SU's Assistant Procurement Manager: *"We have limited suppliers for certain industrial items such as spare parts, so we use collaborative relationships with suppliers in order to be prioritised."*

Firms reported different aspects of collaboration such as forming long-term contracts, information sharing, joint planning and Early Supplier Involvement (ESI) in product design. AU's Marketing Manager explained: *"...We have collaborative relationships and constant communication...we involve them [suppliers] in our new product design so that we share plans on how the new product development and marketing will be executed, including the availability of raw materials. Where necessary, we adjust the product design at an early stage. With this collaboration, we improve our visibility and we can easily and quickly respond to fashion changes. We do research and forecasts in the market and inform our suppliers accordingly."* This statement shows how collaboration with suppliers helps in

improving visibility and product design alignment with the supply chain, which in turn helps to build SCRES through enhancing agility.

- **Collaboration with Customers**

Eight companies (AU, LU, KU, OU, MU, DU, HU, NU) indicated that they develop collaborative relationships with their customers in order to manage disruptions from power asymmetries (stronger customers), machine breakdowns, demand variations, financial difficulties, product characteristics and poor customer delivery performance. Collaboration is implemented through activities like frequent visits to customers and involving customers in some of their operations. DU's Marketing Officer stated: *"Machine breakdowns create a big backlog of work. They [machine breakdowns] delay the jobs resulting in customer complaints. We talk with them and agree. We maintain collaboration with customers. We involve customers in our activities. We visit customers frequently to resolve their grievances."* Some companies indicated that they introduced specific programmes aimed to strengthen customer relationship management as a means to retain them during a disruption, as noted by AU's Marketing Manager: *"We had a problem of poor relationships with customers, but now we have put in place a programme called 'Fidelity' aimed to bring good relationships between the company and final users. We keep visiting customers to improve our relationship."*

Firms like KU revealed that collaboration with customers helps them to mitigate financial problems through short term borrowing. QU indicated that collaboration improves their visibility in the downstream supply chain, which facilitates monitoring and increases customer product knowledge. Collaboration also facilitates creating customer flexibility by requesting customers to wait (demand postponement) in the case of late delivery. HU's Production and Operations Manager stated: *"Unexpected demand increases, sometimes there are no raw materials at the suppliers' side and the demand is high. We give information to*

*the clients and request for more time. Collaboration and communication help us to keep customers waiting.”*

The above analysis also shows how SCRES strategies complement each other – collaboration with customers reinforces other strategies like visibility, monitoring, increasing product knowledge and creating customer flexibility/demand postponement.

- **Informal Networking**

Six companies (HU, KU, JU, PU, QU, EU) revealed that they use their informal connections to mitigate supply chain threats. For example, on threats of financial difficulties and delayed payment to suppliers, JU’s Procurement and Logistics Officer explained: *“Sometimes we do not have enough money to pay suppliers on time. We call the supplier and explain the situation and they accept to wait. As individuals, we have personal relationships with managers in companies that supply us and this collaboration makes our work easy. We understand each other better at a personal level.”* QU’s Procurement Manager indicated that personal relationships between employees can help in facilitating collaboration between firms and stated that: *“... what matters most are the individuals within that system because the individuals’ collaboration determines the system collaboration. So to me, it is mostly about personal relationships”*.

Informal networking helps firms acquire information e.g. regarding prices, to mitigate problems from price variations like a reduced customer base. PU’s Procurement Officer stated: *“We benchmark on other companies that have been buying the item to tell us the price and suppliers. Some of these companies’ employees are our close friends. It is easy to approach them.”* PU’s Procurement Manager revealed that informal networking between managers facilitates a co-opetition strategy – where firms borrow raw materials from their competitors in the case of delays. KU’s Marketing Manager indicated that informal networks

also help them mitigate financial difficulties by borrowing money from customers, stating that: “... *I just give a phone call and money will be deposited without any agreement.*”

Some companies however indicated the dark side of informal networks in building SCRES. For example, companies like BU, PU and JU argued that disruptions from unfair competition and corruption are facilitated by the informal networks between managers of competing firms and government officials. Thus, informal networking can reinforce other strategies. But it can also facilitate threats to SCRES. This therefore shows how it is difficult to generalise resilience – one factor can produce contradictory results to the same or different actors along the supply chain.

#### **4.3.2. Supply Management Strategies**

- **Backward Integration**

Four companies (FU, GU, CU, LU) use backward integration to mitigate disruptions caused by a limited local supply market, supplier delivery failure, material shortages and delays, power shortages and poor quality raw materials. Firms reported that they have expanded into their suppliers’ businesses so as to produce their own raw materials and utilities. Though interviewees conceded that this strategy is costly as it involves venturing into a different business, firms FU and GU, which are sugar manufacturers, revealed that they use their bi-products. FU’s Corporate Marketing Manager stated: “*With the shortage of power, we decided to generate our own power using our bi-products.*” CU and LU indicated that they decided to produce their own raw materials to mitigate raw material shortages due to a limited local supply market and poor quality raw materials. LU’s Assistant Sales Manager stated: “*...Limited supply market...But we do backward integration where we have bought forests to produce raw materials of better quality.*”

- **Outsourcing**

Five companies (EU, HU, JU, RU, LU) highlighted outsourcing as a strategy against threats like financial difficulties, poor customer delivery performance, raw material delays and shortages, poor transport infrastructure and dishonest suppliers. The outsourced activities highlighted were logistics related, including customs clearance, storage and transportation. RU's Sales Manager stated: *"Transport problems... We do not have enough trucks and this delays delivery and increases cost. But we outsource transportation."* Firms like LU indicated that outsourced service providers are specialised in respective areas and can easily respond to emergencies since they have spare facilities. Interestingly, included among the reasons for outsourcing, especially storage facilities, was to safeguard stock from being stolen by dishonest employees. HU's Marketing Manager stated: *"...we order massively and we find an independent store to keep it for safety. It is saleable and we keep it not to be stolen by our employees since it is rare material. Our competitors are willing to buy it from our employees expensively even if they are aware it is stolen from us."* This shows that an outsourcing strategy can complement another SCRES strategy of maintaining strategic stock. Further, outsourcing as a security measure against theft by employees shows a culture of dishonesty and lack of trust – where a company trusts third party providers more than its own employees and where a firm deliberately decides to buy materials stolen from its competitors.

- **Appropriate Supplier Selection**

Nine companies (OU, BU, EU, JU, PU, SU, MU, IU, TU) revealed that they select competent suppliers to mitigate supplier related threats e.g. product counterfeiting, poor quality raw materials (that lead to poor quality products), supplier delivery failures, dishonest suppliers and raw material delays and shortages. JU, EU, MU and PU stated that supplier selection is facilitated by the use of Information and Communication Technology which helps in

maintaining a database of prequalified suppliers. MU's Supply chain Manager noted: *"We have strict quality standards at the firm level...We do extensive vendor qualifications and quality assessment to ensure quality and delivery performance."* Some interviewees e.g. TU indicated that during supplier selection, they consider factors such as integrity and ethics, quality, financial capability and past performance/experience – and that market research, in part, helps to ascertain whether these criteria are met e.g. not employing child labour. Some companies further revealed that continuous supplier appraisal helps them in supplier selection or retention based on their performance. TU's Route-to-Consumer Supply Manager noted: *"We have a challenge of a poor grade of raw materials...We vet our suppliers yearly to determine whether or not to retain them."*

- **Alternative Transportation**

Three companies ( AU, LU, PU) revealed that although their main means of transporting raw materials is water, they sometimes use air as an alternative means of transport. AU argued that this alternative transportation is used when delays and shortages occur due to a long distance from suppliers. LU claimed that they air lift some emergency raw materials in the case of in-transit thefts or accidents, while PU revealed that they use alternative transportation to acquire spares in the case of machine breakdowns. PU's Procurement Manager commented: *"Sometimes we air lift raw materials instead of using water to keep the process going. Even if the insurance compensates, it takes some time, so we airlift as a last option. We airlift a small quantity and the supplier, meanwhile, dispatches"*. All of the three companies maintained that air as an alternative transport mode is used only for emergency purposes, in order to continue operating.

- **Multiple Sourcing**

Seventeen companies (BU, CU, EU, DU, HU, KU, JU, NU, PU, SU, QU, MU, LU, IU, RU, GU, OU) indicated they source from many suppliers to build SCRES against supply-side threats e.g. shortages and delays of raw materials, financial difficulties of suppliers, demand variations, supplier delivery failure, poor quality raw materials, dishonest suppliers, limited local supply market and product counterfeiting. For example, IU's Brand Manager argued: *"Very few suppliers have the capacity to deliver. They are not honest to reveal that they do not manage. So sometimes there are delays or they supply poor quality. This affects our ability to meet customer demand. Sometimes, we seek alternative suppliers. We have a pre-list of reliable suppliers."*

Generally, firms indicated that multiple sourcing helps them to get alternative supplies in case of crisis, as the Procurement and Logistics Officer for JU explained: *"There are items where we have few suppliers e.g. the suppliers of one of our additives are from Germany and in case they get a problem or are out of stock, production is affected...we use alternative suppliers in case the supplier does not have the required quality. We keep a database of suppliers using our ERP system."* Multiple suppliers are also maintained to spread risk through order splitting, as stated by PU's Procurement Manager: *"We keep a list of suppliers who are better in different aspects and we spread risk. We do not have big factories in Uganda to supply us. Thus, we look for more suppliers and divide the jobs according to their capacities."*

- **Supplier Development**

Ten companies (EU, FU, GU, JU, LU, QU, MU, IU, TU, SU) develop their suppliers to create resilience against threats like poor quality raw materials, limited local supply market, raw material delays and shortages, government policy, unfair competition and financial difficulties of suppliers. Companies reported that they develop suppliers using financial

incentives, technical assistance, training, transport facilities, land acquisition and bank guarantees. FU's Corporate Marketing Manager explained: *"We develop suppliers by giving them financial incentives, technical help, soft loans etc...because with a shortage of sugarcane, our production reduces thereby affecting our customers...there is a national sugar policy where each firm should develop its own suppliers without interruption."*

To ensure the successful implementation of the supplier development strategy, companies such as IU and FU revealed that they encourage competing suppliers to cooperate (co-opetition). IU's Finance Manager stated: *"We used to advance money to the suppliers but this affects our cash flows...So we assist our suppliers by helping them get loans from banks, say by providing Local Purchase Orders (LPOs). We have encouraged farmers to cooperate and we enter into contracts with unions of farmers and help them acquire land and quality seeds."*

The idea of competing suppliers forming associations in the above statement shows the complementarity of SCRES strategies – it shows that co-opetition between suppliers reinforces a supplier development strategy. Supplier development further shows how resilience can emerge at the triadic level rather than individual firms in isolation.

- **Maintaining Strategic Stocks**

Sixteen companies (NU, LU, AU, TU, GU, BU, HU, KU, JU, PU, MU, IU, RU, EU, CU, DU) reported maintaining strategic stock as a way of creating resilience against threats such as machine breakdowns, raw material delays and shortages, financial difficulties of suppliers, demand variations, procurement risk, natural disasters and political instabilities. For example, EU's Procurement Manager commented: *"There are instances where we have machine breakdowns and there is increased demand we cannot meet. We try to stock as much as we can (buffer) using our depots."* Companies reported keeping buffers for a long period of time – some up to five months. AU's Marketing Manager noted: *"Since 2011, we put a program*

*for minimum stock level. Our source of raw materials is far away. So we keep stock for at least five months to cater for delays.”* On the threat of disruption from natural disasters e.g. floods, the Brand manager for IU stated: *“Natural calamities e.g. floods where you take a long time without accessing the market, due to impassable roads, e.g. in the North. East, we keep stockholding points near flood affected areas.”* And on disruptions from political instabilities due to chaotic political transitions, CU’s Marketing Manager stated: *“...Towards election in the neighbouring countries, we keep enough stock because we expect chaos...”* But some firms like PU argued that maintaining strategic stock is limited by capacity constraints as stocks have to be kept for a long time due to long and unpredictable lead times.

- **Buying Instead of Making**

Five companies (FU, GU, EU, LU, RU) indicated that in the event of raw material delays and shortages, for example, due to natural disasters or sudden demand increases, they buy finished products from other manufacturers as a short-term measure to maintain customers during a crisis. GU’s Sales and Marketing Executive explained: *“There is a problem of drought which destroys our raw materials...In 2011, there was drought which affected sugarcane yields and the sugar prices shot up since we did not have raw materials. To maintain our supply chain, we imported sugar in order to keep our customers.”* This strategy is appropriate for short term disruptions – it was observed that buying finished products instead of manufacturing them reduces firms’ profitability – but it helps to ensure continuity, as revealed by company RU. The strategy of buying instead of making is also facilitated by co-opetition between manufacturing firms, which enables them to buy emergency finished products from each other, as explained by LU’s Assistant Sales Manager: *“Shortage of raw materials...late delivery to customers brings mistrust. So we go to our competitors with whom we collaborate and buy finished products so as to make our clients happy.”* This finding shows that the strategy of making instead of buying is reinforced by co-opetition.

- **Effective Contracting**

Twelve companies (AU, EU, DU, BU, CU, PU, IU, LU, JU, MU, OU, GU) indicated that they ensure properly drafted and detailed contracts to manage supply chain disruptions from e.g. limited local supply market, financial difficulties (focal firm), reputational risk, power asymmetries, payment threat (from customers), supplier delivery failure, poor quality raw materials and raw material delays and shortages. For example, some firms reported that they enter into long term contracts with suppliers to mitigate raw material shortages but some e.g. DU maintained that such contracts should be flexible to cater for the needed adjustments in case of a crisis. Firms like BU indicated that they form appropriate contracts to mitigate disruptions from price variations by including specific clauses to define how variations should be handled. LU argued that they include clear terms and conditions in their contracts to guard against late payments by customers. EU argued that appropriate contracts prescribing clear terms and consequences of non-compliance are vital to mitigate disruptions from both the upstream and downstream supply chain. EU's Deport Supervisor explained: *"In most cases, we use the contracts to prescribe terms and consequences in order to guard against delivery failure and other non-compliance issues either from suppliers or customers."*

Some companies further reported that they make long term contracts especially for raw materials with limited suppliers so as to increase reliability, as PU's Procurement Officer stated: *"We book early in advance and sign contracts for consignment stocking. We maintain long-term contracts and collaboration with suppliers."* PU further indicated that due to storage capacity limitations and the need to minimise stock holding costs, they make framework contracts (where a big order is made but split into different deliveries for different periods of time). Thus, another SCRES strategy (order splitting) is reinforced by effective contracting.

- **Local Sourcing**

Eight companies (DU, CU, IU, KU, JU, PU, MU, RU) indicated that they buy from local suppliers to manage disruptions from raw material delays and shortages (e.g. caused by long distance sourcing, political instabilities and procurement risk). JU's General Manager explained: *"For beer crates, we have only one manufacturer. Sometimes, the cost of transport is higher than that of purchasing an item. We plan to get alternative materials that can be available locally."* To some companies like RU, PU, KU, CU and DU, local sourcing was portrayed as a tentative strategy that is not sustainable in the long run. For example, PU's Procurement Officer claimed that they source locally during delays to avoid stock outs and idle machines. This was further confirmed by PU's Procurement Manager: *"We don't buy from them [local suppliers] regularly but we order from them once in a while to keep them in business. If the overseas suppliers face a problem, we tell them to bail us out."* The use of local sourcing as a tentative strategy could be due to its adverse outcomes, as will be discussed later (in section 4.4).

- **Order Splitting**

Two companies (MU and PU) indicated that they use order splitting to mitigate disruptions from raw material shortages and storage capacity constraints. This is done by ordering in bulk to avoid price variations but splitting the orders into different smaller deliveries for different periods of time to reduce stock holding. PU's Procurement Manager explained: *"Stock holding is a major problem...Instead of ordering and delivering at once, we breakdown deliveries...We split the dispatch, where the supplier releases a few containers per month. We give suppliers big purchase orders and tell them to dispatch /release in different months."* Another kind of order splitting is where a firm divides a big order among multiple suppliers so as to spread risk and reduce delays and shortages. PU's Procurement Officer stated: "...

*we spread risk. We do not have big factories in Uganda to supply us. Thus we look for more suppliers and divide the jobs according to their capacities.*” MU explained that order splitting – where raw materials are delivered in phases – requires the focal firm to also deliver in phases to the customers, and so on. MU’s Company Pharmacist stated: “... *we decided to breakdown the deliveries to customers so that we can begin processing earlier and supply in phases... but they [customers] would also adjust their distribution... to avoid holding a lot of inventory and deterioration.*” PU’s statement shows that in order to avoid side effects, some SCRES strategies should be implemented consistently throughout the entire supply chain. In the above example, order splitting at a point in the supply chain can cause problems at another point if not consistently implemented.

- **Enhancing Proximity to Suppliers**

Companies MU and LU indicated that they increase proximity to the source of raw materials so as to create resilience against certain supply side threats related to long distance from suppliers e.g. raw material delays and shortages. This can be ensured during supply chain design, by locating near the source of raw materials, as revealed by LU. But it can also be a supply chain redesign decision in the course of operation. For example, MU indicated that they ensure proximity through co-location where they use their bargaining power to have their suppliers establish facilities near them in order to improve communication, visibility and reduce delivery delays. MU’s Company Pharmacist explained: “*The lead time is about 6 months to get materials since the distance from where we source them is also very long. So we decided to deal with them through the parent company which has high bargaining power...some of the suppliers establish their manufacturing facilities near the parent company [co-location].*” This shows that a condition e.g. high bargaining power of suppliers not only produces threats but can also constrain the implementation of certain strategies against threats (e.g. co-location) to reduce raw material delays and shortages.

- **Procurement Management**

Ten companies (MU, TU, IU, NU, CU, AU, JU, LU, PU, EU) indicated that they manage disruptions from power asymmetries, limited local supply market and raw material delays and shortages through effective procurement management. Companies like NU increase their bargaining power by consolidating purchases and buying in bulk so as to improve their value to suppliers and be prioritised during a risk event. Others like EU, PU and MU indicated that they procure their items through their parent companies to enhance their power. MU's Company Pharmacist noted: *"We used our parent company because, due to its bulk buying, they had high bargaining power and could get credits...Having many manufacturing facilities we can place big orders and part of it can be diverted to other branches."*

However, it was also argued that a decentralised procurement system can reduce visibility and cause delays, as stated by the Company Pharmacist for MU: *"...some of the materials were to be sourced from the parent company, which made us fail to have direct contact with the suppliers...we requested to directly source some of the materials from suppliers. This reduced lead times for materials from six months to one month."* Companies like JU, PU, MU, LU and TU highlighted the use of effective procurement planning to avoid unnecessary delays, shortage of raw materials, late payment to suppliers and emergency procurements. While some firms like AU reported purchasing exclusively from few suppliers as a means to ensure reliability and increased bargaining power, others e.g. LU indicated that they increase their bargaining power by facilitating competition between suppliers /competitive bidding. This shows how two seemingly contradictory strategies can achieve the same goal for different companies i.e. exclusive sourcing and multiple sourcing (by competitive bidding).

- **Quality Management**

Six companies (RU, MU, FU, BU, IU, PU) indicated that they manage the quality of raw materials to mitigate quality threats. Some firms like LU require suppliers to attach quality test certificates which are then shown to their customers to confirm adherence to standards. PU revealed that they developed a quality oriented culture based on a principle called *'Quality at source'* where quality orientation is built into their operational processes and each individual at any level is directly responsible to ensure quality. PU's Procurement Officer stated: *"Quality at source... where quality output is not only measured at the end of the production line but at every step of the production process and being the responsibility of each individual..."* But others like BU indicated that they have specific established quality management teams to oversee quality related issues. MU revealed that they conduct quality screening at different levels of the supply chain beginning with supplier quality audits and assessments. MU's Company Pharmacist noted: *"To avoid quality problems, we get materials from trusted suppliers. There are several levels of screening from suppliers, at the parent company and internally at the firm level"*.

- **Exclusive Sourcing**

Two companies (FU and AU) stated that they use exclusive sourcing arrangements to mitigate disruptions from e.g. a shortage of raw materials and a limited local supply market. They argued that the use of exclusive suppliers increases supplier commitment and reduces competition over raw materials where suppliers are few. AU's Marketing Manager explained: *"To overcome the problem of raw material shortages and few suppliers in the market, we have an established supplier for critical items with whom we have a long term relationship and who exclusively supplies only us. So the company cannot supply our competitors. Our competitors also have their own suppliers."* Company FU indicated that the use of exclusive suppliers reduces unnecessary competition over raw materials, which increases supplier

reliability and reduces price variations. FU's Corporate Marketing Manager commented: *"...because, with a shortage of sugarcane, our production reduces thereby affecting our customers...there is a national sugar policy where each firm should develop its own suppliers without interruption."*

- **Inter-branch Stock Transfer**

Three companies (AU, BU, MU) indicated that they manage raw material shortages and delays by transferring stock from one branch to another in different localities. It was argued that this strategy is appropriate for short term disruptions because, in the long run, stock in all the branches may get depleted. AU's Marketing Manager stated: *"Sometimes we get emergency stocks from our sister companies in Kenya or Tanzania in the case of a shortage. Also, if some items cannot be sold in Uganda, we take them to our sister companies in Tanzania and Kenya."* BU added that they hold stock in different locations (branches) strategically to cater for shortages. BU's Sales Coordinator revealed: *"...Since we have stock in different localities, in case of shortage, we shift some and transfer them to locations where they are needed."* Some firms like MU revealed that inter-branch stock transfer can be used to enhance bargaining power while overcoming the challenge of limited storage capacity through the consolidation of purchases (bulk buying) and later redistribution to different branches. This shows that the strategy of inter-branch stock transfer and that of procurement management (e.g. buying in bulk) reinforce each other.

#### **4.3.3. Demand Management Strategies**

- **Creating Customer Flexibility**

Ten companies (RU, OU, SU, QU, JU, NU, BU, LU, HU, KU) indicated that they mitigate disruptions from threats like supplier delivery failure, delays and shortages of raw materials, poor customer delivery performance, poor quality products, power shortages and demand

variations by building flexibility into their customers. Firms like BU and RU revealed they convince customers to buy the available alternative products in the case of delivery failures or quality problems. RU's Sales Manager explained: *"We convince our customers to take alternatives...we would have a shortage for almost six months or a year...we would advise our customers to wait or to use alternative products."*

Another customer flexibility strategy revealed by firms like HU, JU, NU, LU, SU, KU, OU and RU is demand postponement in the case of delivery delays due to power outages and raw material delays and shortages. When there is a crisis, firms communicate with their customers and request them to wait and have their orders fulfilled at a future date. OU's Sales and Marketing Manager commented: *"In case of delays, we manage customer expectations by creating awareness and keep communicating with them and requesting them to wait"*. Firms like NU, HU and KU argued that creating customer flexibility through demand postponement is facilitated by collaborative relationships with customers and effective communication. HU's Production and Operations Manager commented: *"...sometimes there are no raw materials at the suppliers' side and the demand is high. We give information to the clients and request for more time. Collaboration and communication help us to keep customers waiting."* KU argued that they offer incentives to their customers e.g. bonuses and discounts to motivate them to postpone their orders. The above further shows that SCRES strategies i.e. collaboration, risk communication and customer incentives facilitate customer flexibility.

- **Customer Incentives**

Ten companies (AU, DU, JU, OU, GU, EU, SU, LU, HU, RU) indicated that they use customer incentives to create resilience against disruptions from e.g. dishonest customers/distributors, power asymmetries (stronger customers), poor quality products, financial difficulties and a reduced customer base. Included among the incentives are free

products in case of poor quality, as DU's Marketing Officer stated: *"There are customer complaints and we sometimes sort out the poor quality products and replace them, sometimes, we give our customers extra free products."* Others like RU, HU and JU reported giving incentives such as trade credits, cash discounts, trade discounts and transport facilities. For example, HU's Marketing Manager noted: *"High bargaining power of customers... We use trade discounts to maintain them."* Other incentives reported include offering transport facilities to customers and sensitising them about the products, and how to distribute them. JU's Trade Marketing Manager for example explained: *"Inefficiency of distributors... Some do not have enough facilities, they close early and others are compromised by our competitors...We give them incentives like equipping them with knowledge of distribution through trade audits and conferences."*

- **Inventory Management**

Six firms (BU, JU, MU, NU, OU, QU) indicated that they effectively manage inventories to mitigate disruptions from raw material delays and shortages; and financial difficulties. One of the methods reported is rationing of the available stock proportionate to the value of customer orders. This is done when the available finished products cannot fulfil all the orders – each customer order is at least responded to as a means to maintain the customer base. QU's Procurement Officer explained: *"...dry season, we have shortages of raw materials and production is affected. We ration to ensure all our customers get something. We apportion proportionately according to customers' orders. We do this so we don't frustrate our customers because they also have their customers waiting for the product."* Other firms revealed that they mitigate financial difficulties resulting from overstocking as well as shortages by conducting regular stocktaking, developing inventory norms and inventory planning and forecasting. NU's Inventory Manager commented: *"... there is delay due to a shortage of spare parts...Sometimes when we keep a lot of stock; it gets expired causing huge*

*financial losses. We use our scorecard to ascertain which products are highly demanded so that we keep just enough stock.”*

- **Product Recalls**

Thirteen firms (TU, DU, FU, GU, BU, HU, KU, JU, PU, QU, LU, IU, RU) indicated that they ensure effective product recalls as a reactive strategy to manage the potential adverse effects of poor quality and counterfeit products. This is applied when poor quality products have already infiltrated the downstream supply chain to mitigate adverse effects such as reputational risk, reduction in customer base, health hazards and litigation. QU's Procurement Officer noted: *“...Our distributors...we ensure they do not give their customers products that have gone bad in order to preserve our reputation because customers cannot understand that the problem is from distributors. We encourage them to give us back the damaged products and we replace them”*. Firms e.g. PU, BU, and JU argued that product recalls should be conducted effectively e.g. after effective risk communication, explaining the threat to customers, compensation or replacing the poor quality products with the good quality ones and ensuring a quick response, as explained by PU's Procurement Officer: *“In case of complaint or realising that we sent a poor quality product in the market, we immediately communicate to customers and explain the problem to lessen the impact. Where possible we withdraw the product and replace with a better quality one”*. The above shows that a product recall strategy can be reinforced by risk communication.

- **Demand Forecasting**

Four companies (PU, DU, MU, AU) highlighted demand forecasting as one of the strategies for mitigating supply chain disruptions. DU indicated that they avoid running out of stock by making projections based on customers' orders. PU asserted that they minimise stock holding and ensure the continuous flow of raw materials by splitting orders based on their sales

forecasts. Other firms revealed that demand forecasting helps them mitigate the effects of unexpected policy changes and demand variations. For example, MU's Company Pharmacist argued: *"It was hard to maintain a buffer because the nature of our products is such that the policy changes. We decided to work with National Medical Stores [customer] so that they give us annual forecasts. Then we would communicate with the supplier and give them the annual forecasts and we would inform them that based on confirmation of orders, we shall be sourcing from you."* AU indicated that market intelligence helps in demand forecasting by providing information. Further, PU showed that demand forecasting facilitates order splitting, meaning these strategies reinforce each other.

#### **4.3.4. Information Management Strategies**

- **Risk Communication**

Sixteen companies (SU, OU, CU, BU, QU, MU, HU, JU, AU, LU, NU, DU, IU, KU, EU, PU) identified risk communication as one of the strategies for building SCRES to disruptions from raw material delays and shortages, demand variations, political instabilities, unstable taxation, poor customer delivery performance, power shortages, machine breakdowns, supplier delivery failure, quality problems, payment threat to suppliers and product counterfeiting. For example, on improving visibility and traceability to mitigate raw material shortages and delays, MU's Company Pharmacist explained: *"We conduct weekly control tower meetings. We use video conferencing where we discuss with the suppliers to ascertain the status of materials and possible risks to delivery. So we have improved traceability... So in case of delays, some improvisation is made... The control tower meetings created a lot of coordination between the departments ... and also to coordinate the supply chain members."* This example shows that the use of information and communication technology facilitates risk communication.

Other firms communicate risks through meetings, publicity, personal visits, telephone and using internet platforms – some have cultivated a culture of monthly communication about quality threats, as explained by PU’s Procurement Manager: *“Customer complaints on quality: On a monthly basis, we have a meeting of the entire company and we look at the complaints and discuss how to solve them...But in case of complaint or realising that we sent a poor quality product in the market, we communicate to customers and explain the problem to lessen the impact.”* It was found that risk communication helps to facilitate other strategies like co-opetition and creating customer flexibility (demand postponement). For example, HU’s Production and Operations Manager stated: *“Unexpected demand increases...We give information to the clients and request for more time. Collaboration and communication help us to keep customers waiting.”*

- **Market Intelligence**

Eleven firms (TU, OU, GU, BU, KU, NU, PU, LU, IU, RU, AU) indicated that they use market intelligence to gather information about the market especially competitors’ activities so as to detect and mitigate unfair competitive practices. For example, OU’s Sales and Marketing Manager noted: *“What we do is to keep aware of our competitors actions e.g. pricing through our market intelligence.”* LU indicated that they gather information about certain competitors with whom they share suppliers because they deliberately buy all the raw materials towards a potential crisis in order to disrupt their operations. LU’s Logistics Assistant stated: *“We try to have knowledge of their [competitors’] activities because they can buy all the raw materials especially when the factory [supplier] is about to close for some time during facility upgrade or maintenance.”* Market intelligence also helps in forecasting to ascertain potential demand variations as well as sharing information with suppliers and customers about potential threats like product counterfeiting. AU’s Marketing Manager explained: *“We also find out new changes in tastes and preferences and we try to be*

*innovative to create new products. We always do research and forecasts in the market and inform our suppliers accordingly. We advise them to stock in advance in case we predict price increases... We use our customers and wholesalers to gather market intelligence about counterfeit products.”*

- **Increasing Product Knowledge**

Ten companies (BU, NU, RU, OU, PU, DU, KU, LU, CU, QU) stated that they increase knowledge of their products to mitigate disruptions from unfair competition, product counterfeiting, demand variations, reputational risk and poor quality products – it was revealed that these threats are partly caused by limited product knowledge. BU, LU, KU and PU argued that they sensitise customers and the general public about the features of their products in order to fight product counterfeiting. KU’s Marketing Manager stated: *“Counterfeits of our products...We use advertising and publicity showing the features of our products, alerting police etc...”* Firms also educate customers to increase awareness about the quality of their products so as to manage unfair competitive practices – where rival firms reduce quality and reduce the price causing price wars and customer switching, as noted by RU’s Sales Manager: *“...Price war. There are poor quality products from our competitors but which are cheaper...we try to give our customers some discounts and sensitise them about the quality of our products.”*

Some firms reported that they use dealer forums and customer visits to sensitise their distributors about the products and how they should be handled in order to maintain product quality. QU’s Procurement Manager explained: *“We sensitise our distributors on how to handle the product ...We ensure they do not give their customers products that have gone bad in order to preserve our reputation.”* NU revealed that product knowledge is also imparted to enhance employees’ customer complaints handling capabilities. NU’s Inventory Manager explained: *“Our problem is a lack of product awareness among the employees. They fail to*

*effectively address customer complaints and our customers end up shifting to our competitors. But we are using the marketing department to create this product awareness.”*

- **Improving Visibility**

Nine companies (DU, MU, SU, AU, BU, IU, LU, CU, JU) argued that they improve visibility of their supply chains to improve transparency, traceability and information flow necessary to mitigate disruptions from supplier delivery failures, dishonest customers/distributors, raw material delays and shortages, poor quality raw materials, demand variations, in-transit raw material theft and payment threat from customers. Firms like DU and MU argued that their supply chain structures caused a lack of visibility, which resulted in failure to detect dishonest customers and raw material delays, respectively – visibility was reportedly increased by supply chain redesign through eliminating certain nodes which, for example, then reduced the lead time.

Firms like BU and PU indicated that visibility helps them monitor their supply chains to mitigate disruptions caused by dishonest field employees. BU’s Distribution and Central Warehouse Manager commented: *“For thieves we have instituted security measures such as stopping loading at night... We use tracking system on the drivers. We have instances where employees connive with transporters to steal the items in transit.”* LU and SU argued that increasing visibility and contact with suppliers helps them monitor raw material quality problems, while AU involves suppliers in the earlier stages of its product design processes in order to enhance visibility and manage raw material shortages to increase agility – this is facilitated by communication and collaboration with suppliers. AU’s Marketing Manager stated: *“We involve them [suppliers] in our new product design... With this collaboration, we improve our visibility and time to market and we can easily and quickly respond to fashion changes.”* CU and MU indicated that they ensure visibility through supplier visits and using Information and Communication Technology, respectively. MU’s Company Pharmacist

asserted: “...we use video conferencing where we discuss with the suppliers to ascertain the status of materials. So we have improved traceability towards fulfilling the order.” This further reiterates the complementarity among SCRES strategies where strategies such as collaboration with suppliers and using information and communication technology reinforce supply chain visibility.

- **Using Information and Communication Technology (ICT)**

Six companies (BU, HU, JU, IU, LU, MU) indicated that they use communication and information technology to mitigate disruptions from e.g. reputational risk, poor internal coordination and raw material delays and shortages. BU noted that they use telephone and the internet including social networking technology such as skype to coordinate internally and with their supply chain partners. HU revealed that they use information technology to enhance their reputation, attract and retain customers; and MU argued that they mitigate raw material delays by increasing visibility through video conferencing, which helps them to discuss with suppliers on the status of materials and possible threats that might constrain delivery. Others like JU argued that they use Enterprise Resource Planning (ERP) to mitigate raw material delays and shortages by maintaining a database of redundant suppliers. Information and communication technology helps in enhancing corporate reputation and customer retention, as stated by HU’s Marketing Manager: “*We use on line marketing, good and marketable websites, and this makes us attract and retain customers. It also enhances our reputation in the face of suppliers, potential customers and the general public.*”

#### **4.3.5. Product Management Strategies**

- **Manufacturing Flexibility**

Seven companies (NU, PU, OU, JU, DU, QU, MU) revealed that they build resilience to disruptions from demand variations, raw material delays and shortages, machine breakdowns

and insufficient skilled manpower by creating flexibility in their manufacturing processes. This includes product postponement (flexibility) during manufacturing. Firms like OU indicated that they keep components awaiting assembly to customer orders to mitigate demand variations. OU's Sales and Marketing Manager stated: *"We use order based manufacturing or postponement. We produce on order to avoid the problems of demand variations and fashion changes. So we produce what the customer requires."* PU, MU and NU indicated that the flexible workforce in their production processes is instrumental – in the event of a sudden increase in demand, they increase the number of labour shifts to enhance production. PU indicated they maintain multi-skilled staff in the production department who can be shifted between jobs to increase the quantity produced during a crisis. Others like JU indicated that they install multipurpose machines and shift jobs between machines in case of machine breakdowns or use machines to manufacture a different brand in case of raw material delays. JU's Managing Director noted: *"Sometimes, we experience stock-outs due to delay in supply or poor quality leading to production stoppages and this affects the supply in the market. But we try to use multipurpose machines such that when there are no raw materials for certain brands, there are no production stoppages. Also when some machines break down, others can perform the same task in their place."*

- **Ensuring Product Security**

Eight companies (AU, BU, DU, TU, MU, RU, PU, JU) revealed that they manage disruptions from e.g. product counterfeiting, dishonest employees and unfair competition by ensuring product security. JU indicated that they use unique packaging to protect against competitors who withdraw most of the re-usable packaging material from the market with an intention of disrupting their (JU's) production. Firms like BU, DU and RU revealed they install unique security features to protect the product against counterfeiting while MU revealed that they have built counterfeit detection systems into their products. Others e.g. PU and TU indicated

that they use tamper resistant and tamper evident product packaging. Further, they regularly monitor the market and change their packaging and labelling accordingly, as the Procurement Manager for PU, which manufactures bottled mineral water, explained: *“We face a problem of counterfeits. We changed the label to metallic. We also changed the mould bottle. We also changed other features of the performance weight. No company can make a bottle of our neck-type.”*

#### **4.3.6. Financial Management Strategies**

Ten companies (KU, JU, PU, MU, NU, IU, EU, LU, RU, BU, OU, CU) highlighted the use of financial management to mitigate financial related disruptions. These strategies are: borrowing from customers, effective credit recovery and insurance to recover from financial losses.

- **Borrowing from Customers**

Companies like JU and KU reported that they borrow money from their customers. It was reported that raising capital through borrowing from customers is facilitated by the presence of informal relationships. The Marketing Manager for KU commented: *“Sometimes when we have financial problems, our customers give us money in advance and we produce and supply them. It is sort of borrowing from customers. In return we give them business and retain them. It involves trust and loyalty and knowing each other at an individual level. I just give a call and money will be deposited without any agreement.”* This statement shows that the SCRES strategy of borrowing capital from customers is enabled by the informal networks between managers.

- **Effective Credit Management**

Some firms indicated that in order to mitigate the payment threat – where dishonest customers or distributors for example deliberately refuse to pay for the goods advanced on credit, they reduce credit transactions, ask for collateral security before advancing credit or make appropriate contracts with clear terms and conditions regarding payments. For example, PU’s Procurement Manager stated: “...*We ask [distributors] for deposits before we give them distributorship. So we use collateral and deposits to guard against those who are untrustworthy. We have come up with appraisals and reviews together with collateral e.g. buildings. So we ensure they put more valuable collateral to stop them from absconding and refusing to pay.*” Others like RU reported they use effective credit recovery through monitoring the creditors as revealed by RU’s Logistics Assistant: “*There are dishonest distributors. We have dishonest distributors. We have a customer relationship team with credit officers. We keep on checking on them so as to recover the money.*”

- **Insurance**

Six companies (OU, CU, EU, KU, PU, RU) indicated that they insure against certain supply chain risks to get compensation and continue operating after the risk events. The risks insured include theft, those concerning product characteristics e.g. damages for fragile items and poor transport infrastructure e.g. accidents. For example, CU’s Production and Site coordinator noted: “*Our products are fragile. So storage is difficult and some of them are damaged during transportation. We also incur a lot of insurance costs and a small accident can cause a lot of damage. Sometimes there is a poor road network between Kampala and Mombasa. But we insure against those risks so that the insurance pays.*” Other companies insure their products against sea piracy and theft. PU’s Procurement Manager commented: “*We try to recover the stolen raw materials through insurance company but there are hardships. Even recently we had broken voltage regulators but when we applied to the insurance company,*

*we have taken more than five months without getting response and we lose time in waiting.”*

EU indicated that they insure against supplier delivery failure. EU’s Procurement Manager stated: *“We keep at least three suppliers to cater for contingencies. We give them money in advance and in case they fail to perform, the bank compensates us through insurance.”*

#### **4.3.7. Human Resource Management Strategies**

- **Employee Training**

Eight companies (BU, EU, HU, PU, SU, MU, LU, KU) indicated that they train their employees as a means to manage certain supply chain threats related to insufficient skilled manpower. BU claimed that training and mentoring staff helps them build an honest workforce and reduce dishonest employee behaviour. BU’s Sales Manager noted: *“We have a challenge of our staff that are unethical. They sell at a higher price and keep the balance...We do a lot of training and mentoring to build honesty.”* On the threat of insufficient skilled manpower, MU’s Supply Chain Manager stated: *“We had a problem of skilled manpower for specialised activities. We are recruiting and sponsoring workers to train in specialised areas.”* The Depot Manager for EU argued that training employees not only helps in building skills, but also in building a good corporate culture that can strengthen internal coordination, communication and dialogue.

The section that follows analyses the outcomes of implementing some of the supply chain resilience strategies discussed above.

#### **4.4. Outcomes of Implementing SCRES Strategies**

Table 4.3 indicates the outcomes of certain SCRES strategies – not all strategies identified from the data had specified outcomes. From the data, it was found that the interviewees were mostly concerned with adverse or unexpected outcomes of adopting a particular strategy, e.g. side-effects or new threats. Where the outcomes of certain strategies were positive,

interviewees had no need to give further explanations. Only thirteen out of the thirty seven strategies that emerged from the data had adverse outcomes, suggesting that the remaining twenty four strategies had positive outcomes (or worked as expected). The negative aspect of implementing SCRES strategies has been largely neglected in the prior SCRES literature and a focus on this, in this section, is expected to contribute to our understanding of how SCRES can be gained or lost.

Table 4.3: Outcomes of Implementing SCRES Strategies

<b>Strategies</b>	<b>Outcomes</b>
Collaboration with suppliers	Confidentiality risk
	Limited flexibility to switch suppliers
	Poor customer delivery performance
	Supplier complacency
	Raw material delays and shortages
Maintaining strategic stocks	Financial difficulties (focal firm)
	Stock theft
Local sourcing	Poor quality raw materials
	Product counterfeiting
	Financial difficulties (focal firm)
Outsourcing	Loss of control
Exclusive sourcing	Limited flexibility to switch suppliers
Product recalls	Distributor complacency
	Reputational risk
Effective credit management	Reputational risk
	Reduced customer base
Quality management	Raw material delays and shortages
Employee training	Labour turn-over
Insurance	Poor customer delivery performance
Co-opetition	Confidentiality risk
Procurement management	Raw material delays and shortages

The outcomes from SCRES strategies summarised in Table 4.3 are further discussed in the sub-sections below:

#### **4.4.1. Outcomes of collaboration with suppliers**

- **Confidentiality Risk**

Companies LU and PU indicated that collaboration with suppliers results in confidentiality risk where sensitive information is leaked to competitors. For example, LU's Assistant Sales Manager explained: *"The problem with collaboration and sharing our strategic information with suppliers is that when competitors also collaborate with the same suppliers, some leak our confidential information to competitors and we lose some of our competitive strength."*

PU argued that the risk of losing confidential information makes them draft specific agreements with suppliers. PU's Brand Manager stated: ...*"We share certain suppliers with our competitors... For big suppliers, with whom we collaborate, we still fear they can leak our secrets, e.g. our competitive strategies like new products. So we sign confidentiality agreements so that they do not release critical information."*

- **Limited Flexibility to Switch Suppliers**

Companies AU, JU, PU and BU indicated that collaboration with suppliers increases switching costs and limits flexibility to switch suppliers in case of a crisis or when new potentially better suppliers with more favourable terms emerge. BU's Merchandise Manager explained: *"Delays sometimes take up to three months and with such a shortage, our customers shift to competitors. We have specific suppliers with long-term collaborative relationships. But we find ourselves tied in a relationship and it becomes hard to switch suppliers."* JU argued that collaboration with suppliers requires supplier base reduction which can create, for example, dependence on few suppliers which can result in raw material delays and shortages. JU's Trade Marketing Manager commented: *"...It is important to keep one or a few suppliers to establish better and more collaborative relationships. The problem with dependence on one supplier is if 'he' becomes bankrupt, our business continuity is also*

*affected, we can't get raw materials. We are tied.*" This shows that the outcome of a certain strategy can cause the threat it was meant to mitigate.

- **Poor Customer Delivery Performance**

Company JU revealed that collaboration with suppliers calls for sacrifice. This is true for example when collaborating suppliers are unable to supply on time and they request to postpone delivery – affecting production schedules and leading to delayed delivery to customers. The Procurement and Logistics Officer for JU explained: *"This was due to our collaborative relationship with them [suppliers]. But sometimes as you try to create a good relationship you sacrifice e.g. being patient and waiting due to the request from your supplier which affects production and delivery to customers. Customers may shift to competitors."*

The above example shows how implementing a resilience strategy may have inherent sacrifices that lead to more threats. It was found that establishing more collaborative relationships with suppliers to mitigate supply-side threats e.g. raw material delays and shortages, may result in further raw material delays and shortages. This may constrain production, leading to downstream problems of poor customer delivery performance and a reduced customer base.

- **Supplier Complacency**

MU indicated that collaborative and long term relationships with suppliers makes suppliers complacent and inefficient, especially if they realise that they have high bargaining power. MU revealed that some of the suppliers with whom they collaborate may not prioritise them or sometimes delay deliveries of raw materials during a crisis. MU's Company Pharmacist stated: *"Having long time collaborative relationships with suppliers...Those with high bargaining power may be complacent. Sometimes, they delay delivery."* Thus collaboration with suppliers can itself cause raw material delays and shortages.

#### 4.4.2. Outcomes of Maintaining Strategic Stock

- **Financial Difficulties**

Nine companies (AU, PU, FU, MU, LU, GU, IU, JU, EU) indicated that maintaining strategic stocks to respond to raw material delays and shortages from e.g. long distance sourcing increases stock holding costs and ties up capital, particularly for expensive materials and spares. This results in the threat of running into financial difficulties. AU's Marketing Manager stated: *"Our source of raw materials is far away. So we keep stock for at least five months to cater for delays. For example, materials arriving from Japan can take three months, which ties [up] our capital and creates financial problems."* Companies like PU further revealed that they keep stock of finished goods to ensure supply continuity during machine breakdowns or repairs but such stocks lead to problems like expiry, which leads to financial loss. Further, the financial difficulties resulting from maintaining strategic stocks mean firms fail to pay suppliers on time or customs, resulting in a circular effect – further material delays and shortages. JU's Procurement & Logistics Officer explained: *"We place orders, but deliveries are delayed due to a lack of finances, for example to pay for customs clearance – sometimes because money is tied [up] in inventory ... [we] lack enough raw materials and this affects our production."*

- **Stock Theft**

Companies HU, LU and GU revealed that keeping a lot of buffers of raw materials to build resilience against raw material delays and shortages due to e.g. a limited local supply market attracts theft by dishonest employees. HU's Marketing Manager stated: *"There are raw materials where we have one supplier in Uganda who also runs out of stock. Sometimes, we store a lot of cement but we have thieves [employees] ... sometimes we would run out of stock unexpectedly, affecting the clients and the company ... we could not fulfil the orders, which reduced our cash flows."*

The above analysis shows that maintaining strategic stocks can produce negative outcomes due to socially acceptable misbehaviours of employees, resulting in problems like financial difficulties that affect both the upstream and downstream supply chain.

#### **4.4.3. Outcomes of Local Sourcing**

- **Poor Quality Raw Materials**

Six companies (KU, HU, IU, JU, SU, PU) indicated that using local sourcing to mitigate raw material delays and shortages results in another threat of poor quality raw materials. This can in turn lead to the production of poor quality products and customer complaints. KU's Marketing Manager explained: *"... we use our own spirit [raw material] in Uganda when there are political problems in other areas or other delays. But the problem is that Uganda's spirit is poor quality and when we use it we get problems in the market"*. JU indicated that some dishonest local suppliers deliberately adulterate the raw materials and supply poor quality. JU's Procurement and Logistics Officer noted: *"Some local companies supply poor quality items especially those not well established. Some deliberately adulterate the materials to gain more profit. The less trusted suppliers begin dodging if the product is poor quality and payment has already been made."*

- **Product Counterfeiting**

Company PU revealed that local sourcing is susceptible to product counterfeiting as some counterfeiters take advantage of local market knowledge. Further, some local suppliers are themselves counterfeiters, as PU's Procurement Officer explained: *"... to avoid stock out, we source local. But local sourcing is costly ... We also avoid counterfeit. Counterfeiters take advantage of local market knowledge and some local suppliers are counterfeiters."*

- **Financial Difficulties**

PU and DU revealed that local sourcing can cause financial difficulties because local raw materials are expensive. Thus local sourcing is sometimes used as an emergency sourcing strategy especially when outsourced materials are delayed. This leads to paying for redundant raw materials in case the overseas consignment is finally delivered. DU's Marketing Officer stated: "...*When there are delays, we go to the local market for some items. But these are few and expensive...So delays increase our costs whereby we look to the local market and we already have consignment on the way, which becomes expensive.*" PU argued that local sourcing should be used in the short run as an emergency strategy because it is not financially sustainable. PU's Procurement Officer asserted: "...*We incur the cost of buying local to avoid keeping our machines idle. Sustained local sourcing can lead to financial problems*".

The above further shows how a resilience strategy against a threat at a point in the supply chain can produce a different threat at the same or different point in the supply chain. For example, local sourcing to mitigate an exogenous threat like political instabilities can create endogenous threats like financial difficulties and poor quality raw materials.

#### **4.4.4. Outcome of Outsourcing**

- **Loss of Control**

EU and JU indicated that they use outsourcing to mitigate disruptions from delays and the theft of inventory by dishonest employees. However, it was argued that engaging independent firms to perform certain functions deprives firms of control over processes and employees, resulting in the loss of flexibility to respond to certain risk events. EU's Procurement Manager commented: "*We outsource logistics since doing it in-house is financially challenging...The outsourced firms are independent and the challenge is how to control them. Employees are under a different management. They can't have the flexibility we*

*need. We cannot for example force them to work overtime in case of abrupt demand.”* This means outsourcing as a strategy to mitigate delays can cause other delays resulting from a loss of control, which limits flexibility.

#### **4.4.5. Outcome of Using Exclusive Sourcing**

- **Limited Flexibility to Switch Suppliers**

Company AU argued that the use of exclusive sourcing creates dependence on suppliers and high switching costs, which limits flexibility to change suppliers in the case of a crisis such as supplier bankruptcy or inefficiency which can result in raw material shortages. AU’s Marketing Manager explained: *“To overcome the problem of a raw materials shortage and few suppliers in the market, we have an established supplier for critical items with whom we have a long term relationship and who exclusively supplies only us...It becomes hard to change suppliers.”* Thus, the strategy of using exclusive suppliers to create resilience against raw material shortages may in turn lead to the same threat through limiting flexibility to use alternative sources of raw materials.

#### **4.4.6. Outcomes of Product Recalls**

- **Distributor Complacency**

Firm QU, which manufactures perishable products, indicated that their distributors are complacent about product quality since they are aware that spoiled products have to be withdrawn at the manufacturer’s expense. PU’s Procurement Officer explained: *“We encourage them [distributors] to give us back the damaged products and we replace them. But we sometimes incur a lot of losses from these damages. Some distributors become complacent knowing that after all we shall withdraw the product and they do not preserve them well, worsening the quality problem.”*

- **Reputational Risk**

Some firms argued that product recalls are made to mitigate the consequences of poor quality products. HU however argued that these recalls can damage corporate reputation as well. HU's Production and Operations Manager commented: *"...customers complain over poor quality and sometimes run to competitors... This also damages our reputation as product recall attracts public attention."* This further shows how a strategy to build SCRES against a threat can in the end cause the original threat.

#### **4.4.7. Outcomes of Effective Credit Management**

- **Reputational Risk**

Company BU reported that the financial management strategies used to create resilience against financial difficulties like reducing credit transactions or demanding cash payments resulted in downstream threats of loss of reputation and customers' switching to competitors – further reducing cash flows. BU's Export Manager noted: *"We have a problem of delayed payments by our customers and this brings us several financial difficulties. The company policymakers have decided to demand cash transactions and this has made some customers abandon us and shift to our competitors further reducing our reputation and sales revenue."*

- **Reduced Customer Base**

Companies BU and DU revealed that the financial management strategy of reducing credit transactions can result in a threat of reduced customer base affecting the downstream supply chain. DU's Marketing Officer for example argued: *"... when our long-term customer closed down. We lost a lot of money... We got financial problems. We reduced credit to customers as a financial management strategy. We are now stringent. This has however reduced our customer base."* This reduction in customer base caused by stringent credit management was

again implicated in causing financial problems as BU's Export Manager noted: *"The company policy makers have decided to demand cash transactions and this has made some customers abandon us and shift to our competitors further reducing our sales revenue."*

#### **4.4.8. Outcome of Quality Management**

- **Raw Material Delays and Shortages**

Company MU indicated that they build resilience against poor quality raw materials by conducting quality screening at different levels of the supply chain e.g. at suppliers' sites, the parent company and firm level. But it was argued that such quality checks result in raw material delays and shortages. MU's Company Pharmacist observed: *"To avoid quality problems, we get materials from trusted suppliers. There are several levels of screening at the suppliers' site, parent company and internally at the firm level. Something can be advantageous in the upstream but disadvantageous downstream e.g. quality screening upstream but delays downstream."* This further confirms that a strategy to enhance resilience against a particular threat at a certain point of the supply chain may create a different threat at another point.

#### **4.4.9. Outcome of Employee Training**

- **Labour Turn-over**

Four companies (CU, LU, KU, MU) indicated that they train employees to mitigate the threat of insufficient skilled manpower. However, this sometimes doesn't solve the problem – employees move to other companies after acquiring skills. KU's Marketing Manager explained: *"We have unskilled staff that end up causing machine breakdowns through for instance overloading; and also causing injuries but we have sent some of our technical staff to India and Kenya to gain skills...Sometimes when they are trained they go to other companies where they get increased salaries."* This further shows how a strategy to create

resilience against a certain threat can produce consequences that cause or compound the original threat.

#### **4.4.10. Outcome of Insurance**

- **Poor Customer Delivery Performance**

Company PU revealed that the use of insurance against in-transit raw material theft causes problems downstream. It was argued that compensation takes too long, resulting in poor customer delivery performance. PU's Procurement Officer explained: *"Theft of materials during shipping but we aim to recover the stolen raw materials through the insurance company but there are hardships... we applied to the insurance company, we have taken more than 5 months without getting a response and we lose time in waiting, which leads to delayed delivery to our customers. Relying on insurance in Uganda constrains our operations."*

#### **4.4.11. Outcome of Co-opetition**

- **Confidentiality Risk**

Company PU argues that co-opetition helps in information sharing for benchmarking purposes as well as borrowing raw materials in the event of delays. However, co-opetition creates susceptibility to confidentiality risk. PU's Brand Manager stated: *"We share certain suppliers with our competitors but we try as much as possible to keep confidentiality... We do not collaborate with some of our competitors for confidentiality reasons."*

#### **4.4.12. Outcome of Procurement Management**

- **Raw Material Delays and Shortages**

Companies JU, MU and TU revealed that in order to overcome procurement related problems (like high bargaining power of suppliers that may cause supplier complacency, unfavourable sourcing terms and raw material delays and shortages); they manage procurement by e.g. consolidating purchases and buying through the parent company. It was also argued that this

strategy mitigates some of the problems but increases the raw material path length and reduces visibility (contact with suppliers). Firms reported that this in turn causes more raw material delays, as explained by the MU's Company Pharmacist: *"We used our parent company because, due to its bulk buying, they had high bargaining power ...this would also reduce prices of raw materials ... [but] this made us fail to have direct contact with the suppliers. This would cause delays. Some materials were manufactured in the USA and China but had to pass via India."* MU reported that when they switched to sourcing some of the materials directly from suppliers rather than consolidating with the parent company, the lead time for materials reduced from six months to one month. This suggests that the strategy, which they had previously used to mitigate raw material delays and shortages (i.e. buying through the parent company), had instead caused the same threat.

#### **4.5. Concluding Remarks**

The data analysis in this chapter sought to develop a category structure from the data. This resulted in taxonomies of supply chain threats, SCRES strategies, and outcomes of implementing the strategies. The aim was to understand what actors in a developing country context perceive as threats to their supply chains and identify the SCRES strategies adopted and their outcomes in a linear way, as portrayed in the SCRES literature. This was in response to Research Question 1. The table in Appendix 2 presents a summary of the firms' responses to each of the threats, strategies and outcomes discussed in this chapter.

The table in Appendix 2 will show that particular threats are more dominant than others. For example, political instabilities, raw material delays and shortages, product counterfeiting and poor customer delivery performance have been experienced by all the firms. Other threats e.g. natural disasters, communication barriers and national politics have been

identified in not more than five companies each. Further, strategies like collaboration with suppliers, multiple sourcing, risk communication and maintaining strategic stocks have been used more widely than others. Furthermore, financial and quality problems were the more widely highlighted outcomes of SCRES strategies. Finally, a summary of the general observations from findings that appear to be particularly interesting is provided. This will act as a springboard for the next chapter (Chapter 5). These observations include the following:

### *General observations*

#### **1. Firms' Broad Understanding of the Term "Threat"**

From the interview data on threats, it became clear that interviewees had a broad understanding of the term "threat". Some responses referred to threatening events and others to threatening conditions that produced or compounded a threat. For example, some of the findings like long distance sourcing, power asymmetries and being located in a landlocked country were highlighted by some respondents as threats to SCRES. Yet, these can be considered as threatening conditions – not threatening events which are emphasised in the SCRES literature.

#### **2. Firms Concerned with Both Chronic Threats and Endogenous Threats.**

Table 4.4a shows 1) how many distinct types of threat (as listed earlier in Table 4.1) fall under the headings of exogenous or endogenous; and 2) how many firms cited at least one threat in each category. As stated earlier and based on the accounts of the interviewees, endogenous threats originate from the within the supply chain, while exogenous threats originate from outside the supply chain. Firstly, Table 4.4a shows that all the 20 firms cited at least one threat in each broader category of endogenous and exogenous. This suggests Ugandan firms consider threats to their supply chains as both endogenous and exogenous. Table 4.4a also indicates that endogenous threats constituted 65.2% of all the threats that

emerged from the data. Similarly, Table 4.4b further summarises the distribution of firms over threats, strategies and outcomes that were comprehensively illustrated in Appendix 2. From the distribution of firms in Table 4.4b, it can be seen that each of the 20 firms cited more of endogenous threats than exogenous threats. This suggests most of the perceived threats to SCRES in Ugandan firms are endogenous rather than exogenous. These findings are in contrast to the prior SCRES literature, which focusses on both large-scale discrete events and exogenous events.

Further, most of these endogenous threats are chronic, suggesting that Ugandan firms are mostly concerned with chronic threats, e.g. product counterfeiting, raw material delays, financial difficulties, machine breakdowns, etc. rather than large-scale discrete events. For example, only 5 firms highlighted natural disasters (e.g. drought and diseases) but 17 referred to machine breakdowns, 20 referred to both raw material delays and shortages, and product counterfeiting; and 17 referred to machine breakdowns. Please see the complete distribution of firms over threats summary in Appendix 2. And for the summary of the number of firms identifying individual threats, strategies and outcomes (see Appendix 3).

*Table 4.4a: Summary Count of Endogenous and Exogenous Threats; and Respective Number of Respondent Firms from the Data*

<b>Categories of threats</b>		<b>Number of Threats per Category</b>	<b>Number of Firms Citing Threats in this Category at least Once</b>
Exogenous	Geo-political	10	20
	Economic	6	17
	<i>Total number &amp; percentage of exogenous threats</i>	16 (34.8%)	
Endogenous	Supply-side	10	20
	Firm-level	12	20
	Demand-side	8	16
	<i>Total number &amp; percentage of endogenous threats</i>	30 (65.2%)	

Table 4.4b: Number of Threats, Strategies & Outcomes Cited by Each Firm

	<i>Respondent Firms</i>																			
	AU	BU	CU	DU	EU	FU	GU	HU	IU	JU	KU	LU	MU	NU	OU	PU	QU	RU	SU	TU
<b>Categories</b>																				
<b>Threats</b>																				
<b>Exogenous Threats</b>	4	10	7	6	4	7	8	11	9	10	8	8	7	5	4	11	6	8	2	8
<b>Endogenous Threats</b>	11	18	20	11	17	15	16	23	17	24	21	21	17	19	11	18	12	17	10	10
<b>Resilience Strategies</b>																				
Relationship Management	2	2	1	1	3	1	0	3	3	3	3	3	3	2	3	4	3	2	1	1
Supply Management	6	6	6	4	8	5	6	3	8	8	3	10	11	3	3	9	2	6	3	4
Demand Management	2	3		3	1	1	2	3	1	4	2	3	2	2	3	2	3	3	2	1
Information Management	3	5	3	3	1	0	1	2	4	3	3	5	3	3	3	3	2	2	2	1
Product Management	1	1	0	2	0	0	0	0	0	2	0	0	2	1	1	2	1	1	0	1
Financial Management	0	0	1	0	1	0	0	0	0	0	2	0	0	0	1	2	0	2	0	0
Human resource management	0	1	0	0	1	0	0	1	0	0	1	1	1	0	0	1	0	0	1	0
<b>Outcomes</b>	2	3	1	2	2	1	2	3	2	6	2	4	4	0	0	6	1	0	1	1

### **3. The Role of the Ugandan Environment in the Perceived Threats and Strategies**

Some of the interesting threats to SCRES appear to be particularly arising from the context of Uganda earlier described in Chapter 1. For example, corruption and a weak legal system, which have not been previously considered in supply chain risk and resilience literature, have been identified as threats to SCRES. Further, the explanations for some of the threats that were identified in the data but which are already highlighted in the SCRES literature have been grounded in the study context and their explanations differ from those in the literature. For example, the threat of political instabilities is caused by being located in a landlocked country and relying on Kenya as a transit route, which makes political disruption that impedes transportation to, and through, Kenyan ports a problem for Ugandan suppliers and distributors. Analysis further showed that the threat of political instabilities is caused by e.g. chaotic political transitions in the Ugandan neighbouring countries of Kenya, Democratic Republic of Congo and Southern Sudan.

Similarly, some SCRES strategies are evidently either facilitated or constrained by the Ugandan environment. For example, co-opetition where rival firms borrow raw materials from each other could be attributed to a socially acceptable practice of sharing; and maintaining strategic stocks, which was reportedly constrained by theft from dishonest employees who view theft as a socially acceptable practice. The following table (4.5) shows a summary of the threats to SCRES that were reportedly caused or compounded by the Ugandan political, cultural and geographical environment.

Table 4.5: Threats Caused or Compounded by the Ugandan Political, Cultural and Geographical Environment

	<b>Threats</b>	<b>Consequences (associated threats)</b>
POLITICAL ENVIRONMENT	Political Instabilities	Raw material shortages and delays, poor customer delivery performance
	National Politics	Informal sector, unfair competition, demand variations
	Weak Legal System	Product counterfeiting
	Government Policy	Raw material delays and shortages, order cancellations , unfair competition, unstable taxation e.g. unexpected hikes, poor customer delivery performance, demand variations, product counterfeiting
CULTURAL ENVIRONMENT	Corruption	Unfair competition, dishonest customers/distributors, raw material delays and shortages, product counterfeiting, reduced customer base, weak legal system, poor transport infrastructure, order cancellations
	Product Counterfeiting	Reduced customer base, reputational risk, poor quality raw materials
	Informal Sector	Unfair competition, raw material delays and shortages, reduced customer base, product counterfeiting, financial difficulties
	Unfair Competition	Raw material delays and shortages, Reputational risk, poor customer delivery performance, reduced customer base
	Dishonest Suppliers	Financial difficulties, supplier delivery failure, poor quality raw materials, raw material delays and shortages, unfair competition, Product counterfeiting, reduced customer base
	Dishonest Customers/Distributors	Financial difficulties, Poor customer delivery performance, reduced customer base, payment threat (from customers)
	Reputational risk (Negative Perceptions of Overseas Suppliers)	Raw material delays and shortages
	Dishonest Employees	Machine breakdowns, poor quality products, reputational risk, reduced customer base, financial difficulties, stock theft, Poor customer delivery performance, In-transit raw material theft
	Owner/Management Behaviour	Procurement risk, financial difficulties, poor internal coordination, poor customer delivery performance, poor quality raw materials, payment threat (to suppliers/labour)
	Customer Characteristics	Product counterfeiting, demand variations, reduced customer base, poor customer delivery performance, order cancellations
GEOGRAPHICAL ENVIRONMENT	Geographical Location/Landlockedness	Poor transport infrastructure and political instabilities in the transit route country
	Long distance sourcing (Due to Spatial Proximity)	Raw material delays and shortages, communication barriers & poor information flow

#### **4. Behavioural Influence on Threats and Strategies**

Some of the threats to SCRES identified were behavioural: they resulted from the behaviour of both supply network actors and other actors in the environment. Threats like owner management behaviour, dishonest employees, dishonest local suppliers, dishonest customers/distributors, corruption and poor internal coordination are clearly behavioural in nature. Some other threats that are seemingly non-behavioural like machine breakdowns, poor quality products, financial difficulties and product counterfeiting were caused by some of the behavioural factors mentioned above; and certain other social customs and practices. For example, it was found that dishonest employees deliberately destroy machines, connive with suppliers to inflate the costs of raw materials; and some dishonest local suppliers were supplying counterfeit raw materials. In the current SCRES research, behavioural factors have received less attention; and those that have been highlighted, like collaboration and social capital, have been shown only to be strategies for creating resilience, not as threats to resilience.

#### **5. The Need for a Systemic Analysis of Threats, Strategies and Outcomes**

Some of the threats, strategies and outcomes discussed in this chapter were not previously considered in the literature. Thus, in itself, this chapter makes some contribution to the literature. However, it was clearly difficult to explain supply chain threats in isolation. The causes or consequences of threats from a certain group of companies were identified by others as threats in their own right – thus the interrelatedness of threats was observed. For example, company JU reported that the threat of financial difficulties results in late payment to workers. In retaliation, they destroy machines, disrupt production and produce poor quality products deliberately. From the summary in Table 4.5 above, it is shown that certain threats produced or compounded other threats. It was also revealed from the data that some SCRES strategies reinforce each other e.g. informal networks reinforcing co-opetition; co-opetition

reinforcing supplier development; and using information and communication technology facilitating visibility and supplier development. The findings on the outcomes also revealed that some resilience strategies had adverse outcomes that reduce SCRES – including what some interviewees had identified as threats.

Finally, it is argued here that, although this chapter attempts to develop taxonomies of threats, strategies and outcomes, individually and separately, it was clear from the findings that threats are interrelated and so are the strategies to mitigate them – threats lead to strategies, which can sometimes have adverse outcomes that require further strategies to be deployed. This inter-relatedness appears fundamental to how supply chains as Complex Adaptive Systems behave when any attempt is made to intervene in them. The second level of analysis is therefore intended to be more theoretical and to address this general question of how strategies, the threats which provoke them and the outcomes that arise, are all related. It is this second level of analysis that constitutes the main attempt at theory building. The table in Appendix 4 shows how the interrelationships were identified from the data; and these were further summarised in Table 5.1 in Chapter 5.

## CHAPTER 5

### SECOND LEVEL ANALYSIS: USING CAS AND EMBEDDEDNESS THEORY FRAMES

#### 5.1. Introduction

This chapter presents a more integrative analysis of findings using the CAS and embeddedness theoretical frameworks. The chapter begins with the CAS perspective which calls for a systemic analysis of the inter-relationships among threats (and associated conditions), strategies and outcomes. These interrelationships are identified from the data and the network constituted by these links and nodes is tabulated (Table 5.1) – this is reinforced with a graph and a network map (in 5.2). Two example fragments from this network are discussed (in 5.2.1. and 5.2.2) to show that the systemic nature of threats and strategies to mitigate them produce non-linear outcomes. Later, an embeddedness framework is adopted to explain important features of the relationships identified and the insights into resilience that can be gained from an embeddedness standpoint are highlighted (5.3). The chapter ends in 5.4 with the concluding remarks, mainly indicating that the behaviour of a supply chain as a CAS – in this case its resilience – is determined by its embeddedness.

#### 5.2. The Complex Adaptive Systems Interpretation

A central feature of a CAS is the way that intervention in the system can produce unexpected, successive adaptations within the system to the intervention, and in turn to the adaptations themselves. The analysis here is therefore concerned with the network of inter-relationships among threats (and associated conditions), strategies and outcomes that shows this quality of responding to endogenous and exogenous threats. The nodes from this network are given in

Table 5.1, which counts the number of incoming, outgoing and total links to the other nodes for each node. This network consists of nodes that are conditions, threats, strategies or outcomes with directed edges showing causation as claimed by the interviewees. These nodes are the categories earlier discussed in Chapter 4.

*Table 5.1: Nodes in the Network of Conditions, Threats, Strategies and Outcomes Ranked According to Total number of Links (Sum of Links into & out of the Node)*

<b>Rank</b>	<b>Node (Categories taken from Chapter 4)</b>	<b>Links into the Node</b>	<b>Links out of the Node</b>	<b>Total No. of Links</b>
1	Raw material delays and shortages	23	27	50
2	Financial difficulties (focal firm)	18	12	30
3	Poor customer delivery performance	20	6	26
4	Reduced customer base	20	1	21
5	Poor quality products	8	12	20
6	Poor quality raw materials	10	9	19
7	Product counterfeiting	7	12	19
8	Machine breakdowns	6	12	18
9	Demand variations	4	13	17
10	Unfair competition	5	12	17
11	Payment threat (to suppliers/labour)	5	11	16
12	Collaboration with suppliers	7	7	14
13	Risk communication	13	0	13
14	Government policy	0	12	12
15	Corruption	0	11	11
16	Dishonest employees	1	10	11
17	Effective contracting	10	1	11
18	Limited local supply market	0	11	11
19	Order cancellations	6	5	11
20	Reputational risk	8	3	11
21	Supplier delivery failure	2	9	11
22	Collaboration with customers	6	4	10
23	Collaboration with government	10	0	10
24	Dishonest customers/distributors	1	9	10
25	Dishonest suppliers	0	10	10
26	Improving visibility	10	0	10
27	Multiple sourcing	9	1	10
28	Poor internal coordination	2	8	10
29	Poor transport infrastructure	2	8	10
30	Maintaining strategic stocks	7	2	9
31	Payment threat (from customers)	3	6	9
32	Product characteristics	0	9	9

33	Coopetition	7	1	8
34	Informal sector	2	6	8
35	Local sourcing	4	4	8
36	Political instabilities	1	7	8
37	Procurement risk	2	6	8
38	Appropriate supplier selection	6	1	7
39	Creating customer flexibility	7	0	7
40	Financial difficulties of suppliers	1	6	7
41	Increasing product knowledge	6	1	7
42	Power shortages	0	7	7
43	Supplier development	6	1	7
44	Customer characteristics	1	5	6
45	Insufficient skilled manpower	0	6	6
46	Order splitting	5	1	6
47	Outsourcing	5	1	6
48	Owner management behaviour	0	6	6
49	Power asymmetries (stronger customers)	0	6	6
50	Communication barriers	1	4	5
51	Customer incentives	5	0	5
52	Industrial disputes	1	4	5
53	Informal networking	3	2	5
54	Insurance	4	1	5
55	In-transit raw material theft	3	2	5
56	Natural disasters	0	5	5
57	Procurement management	3	2	5
58	Using Information Communication Technology	4	1	5
59	Backward integration	4	0	4
60	Effective credit recovery	1	3	4
61	Long distance sourcing	1	3	4
62	Manufacturing flexibility	4	0	4
63	Product recalls	2	2	4
64	Stock theft	2	2	4
65	Confidentiality risk	3	0	3
66	Demand forecasting	3	0	3
67	Employee training	1	2	3
68	Ensuring product security	3	0	3
69	Exchange rate fluctuations	0	3	3
70	Exclusive sourcing	2	1	3
71	Financial difficulties of customers	0	3	3
72	Limited flexibility to switch suppliers	2	1	3
73	Market intelligence	3	0	3
74	Power asymmetries (stronger suppliers)	0	3	3
75	Quality management	1	2	3

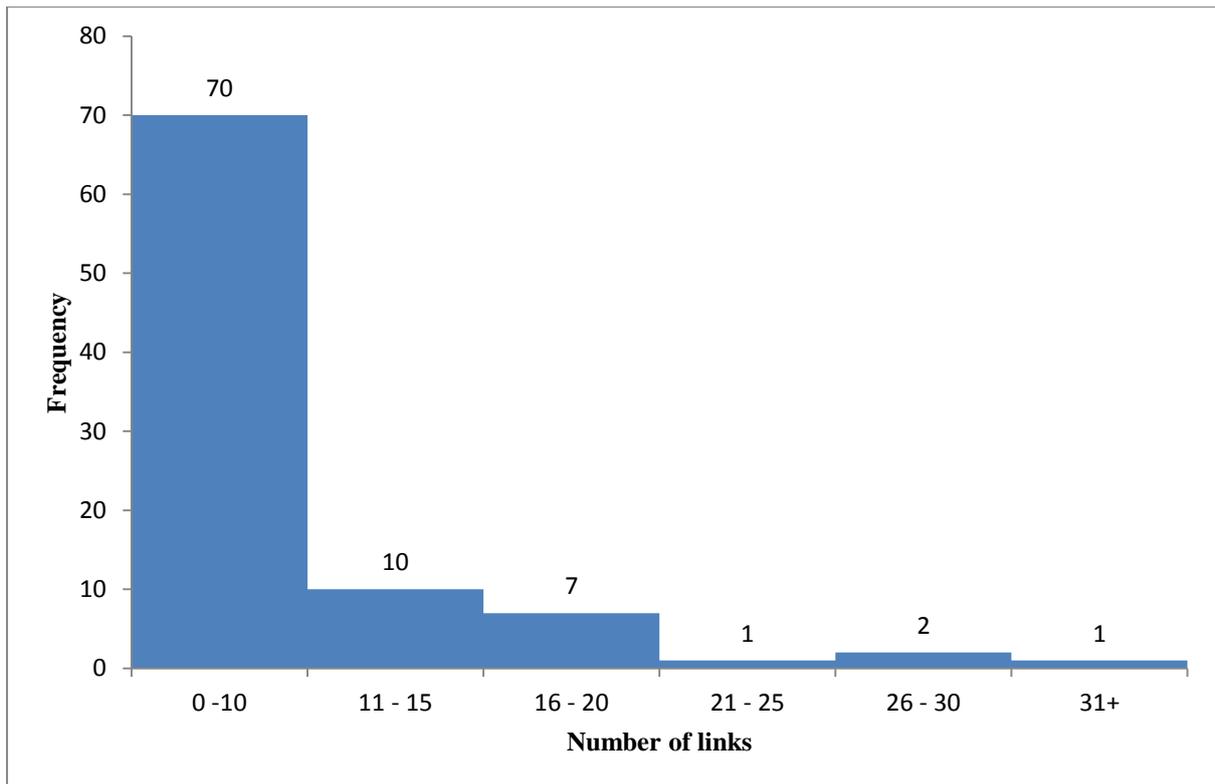
76	Unstable taxation	1	2	3
77	Alternative transportation	2	0	2
78	Buying instead of making	2	0	2
79	Distributor complacency	1	1	2
80	Enhancing proximate to customers	2	0	2
81	Geographical location (Landlockedness)	0	2	2
82	Inter-branch stock transfer	1	1	2
83	Inventory management	2	0	2
84	National politics	0	2	2
85	Weak legal system	1	1	2
86	Borrowing from customers	1	0	1
87	Enhancing proximity to suppliers	1	0	1
88	Labour turnover	1	0	1
89	Loss of control	1	0	1
90	Supplier complacency	1	0	1

From Table 5.1, it can be seen that there are certain nodes both with many incoming and outgoing links – including the threats of raw material delays and shortages, financial difficulties (focal firm), poor customer delivery performance, poor quality raw materials and poor quality products. For example, there are 23 links into and 27 links out of the threat of raw material delays and shortages node. Likewise, there are 18 links into and 12 links out of financial difficulties (focal firm) node. This suggests they have many antecedents and are also outcomes of many other actions, e.g. side-effects of other resilience strategy implementations. Such highly connected threats (or hubs) are difficult to control because they occur and affect resilience in multiple ways – meaning they deserve much attention. For example, the data shows that the threat of financial difficulties (focal firm) can result from other threats like dishonest employees and suppliers and can lead to raw material delays and shortages due to failure to pay suppliers on time. This also affects the downstream supply chain by constraining production and delivery to customers. Financial difficulties can also lead to failure to pay employees who retaliate by destroying machines and deliberately producing poor quality products. But financial difficulties can also be an outcome of

resilience strategies like maintaining strategic stocks and local sourcing to mitigate raw material delays and shortages caused by long distance sourcing.

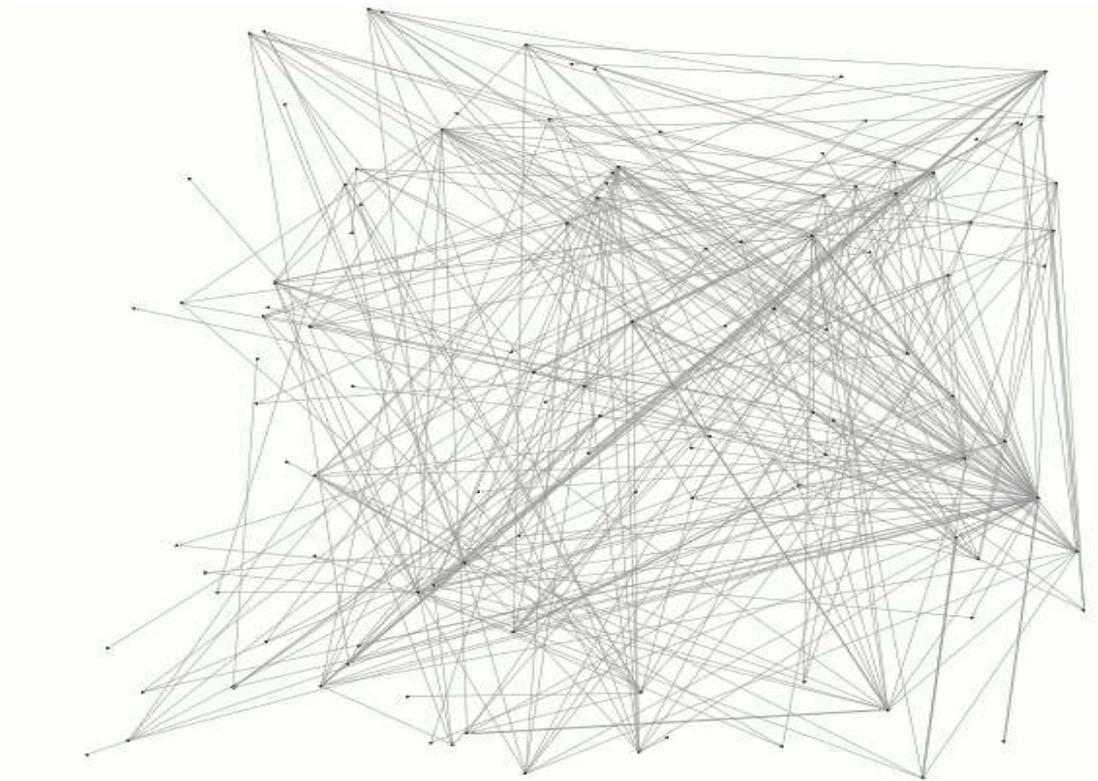
Further, it is observed from Table 5.1 that the top ranked nodes, for example the top five which have 20 links and above, are all threats that are internal to the supply chain. This suggests that the most important threats to SCRES in the context studied are perceived to be endogenous rather than exogenous threats. In support of the first level analysis, most highly ranked nodes are chronic, continuous problems, e.g. product counterfeiting, machine breakdowns, demand variations, supplier delivery failures, etc. A discrete and potentially catastrophic threat like natural disasters, for example, had only 5 outgoing links (and no clear causes). The first level analysis in chapter 4 shows that only 5 companies highlighted natural disasters. However, 17 referred to machine breakdowns and all the 20 firms to raw material delays and shortages.

Figure 5.1 presents a histogram that illustrates the degree distribution of the links between nodes. The figure supports Table 5.1 in showing there are a relatively small number of nodes involved in a large number of the links, connecting the network together. For example, there is only one node with over 30 links, 2 nodes with 26-30 links, but 70 nodes with 10 or less links each.



*Figure 5.1: Degree Distribution of Links between Nodes*

The Gephi software was then used to construct the network map in order to visualise the nature of the network as a whole of threats, strategies and outcomes that emerged. The generated network became too complex and densely populated to include labels of the nodes and links but it gives a visual impression of its density, as Figure 5.2 illustrates.



*Figure 5.2: A Gephi Software Generated Network of Threats (and Conditions), Strategies and Outcomes*

The above network shows that resilience involves complex relationships – not linear relationships, between threats and strategies. Although many of the prior studies have focused on strategies for building resilience, without identifying the threats that provoke such strategies, the interconnectedness revealed by this study confirms that threats, strategies and outcomes should be considered jointly, if we are to understand resilience. Figure 5.3 that follows will show that some scholars (e.g. Zsidisin & Wagner, 2010; Pettit et al., 2013), who have studied threats and resilience strategies simultaneously, typically emphasise that supply chain threats can be linked to resilience strategies in a linear way. This suggests that building resilience may only be about identifying threats and corresponding strategies (e.g. Pettit et al., 2013). Figure 5.3 compares this prior perspective with the findings from this study, which have shown that resilience is about a complex set of threats, strategies and outcomes that form a complex network at different points of the supply chain, and include vicious cycles.

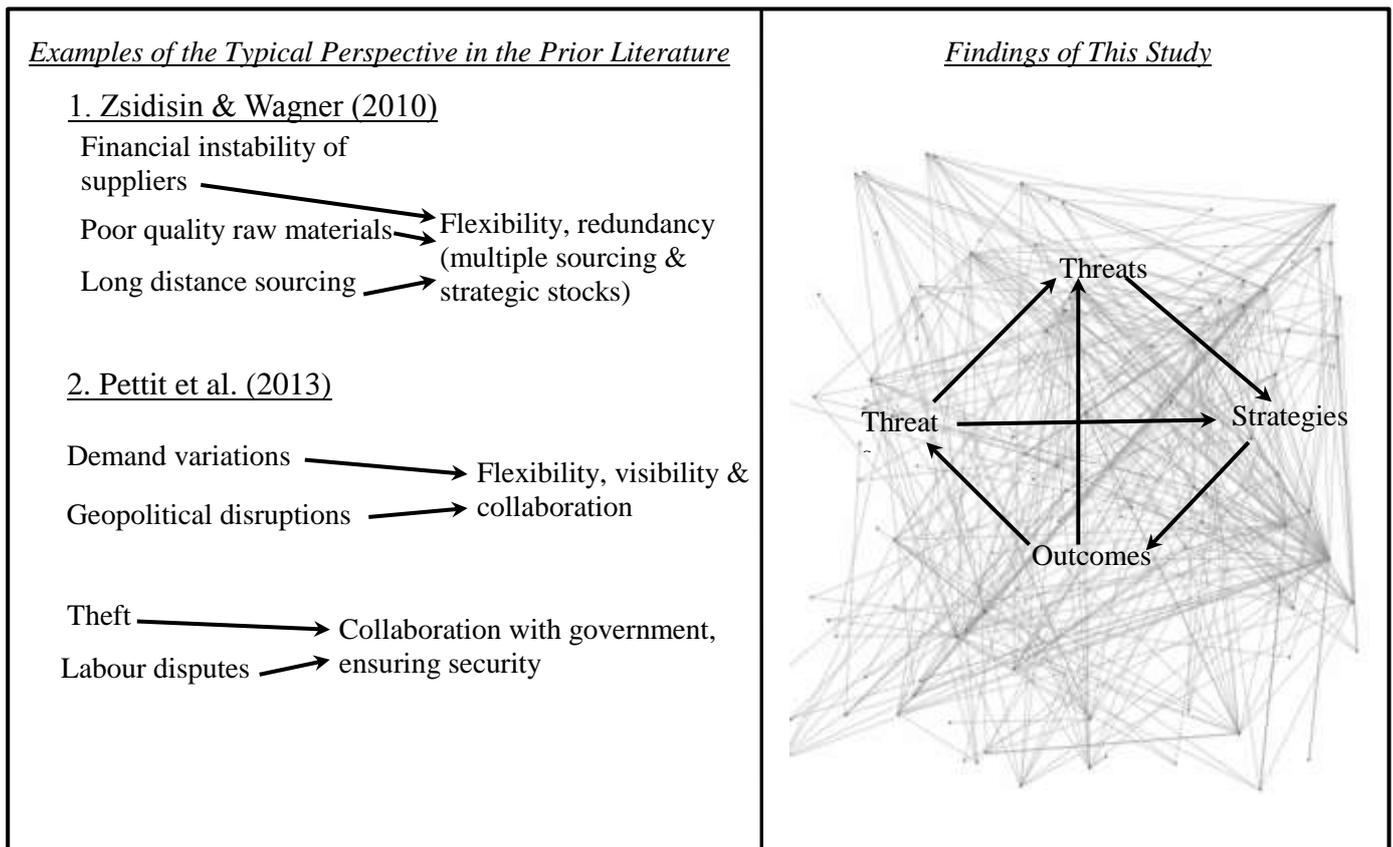


Figure 5.3: Typical Perspective in the Prior Literature on the Relationships between Threats and SCRES Strategies, Compared with the Findings of this Study

To analyse the network qualitatively, particular fragments were isolated from the larger complex network. To find the starting point of a fragment, threat nodes with no observable causes or precedents were identified. This was followed by tracing forward the successive adaptations exhibited in the network to this threat. A certain network fragment is complete when the last node has no observable effects or forms a closed loop. The point of analysis here is to reveal the general characteristics of the relationships and what this tells us about resilience, not to identify a canonical set of network fragments – so in what follows, two examples are presented only to show how CAS can help interpret and improve our understanding of SCRES. In reality, the network fragments are all interconnected in some way because the network is completely connected: there are no sub-networks that have no connections with the rest of the network. Thus – as will be theorised later – there is an indefinitely continuing process of trying to be resilient.

### 5.2.1. Example One –The Threat of Limited Local Supply Market and Successive Adaptations

Sixteen firms (AU, CU, FU, KU, SU, LU, EU, HU, JU, MU, NU, RU, PU, IU, QU & TU) highlighted the threat of a limited local supply market. Twelve of these companies argued that this leads to long distance sourcing, resulting in the upstream threat of delays and shortages of raw materials and spares. If a firm runs out of raw materials, this can halt production, which then disrupts the downstream network. In CU, long distance sourcing causes communication and information flow problems, which make it difficult to establish collaborative relationships with suppliers, causing further delays and shortages. Some firms (e.g. AU, FU, LU, MU, IU, JU, EU, HU & PU) respond to raw material shortages from long distance sourcing by maintaining strategic stocks. But this increases stock holding costs, including from theft, and ties up capital, particularly for expensive materials and spares. This results in the threat of running into financial difficulties. AU's Marketing Manager stated: *"Our source of raw materials is far away. So we keep stock for at least five months to cater for delays. For example, materials arriving from Japan can take three months, which ties [up] our capital and creates financial problems."* Further, the financial difficulties resulting from maintaining strategic stocks mean firms fail to pay suppliers on time or customs, resulting in a circular effect – further material delays and shortages. JU's Procurement & Logistics Officer explained: *"We place orders, but deliveries are delayed due to a lack of finances, for example to pay for customs clearance – sometimes because money is tied [up] in inventory ... [we] lack enough raw materials and this affects our production."* Figure 5.4 illustrates the above discussion together with more that will follow after the figure.

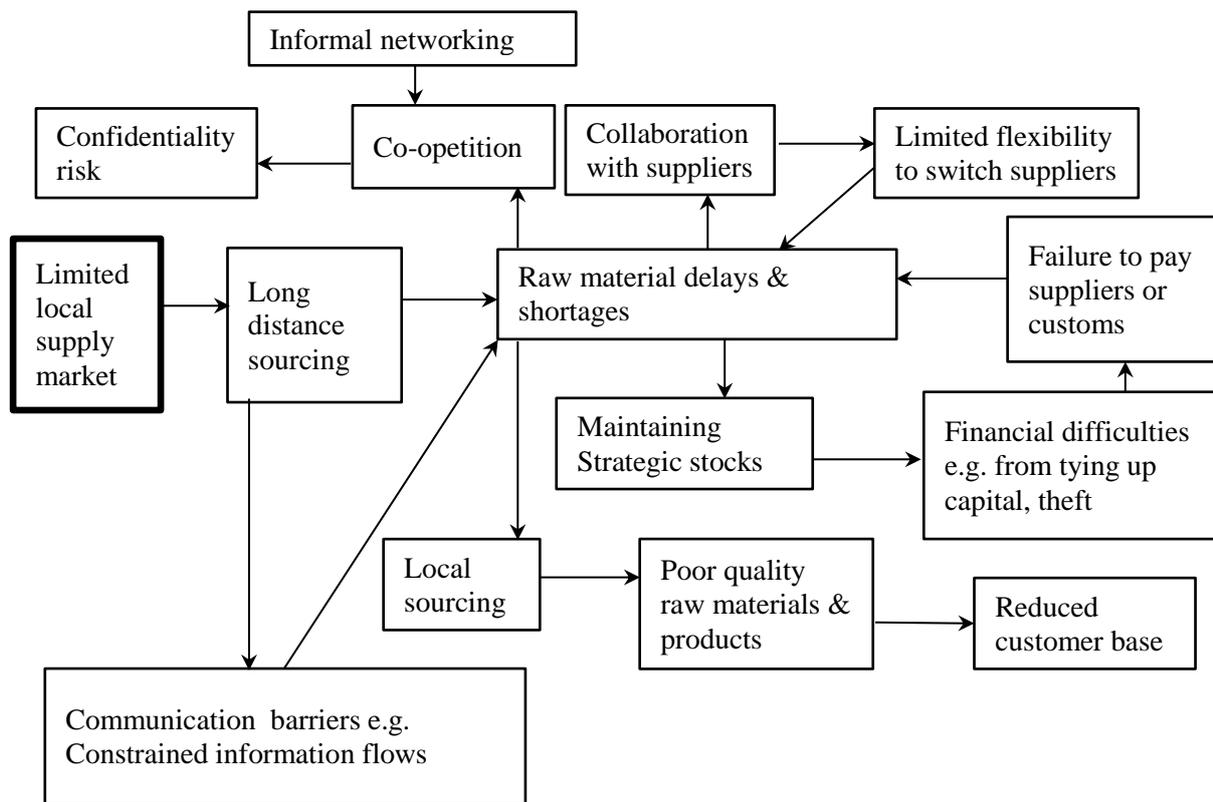


Figure 5.4: Effects of Limited Supply Market on SCRES

Firms such as KU, RU & PU indicated that they use local sourcing to mitigate the disruptions caused by long distance suppliers, but they conceded that this compromises quality, which negatively affects their downstream customers. Some companies (e.g. AU, CU, SU, MU, RU, JU, LU, & PU) indicated that they mitigate delays by developing collaborative relationships with suppliers, but AU, PU and JU argued that forming deep relationships limits flexibility to switch suppliers when faced with a crisis, causing further delays and shortages.

PU, RU and LU reported that co-opetition, a form of collaboration with rival firms, helps create resilience against raw material delays and shortages. Interviewees claimed that they borrow materials from other firms (without interest) and replace the goods when their consignment arrives. PU's Procurement Manager stated: *"We work together with our competitors by getting raw materials from them and replacing them when ours are delivered"*

... *This kind of arrangement is facilitated by our networks as managers. We know each other and we communicate during crises to bail each other out.*” This co-opetition strategy based on informal networks and social relations shows how SCRES may emerge from a mutual interaction between the system and other independent, rival systems. It demonstrates how the resilience of a supply chain as a CAS can be interlinked with other systems. The data also shows that this is facilitated by the embeddedness of the supply network, as will be explained later. Informants from LU, for example, reported that they exchange information with competitors to mitigate threats, e.g. reporting on dishonest distributors. But it was also revealed that co-opetition can present confidentiality risks. For example, PU’s Brand Manager stated: *“We do not collaborate with some of our competitors for confidentiality reasons...”* This implies that co-opetition can help to build resilience against supplier related threats, e.g. raw material shortages and delays, but it can also produce threats, e.g. related to information leakage. PU’s Procurement Manager also indicated that some competitors use their informal, social networks to bribe government officials to evade or pay fewer taxes, which results in unfair competition.

The effects described above produce the non-linearity that is characteristic of a CAS. There is no simple, linear relationship between the disturbances experienced by the supply network and the reliability and availability of the final product – because they are mediated by a series of adaptations and effects within the network. The threat of a disturbance (delays and shortages of spares and raw materials) is shaped by another threat (limited local supply market), which triggers a condition (long distance sourcing), with the adaptation to this (e.g. maintaining strategic stocks) creating other threats (such as financial losses from tying capital up in stock). This in turn can lead to other threats and circular effects, including the reoccurrence of the original threat (e.g. raw material delays and shortages) but with different antecedents (e.g. a failure to pay suppliers or customs). Firms such as CU further revealed that they find it difficult to implement SCRES strategies (e.g. collaboration with suppliers)

against other threats due to communication barriers and poor information flow created by long distances from suppliers. Thus, a particular condition can affect resilience through multiple routes – first, by producing threats; and second, by constraining the implementation of other resilience strategies.

This analysis shows that the consequences of a particular threat and/or condition, as well as the mitigating strategies at any point, can propagate through the supply network. Thus, in the process of trying to attain resilience, risk migrates rather than becomes resolved, e.g. as one threat becomes transformed into another. This migration of one kind of risk to another is generally accompanied by a movement from one point in the supply network to another (e.g. from upstream to downstream) – and this will be further revealed in the second example. In this first example, an attempt to mitigate a threat originating from the supply side (e.g. limited local supply market or raw material delays and shortages) caused firm level threats, such as financial difficulties, which caused other upstream threats such as failure to pay suppliers and raw material delays and shortages. Further, an attempt to mitigate these raw material delays and shortages through local sourcing produced a threat of poor quality raw materials and products that affected downstream supply chain by reducing the customer base.

#### *5.2.2. Example Two – The Threat of Dishonest Employees and Successive Adaptations*

Twelve firms (GU, LU, IU, TU, JU, KU, EU, HU, BU, AU, NU, & PU) indicated that dishonest employees disrupt the production and delivery of their products through, for example, product adulteration, which leads to poor quality products that affect a firm's reputation with its customers; malicious machine damages (leading to breakdowns), which also affect product quality and require stock holding (with its associated problems); and stock theft, which has direct financial implications for the firm. Firms such as BU, EU, and HU argued that the culture of dishonesty through connivance is deeply entrenched in employees. But dishonest behaviour is sometimes caused by the late payment of salaries (due to financial

difficulties). For example, JU's Regional Sales Manager explained that their field-based sales personnel sometimes disappear with company money when salaries are delayed. Likewise, JU's Procurement Manager commented that workers: *"... stop working, destroy machines, destabilize the processes and produce poor quality beer intentionally. Sometimes, we are unable to supply or we supply spoilt beer."* Such behaviour produces an obvious non-linearity for the network, whereby relatively minor perturbations become amplified through cycles of repeated delay and protest, as evident in the closed loops of causation in Figures 5.5 and 5.6. This non-linearity seemed clear to the informants. For example, TU's Trade Marketing Manager explained: *"Late staff payment is a problem that started small but has eventually affected the whole supply chain. Production is affected, the market is affected and we fail to get cash inflows to pay our suppliers."* Firms such as BU attempt to overcome financial difficulties so they can pay employees by using financial management strategies (e.g. by reducing customer credit limits and demanding cash payments). But this leads to reputational risk and the loss of customers, further reducing financial inflows. BU's Export Manager noted: *"The company policy makers have decided to demand cash transactions and this has made some customers abandon us and shift to our competitors further reducing our sales revenue."*

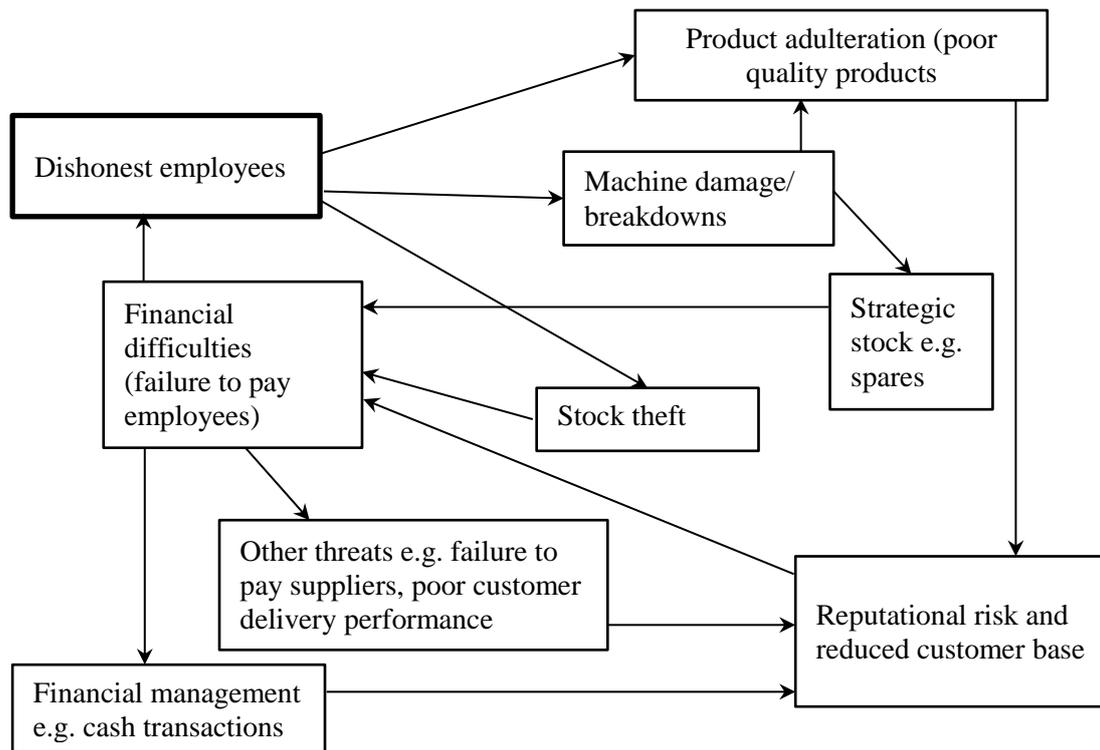
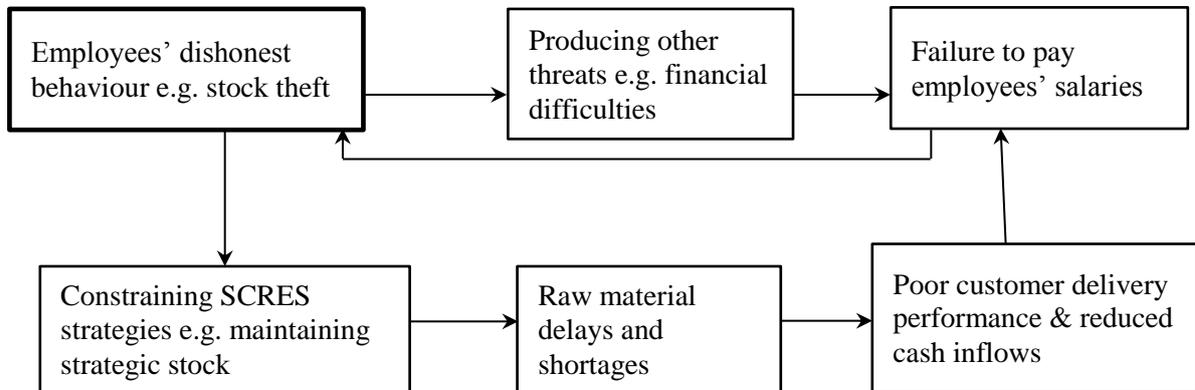


Figure 5.5: The Threat and Consequences of Dishonest Employees

Employee misbehaviour is a threat in its own right but it also produces other threats, e.g. financial difficulties, and limits the implementation of SCRES strategies against other threats. For example, stock theft hinders the use of strategic stocks for safeguarding against shortages and delivery failures, as noted by HU’s Marketing Manager: *“Sometimes, we store a lot of cement but we have thieves [employees] ... sometimes we would run out of stock unexpectedly, affecting the clients and the company ... we could not fulfil the orders, which reduces our cash flows.”* JU argued that a loss of income due to employee misbehaviour results in further staff payment problems, which in turn leads to further misbehaviour – a vicious cycle, as illustrated in Figure 5.6.



*Figure 5.6: A Vicious Cycle - Dishonest Employee Behaviour Constraining other SCRES Strategies*

In general, the network fragment examples discussed above help to confirm that the supply network should be seen as a CAS. Interventions, in the form of strategies aimed at responding to threats do not have simple, self-contained outcomes. Adaptations and consequences propagate over time and space. And the relationships between the threats experienced by the network and the ultimate effects are evidently non-linear and generally stochastic. The result is the migration of supply chain risks and a process of continuing adaptation. The examples demonstrate that, in building SCRES, we should be concerned with both the network of firms and the network of threats and conditions that produce threats, strategies and outcomes. Yet although the effects experienced are broadly explained by seeing the supply network as a CAS, the CAS framework offers little help in analysing the effect of context. The two examples discussed above have shown how the initiating threats, and many of the causal influences that have been discussed, characterise the Ugandan context that was earlier highlighted in Chapter 1. They show how instrumental this context is, in explaining why the inter-relationships that have been identified manifest. This is supported by Table 5.1, where most of the nodes that have no incoming links are grounded in the

context, e.g. government policy, corruption, insufficient skilled manpower, and geographical location (landlockedness). Hence, another theoretical framework – embeddedness – is adopted to understand how the presence of the supply network, or part of it, in a developing country affects its resilience. An alternative theoretical lens that would potentially help to interpret the data would be the institutional theory (e.g. DiMaggio & Powell, 1983), as some findings like government policy and corruption that reportedly produce threats to SCRES seem to reflect the institutional pressures. But embeddedness incorporates institutions (e.g. Hollingsworth & Boyer, 1997; Zhang, 2014) and institutions can also be embedded in other situations (Hollingsworth & Boyer, 1997). And the embeddedness perspective goes beyond institutions and includes other relevant non-institutional influences, which were revealed by the data as causing a threat to SCRES such as geography.

### **5.3. The Embeddedness Perspective**

Embeddedness is a multi-disciplinary concept that has been given a number of different meanings (e.g. Polanyi, 1944; Granovetter, 1985; Halinen & Törnroos, 1998; Hess, 2004; Choi & Kim, 2008). For example, Hess (2004) defined embeddedness “*as the set of social relationships between economic and non-economic actors (individuals as well as aggregate groups of individuals, i.e. organizations), which in turn create distinctive patterns of constraints and incentives for economic action and behaviour*”. Meanwhile, Halinen & Törnroos (1998) defined embeddedness as “*companies' relations with, and dependence on, various types of networks.*” What is common to these definitions is the idea that economic actors exist in, and are influenced by, networks of relationships with other economic or non-economic actors, either directly or indirectly (Choi & Kim, 2008). This means embeddedness can be both voluntary and involuntary.

Scholars have suggested various categories of embeddedness. For example, Halinen & Törnroos (1998) proposed six types of embeddedness: social, political, market, technological, temporal and spatial. Meanwhile, Hess (2004), drawing on Polanyi (1944), Granovetter (1985), and Halinen & Törnroos (1998), proposed three categories: network (including structural and relational embeddedness), societal (including cultural and political embeddedness), and territorial. Based on the findings from this study, Hess' (2004) categorisation seems especially relevant. The first category – network embeddedness – comprises of structural and relational embeddedness. On the one hand, structural embeddedness refers to the value of a firm's structural position in a supply network that involves informational and reputational benefits and is influenced by some monitoring and controlling mechanisms (Kim, 2014). Thus, it denotes the degree of dependency of a company on its direct and indirect business partners in supply networks (Choi & Kim, 2008). Highly structurally embedded supply networks are characterised by well-established patterns of exchange that occur at multiple levels, high frequency of interactions, responses to events based on a set of routines and the presence of transaction-specific physical investments (Kim et al., 2015b). On the other hand, relational embeddedness refers to the strength of relationships between firms in the supply network that influences the level of integration between them (Kim, 2014). Relational embeddedness is characterised by trust, commitment, free information sharing; and relational norms and shared values that govern conflict resolution (Kim et al., 2015b).

But in this particular study, the interest is not in the way that a supply chain embeds a particular organisation, but in the way the supply chain is embedded in a developing country – so the focus is not on the network (relational and structural) embeddedness. This is different from prior supply chain research adopting an embeddedness perspective, which has focused on network (structural and relational) embeddedness. The notable recent exception is Wu & Pullman (2015), who also acknowledged the dominant focus of prior studies on

structural and relational embeddedness. The failure to focus on cultural embeddedness, for example, makes it difficult to understand how and why supply network agents choose to act the way they do and how their actions affect the supply network (Wu & Pullman, 2015). Further, this prior supply chain work has portrayed embeddedness as a positive phenomenon or facilitator (e.g. Choi & Kim, 2008; Bernardes, 2010; Gligor & Autry, 2012; Kim, 2014). For example, Choi & Kim (2008) explained that firms' understanding of their suppliers' structural embeddedness (described as the configuration of network of relations with suppliers and customers at different tiers) facilitates supplier selection and management, which in turn mitigates supplier performance related risks e.g. through identifying financially unstable suppliers. Similarly, Kim (2014) showed how an understanding of the supplier structural embeddedness helps to increase the level of integration between a buying firm and the suppliers e.g. through appropriate information exchanges.

Kim (2014) further argued that managing the information on the positional advantage of a supplier (structural embeddedness) helps in mitigating risks related to the deviant behaviours of suppliers, and to gain access to novel information and innovative ideas embedded in a network. Other scholars like Kim et al. (2015b) have explained how both structural and relational embeddedness between supply chain partners enhance systemic innovation through e.g. knowledge sharing and relationship management. Similarly, Bernardes (2010) argued that relational embeddedness enhances innovation, which is important for customer responsiveness (agility). As earlier observed, the foregoing discussion presents embeddedness as an entirely positive phenomenon in supply chain management.

Indeed, the prior literature on embeddedness beyond operations and supply chain management partly supports the above positive view of embeddedness. It is argued that embeddedness can improve collaboration, adaptation and responsiveness (Uzzi, 1997). Moreover, all embeddedness outcomes mentioned above e.g. increased knowledge sharing, collaboration, adaptation, agility, and innovation have been linked to improving SCRES (e.g.

Christopher & Peck, 2004; Jüttner & Maklan, 2011; Pettit et al., 2013; Golgeci & Ponomarov, 2013; Rajesh & Ravi, 2015). However, it is also argued that embeddedness can be a source of constraints to SCRES, e.g. by promoting unethical practices (Granovetter, 1985; Prechel & Morris, 2010) and increasing vulnerability to exogenous shocks and information asymmetry (Uzzi, 1997). This can be clearly understood if we consider the broader context in which the supply network is embedded, rather than how the supply network embeds entities within it. This position was recently supported by Wu & Pullman (2015), who contended that the behaviour of supply network partners and general configuration of the supply network is mainly determined by its cultural embeddedness. This study therefore focuses on the following three categories of embeddedness, which are related to the findings in Table 5.2:

1. Cultural embeddedness: the collective understanding of beliefs, values and symbols that provides scripts, which guide economic strategies and goals (Dequech, 2003). Previous researchers (e.g. Granovetter, 1985; Hess, 2004) have argued that firms are embedded in certain cultural influences which constrain rational economic choices. Ethical reasoning, decision making and behaviour; and resultant management practices are embedded in different national cultures and hence vary across cultures based on how employees in the different cultures evaluate the legitimacy of certain customs and practices (Thorne & Saunders, 2002; Bandelj, 2008; Chevrier, 2009).
2. Political embeddedness: the manner in which economic institutions and decisions are shaped by a struggle for power that involves economic actors and non-market institutions, including national policies and state legal frameworks (Hardy et al., 2005). Political embeddedness is especially relevant to the contemporary global supply chains since the activities of different political stakeholders in different

countries influence business practices e.g. considering the role of political networks and lobbying in business transactions (Hardy et al., 2005).

3. Territorial embeddedness: concerning the geographical location of business, e.g. spatial proximity, and different networks of relationships in that location (Halinen & Törnroos, 1998; Filippi et al., 2011). Territorial embeddedness includes transportation infrastructure, price of transportation and the nature of the land and ground in a given location which influence supply chain activities (e.g. Hess, 2004; Filippi et al., 2011).

In Table 5.2 below, the categories of embeddedness i.e. political, cultural and territorial, identified from the data will be presented together with respective components and examples of threats they produce or compound, as reported by the interviewees. These have been discussed at length in Chapter 4, which presented all the relevant findings under a category structure of threats, strategies and outcomes. Table 5.2 therefore provides a summary of the relevant findings from an embeddedness perspective to further facilitate theorising on SCRES.

Table 5.2: Aspects of Embeddedness Revealed in the Data: Political, Cultural & Territorial Embeddedness

Category	Components & Sample Evidence from the Data (these are discussed in details in Chapter 4)	Example Quotations from the data	Examples of Associated Threats
<b>Political Embeddedness</b>	<p><b>Political Instabilities</b></p> <ul style="list-style-type: none"> <li>✓ Chaotic political transitions that result in demonstrations, civil conflicts, and wars.</li> <li>✓ Local political conflicts, such as opposition demonstrations followed by violent police crackdowns</li> <li>✓ Political instabilities of neighbouring countries e.g. Kenya and Southern Sudan</li> </ul>	<p><i>“Sudan has been one of our main destinations and the war has affected our supply chain. Instabilities in Congo, Rwanda and Burundi affect our supply chain.”</i> (GU’s Sales &amp; Marketing Executive)</p>	<ul style="list-style-type: none"> <li>- Raw material shortages and delays</li> <li>- Disruption in the distribution of products</li> </ul>
	<p><b>National Politics</b></p> <ul style="list-style-type: none"> <li>✓ Politically connected firms use their political networks to gain favours e.g. tax exemptions and cash hand-outs, which promotes unfair competition</li> <li>✓ National politics perpetuate corruption where business success in Uganda largely depends on political connections and patronages.</li> <li>✓ Politicians have engaged with and boosted the informal sector instead of regulating it - as means to achieve political capital and acquire votes to maintain their grip on power</li> <li>✓ Different political parties have adopted different colours as distinguishing features, which has greatly influenced customer choices especially in the fashion industry.</li> </ul>	<p><i>“Due to corruption, most of our competitors do not pay taxes on some materials...you know in Uganda things are handled with political influence and less professionalism...Some companies have closed due to the informal sector. Informal actors are favoured by politicians looking for votes.”</i> (PU’s Procurement Manager)</p>	<ul style="list-style-type: none"> <li>- Informal sector and unfair competition</li> <li>- Demand variations</li> </ul>
	<p><b>Government Policy</b></p> <ul style="list-style-type: none"> <li>✓ Selective subsidisation and tax exemptions that create unfair competition</li> <li>✓ Policy on taxation involving unexpected tax increases</li> <li>✓ Policy on counterfeits where the government standards body (Uganda National Bureau of Standards) recommends the use of counterfeits rather than fight them</li> <li>✓ Policy on weight limits for carriage trucks leading to distribution cost escalations and delivery delays</li> <li>✓ Bureaucratic procurement policy that leads to late approvals and payments</li> </ul>	<p><i>“The government policy of subsidising some investors selectively has affected us. The subsidised out-compete us on price. This may be due to corruption or political connections because some firms are given more years of tax exemptions than others.”</i> (BU’s Merchandise Manager)</p>	<ul style="list-style-type: none"> <li>- Raw material delays and shortages</li> <li>- Order cancellations</li> <li>- Unfair competition</li> <li>- Unstable taxation e.g. unexpected hikes</li> <li>- Poor customer delivery performance</li> <li>- Demand variations</li> <li>- Product counterfeiting</li> </ul>

	<ul style="list-style-type: none"> <li>✓ Donations highlighted among the causes of order cancellations especially for pharmaceutical firms which lead to prolonged storage of the initially procured raw materials</li> </ul>		
	<p><b>Weak Legal System</b></p> <ul style="list-style-type: none"> <li>✓ Weak laws, including on copyright, and corruption responsible for frequent copyright infringements</li> <li>✓ Due to weak legal system, customers default on payment, leading to financial crisis</li> </ul>	<p><i>“Our original label/logo was copied and because of the weak Ugandan law compounded by corruption, it will take a long time to have copy right laws”.</i> (TU’s Route-to-Consumer Supply Manager)</p>	<ul style="list-style-type: none"> <li>- Product counterfeiting</li> </ul>
<b>Cultural Embeddedness</b>	<p><b>Corruption</b></p> <ul style="list-style-type: none"> <li>✓ Firms reported corruption e.g. in the form of bribery, conflict of interest, connivance, political favouritism and lack of transparency</li> <li>✓ The culture of corruption mainly originates from government complacency, government policy and national politics where political connections influence business</li> <li>✓ Corruption exacerbates the threat of taxation where some firms pay taxes while others do not.</li> <li>✓ Firms indicated that corruption leads to the withdrawal of donations by developed countries prompting the government to hike taxes as compensation for the lost revenue.</li> </ul>	<p><i>“We are in touch with government and Uganda Revenue Authority [government body] to handle counterfeiters. They [counterfeiters] may be part of the investigators. They get a lot of profit and can bribe Uganda Revenue Authority and other government staff.”</i>(BU’s Export Manager)</p>	<ul style="list-style-type: none"> <li>- Unfair competition</li> <li>- Dishonest customers/distributors</li> <li>- Raw material delays and shortages</li> <li>- Product counterfeiting</li> <li>- Reduced customer base</li> <li>- Weak legal system</li> <li>- Poor transport infrastructure</li> <li>- Order cancellations</li> </ul>
	<p><b>Product Counterfeiting</b></p> <ul style="list-style-type: none"> <li>✓ Product counterfeiting is partly perpetuated by the nature of Ugandan customers who prefer low price to quality. Thus, they buy counterfeits knowingly as long they are cheaper than genuine products</li> <li>✓ Ethical culture where government employees responsible for fighting counterfeiting are themselves counterfeiters</li> <li>✓ Unethical local suppliers who deliberately deliver counterfeit raw materials</li> </ul>	<p><i>“We have a problem of people who produce fake products. Our government is not yet strict on people who produce concrete. They cannot certify people who produce concrete and they do not oversee them. Some are not registered and nothing is known on how they work...no clear standards are set yet.”</i> (HU’s Production and Operations Manager)</p>	<ul style="list-style-type: none"> <li>- Reduced customer base</li> <li>- Reputational risk</li> <li>- Poor quality raw materials</li> </ul>
	<p><b>Informal Sector</b></p> <ul style="list-style-type: none"> <li>✓ Managers in some industries are not willing to formerly register their businesses mainly to avoid taxes. This creates unfair competition e.g. about 80% of actors in the dairy industry are unregistered.</li> </ul>	<p><i>“Our major threat is the informal market. In this industry, the informal market is bigger than the formal one. These [informal actors] sell quite cheaply since they do not</i></p>	<ul style="list-style-type: none"> <li>- Unfair competition</li> <li>- Raw material delays and shortages</li> <li>- Reduced customer base</li> <li>- Product counterfeiting</li> </ul>

		<i>pay tax and since the majority of Ugandans are poor, we lose the market. But we also lose milk raw material because the informal market takes the largest portion". (QU's Procurement Manager)</i>	- Financial difficulties
	<p><b><i>Unfair Competition</i></b></p> <ul style="list-style-type: none"> <li>✓ Price wars because some firms avoid or evade taxes due to corruption either by bribing tax officials or utilising their political connections</li> <li>✓ Firms use connivance to sabotage their competitors' supply chain operations. For example, they collude with suppliers so as not to deliver raw materials to their competitors or at least to deliver late</li> <li>✓ Some firms bribe the competitors' distributors so as to stop them from displaying or selling their (competitors') products</li> <li>✓ Culture where firms subject their competitors to negative publicity and bad mouthing</li> <li>✓ Firms connive with their competitors' employees and buy stolen raw materials. Such culture perpetrates theft of stock, thereby constraining the holding of strategic stock as a resilience strategy</li> </ul>	<i>"We don't have a level playing field...due to corruption; most of our competitors do not pay taxes on some materials. Hence our competitors beat us on price and this affects our sales [we experience] price wars where our competitors undercut us. We lose customers to our competitors." (PU's Procurement Manager)</i>	<ul style="list-style-type: none"> <li>- Raw material delays and shortages</li> <li>- Reputational risk</li> <li>- Poor customer delivery performance</li> <li>- Reduced customer base</li> </ul>
	<p><b><i>Dishonest Suppliers</i></b></p> <ul style="list-style-type: none"> <li>✓ Some local suppliers are dishonest and unreliable. They are deceptive about their capacity and they accept orders that they fail to deliver</li> <li>✓ Suppliers have a culture of accepting business even if they know they do not have the products</li> <li>✓ Some suppliers promote unfair competition by conniving with the companies' competitors to deny them raw materials, supply late, supply poor quality or reveal confidential information</li> </ul>	<i>"They bring things below specification e.g. less quantity and quality and connive with our employees...If you receive less material, you end up miscalculating and you run out of raw materials unexpectedly." (JU's Procurement Manager)</i>	<ul style="list-style-type: none"> <li>- Financial difficulties</li> <li>- Supplier delivery failure</li> <li>- Poor quality raw materials</li> <li>- Raw material delays and shortages</li> <li>- Unfair competition</li> <li>- Product counterfeiting</li> <li>- Reduced customer base</li> </ul>
	<p><b><i>Dishonest Customers/Distributors</i></b></p> <ul style="list-style-type: none"> <li>✓ Customers or distributors refuse to pay for the products they are supplied with on credit and keep defecting to different companies</li> <li>✓ Customers issue post-dated cheques without funds on their accounts while others use their political connections to dodge payments for products</li> </ul>	<i>"After entrusting the distributor with goods worth millions, they disappear, refuse to pay or switch to competitors. But we forward to the legal department to handle such cases. But sometimes these cases</i>	<ul style="list-style-type: none"> <li>- Financial difficulties</li> <li>- Poor customer delivery performance</li> <li>- Reduced customer base</li> <li>- Payment threat (from customers)</li> </ul>

	<ul style="list-style-type: none"> <li>✓ Some customers connive with company employees and either manipulate the prices and share the difference or load more quantity into lorries/containers than bought</li> <li>✓ Distributors intentionally and secretly close down their businesses to dodge paying for the products advanced to them on credit</li> <li>✓ Some opportunistic distributors are bribed and compromised by competitors to malice the companies they distribute for</li> </ul>	<p><i>vanish due to corruption [bribery].”</i> (Assistant Sales Manager for LU)</p>	
	<p><b><i>Negative Perceptions of Overseas Suppliers</i></b></p> <ul style="list-style-type: none"> <li>✓ Some overseas suppliers have a negative perception of firms from African countries (e.g. corrupt, likely to collapse) leading to denying them trade credit.</li> </ul>	<p><i>“Most of the foreign suppliers do not consider African companies as creditworthy. Before they dispatch your containers you must pay in full...overseas suppliers have such negative perceptions...It might be due to wars, political conflicts, corruption or the high rate of collapse of companies.”</i> (PU’s Procurement Officer)</p>	<ul style="list-style-type: none"> <li>- Reputational risk leading to raw material delays and shortages</li> </ul>
	<p><b><i>Dishonest Employees</i></b></p> <ul style="list-style-type: none"> <li>✓ Employees connive and steal finished products and raw materials while in transit or when stored on the company’s premises</li> <li>✓ Employees connive with suppliers and record more quantity of raw materials than actually received</li> <li>✓ Some employees connive with suppliers and inflate the cost of raw materials</li> <li>✓ Some employees inflate the prices of finished goods and sell at more than the prices set by the company (retaining the difference)</li> <li>✓ Employees steal company money, deceive customers, deliberately produce poor quality products and cause machine breakdowns, sometimes as a retaliation against low and delayed salaries</li> </ul>	<p><i>“The sales staff connives with clients and they know the base line price but they show you a different price and they share. Even internally, in stores, the loading clerk would connive with the storekeeper, the sales person and the client so they would balance the stock but the physical stock would not exist.”</i> (HU’s Marketing Manager)</p>	<ul style="list-style-type: none"> <li>- Machine breakdowns</li> <li>- Poor quality products</li> <li>- Reputational risk</li> <li>- Reduced customer base</li> <li>- Financial difficulties</li> <li>- Stock theft</li> <li>- Poor customer delivery performance</li> <li>- In-transit raw material theft</li> </ul>
	<p><b><i>Owner/Management Behavior</i></b></p> <ul style="list-style-type: none"> <li>✓ In most local firms, top managers are the owners: they resist formal structures and fail to separate the companies’ operations from their own private affairs.</li> <li>✓ Top managers intervene in professional activities, such as procurement, and cause procurement risk by either making</li> </ul>	<p><i>“The owner makes decisions alone. There are purchases made without the knowledge of the procurement department. Last week the chairman [owner] told me there is</i></p>	<ul style="list-style-type: none"> <li>- Procurement risk</li> <li>- Financial difficulties</li> <li>- Poor internal coordination</li> <li>- Poor customer delivery performance</li> </ul>

	<p>duplicate purchases or purchasing poor quality items</p> <ul style="list-style-type: none"> <li>✓ Unfair treatment of employees by top management where some are rewarded more than others unjustifiably resulting in e.g. employee unethical behaviour</li> </ul>	<p><i>a consignment of raw materials in transit but the procurement department is not aware. This kind of arrangement leads to the purchase of poor quality raw materials and de-motivation of employees.</i>” (JU’s Regional Sales Manager )</p>	<ul style="list-style-type: none"> <li>- Poor quality raw materials</li> <li>- Payment threat (to suppliers/labor)</li> </ul>
	<p><b>Customer Characteristics</b></p> <ul style="list-style-type: none"> <li>✓ Customers prefer low price to quality which increases vulnerability to unfair competition involving price wars</li> <li>✓ Ugandan customers are willing to buy counterfeit products knowingly (as long as they are cheaper)</li> <li>✓ Customers have limited product knowledge and this leads them to submit wrong specifications</li> <li>✓ Some customers economically depend on agriculture – in the case of bad weather, their income is very low</li> </ul>	<p><i>“Customers do not know enough about the product and are price sensitive. They end up moving for competitors or importers from China which is relatively cheaper but of low quality...There is a problem of counterfeit especially from China. Customers do not mind quality but price.”</i> (OU’s Sales and Marketing Manager)</p>	<ul style="list-style-type: none"> <li>- Product counterfeiting</li> <li>- Demand variations</li> <li>- Reduced customer base</li> <li>- Poor customer delivery performance</li> <li>- Order cancellations</li> </ul>
<b>Territorial Embeddedness</b>	<p><b>Geographical Location/Landlockedness</b></p> <ul style="list-style-type: none"> <li>✓ Uganda is a landlocked country and most raw material imports have to pass through neighbouring Kenya.</li> <li>✓ Political chaos in Kenya disrupts the flow of raw materials resulting in delays and production stoppages</li> <li>✓ Vulnerability to threats caused by poor road transport infrastructure in the transit country - Kenya</li> </ul>	<p><i>“Uganda, being a landlocked country, most of the raw materials come from Europe by sea, and air is not cost-effective. There are delays because we need to transport them from Mombasa by road. The road infrastructure is also poor... It takes around fifteen days from the seaport to Uganda. Transporting from Mombasa to Uganda is costly.”</i> (MU’s Supply Chain Manager)</p>	<ul style="list-style-type: none"> <li>- Poor transport infrastructure and political instabilities in the transit route country</li> </ul>
	<p><b>Spatial Proximity</b></p> <ul style="list-style-type: none"> <li>✓ Overseas sourcing of most raw materials and long distances from the suppliers</li> <li>✓ Long distance sourcing leads to maintaining huge stocks of raw materials for longer periods of time</li> <li>✓ Difficulties in maintaining collaborative relationships with distant suppliers due to communication barriers and poor information flow</li> </ul>	<p><i>“Raw materials can take a long time to reach us because of long distance sourcing and we exhaust the buffers. In fact as I speak, due to the exhaustion of our buffers, we are now on standstill. We cannot produce due to delayed raw materials and yet customers have already paid in advance.”</i> (JU’s Sales and Marketing Manager)</p>	<ul style="list-style-type: none"> <li>- Raw material delays and shortages</li> <li>- Communication barriers &amp; poor information flow</li> </ul>

As can be observed from Table 5.2, the categories of embeddedness can overlap. Although a factor such as corruption can be analysed from a cultural perspective – where people may view it as a norm – it can also be argued to be a political factor arising from a weak legal system, government policy, or a lack of political will. Similarly, factors such as a weak legal system could be perpetuated by culture, such as where the civil society legitimises bribery. Further, a supply network may be embedded in political and cultural milieus due to its territorial embeddedness, e.g. being located in a generally underdeveloped continent with political immaturity and economic constraints. The remainder of this section will discuss the insights into resilience that can be gained from an embeddedness standpoint.

### *5.3.1. Embeddedness as Both an Enabler and Inhibitor of SCRES*

The data revealed some evidence that embeddedness can enable SCRES. For example, through co-opetition, competitors borrow raw materials from each other to mitigate raw material delays. This is facilitated by the actors' involvement in informal networks, which develop in a supportive cultural context. However, it was also found that embeddedness is a source of threat. Firms such as BU and CU attributed specific threats, such as delays and damage to fragile consignments – as a result of poor transport infrastructure – to the embeddedness of the supply network in a political and cultural context that exacerbates corruption. JU's Procurement Manager argued: *“This poor road network should be attributed to a lack of political will and corruption in African countries including Uganda ... It is public knowledge. Corruption has now become part of the government and our daily activities. No bribe, no service, no survival.”* Other threats were found to originate from territorial embeddedness, such as being located far away from the source of raw materials and in a landlocked country, which creates vulnerability to political instabilities in the transit route country. For example, PU's Procurement Manager explained: *“When there was political*

*violence in Kenya, all manufacturing companies in Uganda ran out of stocks of raw materials ... They could not be delivered via Mombasa.”*

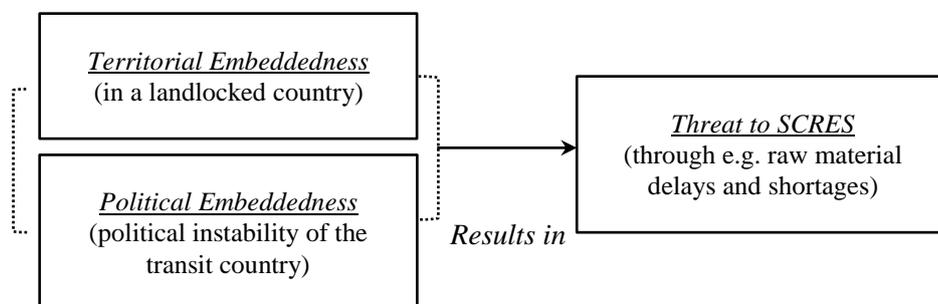
### *5.3.2. Embeddedness Causing Unexpected Adverse Outcomes from SCRES Strategies*

This study found that some SCRES strategies yielded unexpected adverse outcomes as a result of embeddedness. For example, maintaining strategic stocks to guard against the raw material delays and shortages that result from long distance sourcing may become ineffective due to cultural acceptance of employees stealing the stock. This is not a consequence that is evident from prior empirical work on SCRES that has been conducted in Western countries. Further, although informal networking can create resilience against certain threats (e.g. financial difficulties and raw material delays) and reinforce strategies (e.g. co-opetition), it can also act as a barrier to SCRES due to cultural and political embeddedness (e.g. when firms use their informal networks to avoid taxes). JU’s Procurement & Logistics Officer stated: *“Some competitors lobby the government and dodge or pay low taxes. There is corruption in government where beneficiaries pay less or no tax and end up charging a lower price, which affects our customer base.”*

### *5.3.3. Different Categories of Embeddedness Combining to Produce Threats to SCRES*

The notion that the embeddedness of the supply network is both direct and indirect (Choi & Kim, 2008) appears to be due to its overlapping nature – being voluntarily embedded in one aspect implies automatic embeddedness in another (see Figure 5.7). In the data for this study, for example, it was found that being (voluntarily) territorially embedded in a landlocked country (e.g. as a location decision) implies also being embedded in the conditions of the transit neighbouring country involuntarily. This can be a source of vulnerability, e.g. in the case of political instabilities. This suggests that combinations of different forms of embeddedness (e.g. territorial and political) can produce threats that would not occur if one or

the other form were not present. For example, it can be argued that being embedded in a landlocked country may not be a threat to a firm’s SCRES as long as there is no political instability in a neighbouring transit route country. Similarly, political instability in the neighbouring country only becomes a threat only if a company is operating in a landlocked country and the politically unstable neighbouring country is in its major transit route. LU’s Assistant Sales Manager, for example, explained: “*Being a landlocked country, most of our imported raw materials pass through Kenya. During the post-election violence [in Kenya] we lacked raw materials, which constrained production.*”



*Figure 5.7: Combined Territorial and Political Embeddedness Forming a Threat to SCRES*

#### **5.4. Concluding remarks**

The above findings provide important insights for furthering our understanding of SCRES. It was found, for example, that threats and strategies are interrelated in the sense that strategies to build SCRES may produce adverse outcomes in the form of new or former threats, either at the same or a different point of the supply network. Equally, resilience strategies may conflict or mutually reinforce each other. The relationships between supply chain phenomena, and the points where they occur in the supply chain, were reportedly caused by the factors emanating from the context in which the supply chains are situated. This suggests that the way the supply chain becomes a system is explained by its embeddedness – because it is embeddedness that produces or explains the nature of many of the relationships between threats, strategies, etc. Thus to build SCRES, we need to understand that the behaviour of a

supply chain as a CAS is influenced by its embeddedness. Together, the CAS and embeddedness views therefore explain risk migration in the supply chain. And risk migration implies that resilience is potentially an unending process of adapting both to threats and the outcomes of prior adaptations. This is one of the main contributions of this research which will be discussed further alongside others in Chapter 6.

## **CHAPTER 6**

### **DISCUSSION AND CONCLUSIONS**

The aim of this research has been to explore Supply Chain Resilience (SCRES) in the context of a developing country. This was motivated by the paucity of empirical studies on SCRES in the extant literature, with those that have been conducted focussing on a developed country context. But it is clear that developing countries are important in global supply chains and also face supply chain disruptions – some of which are not only unique but can result in disastrous consequences, including fatalities. Further, evidence suggests that the consequences of supply chain disruptions in developing countries can propagate to the developed world. Thus, there has been a need to investigate the perceived threats to supply chains in developing countries and to examine how firms attempt to create resilience to these threats. A case study analysis of a supply network of 20 manufacturing firms in the developing country of Uganda was conducted, leading to the research findings, which are reflected upon in this final chapter. This chapter therefore contains the following four sections: Discussion of the contributions from the study (6.1), theoretical implications (6.2), developing propositions about SCRES and meaning of SCRES from the findings (6.3), implications of the findings for practice (6.4); and finally, the limitations and future research implications (6.5).

#### **6.1. Research Contributions**

The contributions of this thesis are built upon two research questions formulated based on the gaps earlier identified in the SCRES literature:

RQ1: What are the elements of supply chain resilience in a developing country?

- What do manufacturing firms in Uganda perceive to be the threats to their supply chains?
- What strategies do they adopt to build resilience to these threats?
- What are the outcomes of implementing these strategies?

RQ2: How are threats and strategies interconnected with the outcomes?

- What does this interconnectedness mean for supply chain resilience?

The first research question was answered in Chapter 4 which analysed and presented the findings in three broad categories and their respective sub-categories. These categories are: the perceived threats to SCRES, the strategies adopted to build resilience to these threats and the outcomes of implementing such strategies. As earlier mentioned in Chapter 4, this thesis concentrated on the negative outcomes because where strategies worked or had positive outcomes, interviewees did not need to provide further explanations. Moreover, investigating these negative outcomes is in itself a contribution, as besides their significant implication for SCRES, they have not been considered in the SCRES literature before. Although there are various benefits of adopting SCRES strategies, recent research points to the need to also empirically investigate the adverse outcomes of these strategies as suggested by Kamalahmadi & Parast (2016). The second research question was answered in Chapter 5, where the data analysis involved identifying the network of inter-relationships among threats (and associated conditions), strategies and outcomes, with directed edges showing causations as claimed by the interviewees. The emergent network of causations was qualitatively analysed and interpreted using a CAS theory frame. This was subsequently supplemented by an embeddedness perspective, resulting in new insights about SCRES. The findings from this research have resulted in the research contributions discussed here below.

To begin with, this study provides empirical evidence from a developing country context based on a supply network analysis. With the exception of a few notable studies (e.g.

Brandon-Jones et al., 2014; Scholten & Schilder, 2015), most of the studies on SCRES to date have used a firm as the unit of analysis (e.g. Gölgeci & Ponomarov, 2013; Gölgeci & Ponomarov, 2014; Ambulkar et al., 2015). Thus, by analysing a supply network of manufacturing firms, this study responds to the recent suggestion by Kim et al. (2015a) that a more appropriate level of analysis for SCRES phenomena would indeed be a supply network. In addition, the developing country context has provided novel findings that have not been considered before in the SCRES research which as hitherto established, focusses on the developed world. For example, findings on the perceived threats to SCRES suggest that firms in Uganda are mainly concerned with chronic threats like raw material delays and shortages, financial difficulties, machine breakdowns, product counterfeiting and quality problems, rather than the large-scale catastrophic events. This is in contrast to the previous empirical studies on SCRES, which have emphasised the high-profile catastrophic, discrete events, e.g. terrorist attacks, the global financial crisis, rail crashes and Hurricane Katrina (e.g. Rice & Caniato, 2003; Jüttner & Maklan, 2011; Johnson et al., 2013; Scholten et al., 2014). In this study, the data revealed that seemingly small threats which are mainly chronic may have considerable consequences, and this is arguably due to the non-linearity that characterise supply chains as complex adaptive systems. Further, it is logical that, over time, these chronic threats may weaken the capacity of the supply chain to respond to large-scale events, meaning SCRES can be gradually lost.

Second, this study has enabled a comprehensive empirical analysis of threats to SCRES. Most of the previous studies on SCRES do not expressly discuss the threats facing supply chains that call for resilience – they only focus on the strategies for building resilience (e.g. Gölgeci & Ponomarov, 2013; Wieland & Wallenburg, 2013; Brandon-Jones et al., 2014; Gölgeci & Ponomarov, 2014; Ambulkar et al., 2015). Yet, the notion that the resilience of a supply chain should be analysed from the Complex Adaptive System (CAS) perspective (e.g. Day, 2014) suggests that threats and strategies should be analysed systemically and jointly, if

we are to understand how resilience is potentially gained or lost. Zsidisin & Wagner (2010) moved in this direction by linking SCRES practices to risk sources but only considered supply-side threats. Arguably, only Pettit et al. (2010) analysed a comprehensive list of supply chain vulnerabilities and argued that they should be counterbalanced with corresponding resilience capabilities, in order to attain the desired SCRES. However, like the rest of the studies on SCRES, both of these studies did not consider the outcomes of resilience strategies. And while they seem to suggest that supply chain threats can be linked to resilience strategies in a linear way, this study found that threats, strategies and outcomes are so interconnected to the extent that they form a complex network across different points of the supply network, further increasing its complexity.

Furthermore, some of the (sources of) threats to SCRES that have emerged from this study like corruption, dishonest employees and a weak legal system, were not considered in both Pettit et al. (2010) and Zsidisin & Wagner (2010) or elsewhere in the broader SCRES literature. While these previous empirical studies were conducted in the developed world, this study finds that threats such as mentioned above reflect the context of a developing country in which the supply chains are embedded. Also, some of the threats identified in this study and which are already highlighted in the SCRES literature, have been explained with new empirical evidence grounded in the context and different from that in the prior works. For example, the threats of theft and national politics were also identified by Urciuoli et al. (2014) but explained differently from how they are explained in this research. Theft, for example, was explained as an exogenous threat perpetrated by sea pirates while the threat of national politics was explained in terms of resource limitation and allocation failures in some countries that result in failure to combat security problems (Urciuoli et al., 2014). In contrast, the findings of this study reveal that theft is also an endogenous threat that is perpetrated by firms' own employees, and the threat of national politics is explained in terms of political patronages and politicians' perpetuation of unfair competition through e.g. corruption and

encouraging informal actors who dodge taxes. This unique explanation reflects the context of a developing country that will be discussed further as the effect of embeddedness. The above discussion is further summarised below in Table 6.1.

*Table 6.1: Comparing Some Findings with the SCRES Literature*

<b>Existing SCRES literature</b>		
<i>Examples of prior empirical work</i>	<i>Understanding of SCRES</i>	<b>Findings from this study</b>
Rice & Caniato, 2003; Jüttner & Maklan, 2011; Johnson et al., 2013; Scholten et al., 2014.	Emphasis on high-profile catastrophic, discrete events, e.g. terrorist attacks, the global financial crisis, rail crashes and Hurricane Katrina	Threats to SCRES are mainly chronic like raw material delays and shortages, financial difficulties, machine breakdowns, product counterfeiting and quality problems.
Rice & Caniato, 2003; Jüttner & Maklan, 2011; Johnson et al., 2013; Scholten et al., 2014.	Emphasis on exogenous threats like terrorist attacks, the global financial crisis, rail crashes and Hurricane Katrina	SCRES is about both endogenous threats and exogenous threats. The most important threats as observed in Chapter 5 (Table 5.1) are endogenous (i.e. they originate from within the supply chain).
Gölgeci & Ponomarov, 2013; Wieland & Wallenburg, 2013; Brandon-Jones et al., 2014; Gölgeci & Ponomarov, 2014; Ambulkar et al., 2015.	These studies focussed only on SCRES strategies suggesting SCRES can be understood by e.g. investigating strategies without simultaneously considering threats and outcomes of these strategies	Supply chain threats and conditions that produce threats; strategies and outcomes should be analysed systemically and jointly rather than individually and separately, if we are to understand how SCRES can be gained or lost.
Pettit et al. 2010; Zsidisin & Wagner, 2010.	Supply chain threats and resilience strategies or capabilities can be segregated and linked in a linear way	Supply chain threats and conditions that produce threats; strategies and outcomes are so strongly interconnected to the extent that they form networks of causations occurring at different points of the supply networks.

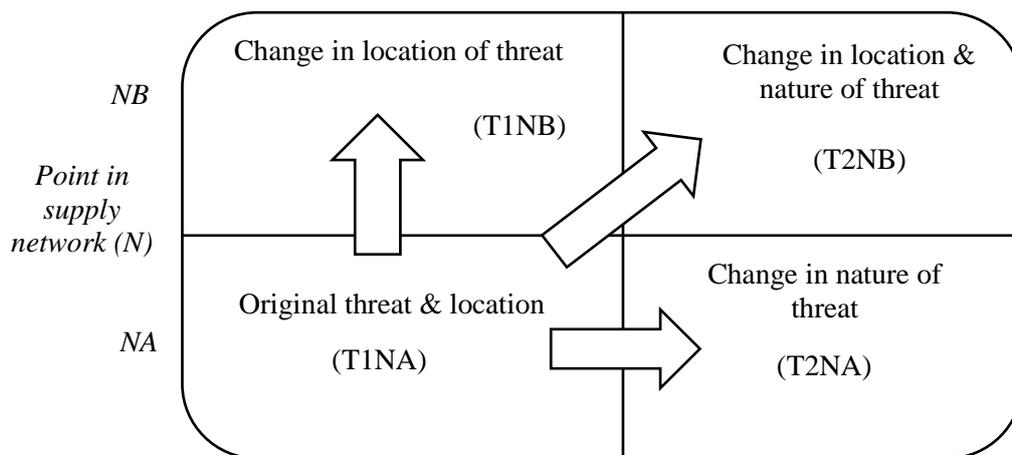
Third, in this study, Complex Adaptive Systems (CAS) theory lens has been used to interpret the data. Although prior studies have proposed CAS as an appropriate lens for understanding SCRES (e.g. Hearnshaw & Wilson, 2013; Day, 2014), this is the first empirical work on SCRES that ascertains CAS' practical utility. Using the CAS theory lens, this study found that SCRES phenomena cannot be easily explained in a linear, sequential way – they should be explained systemically rather than individually and separately. For

example, it became difficult to organise the data under different components of CAS since threats and strategies are interrelated and so are the components of a CAS.

Fourth, this study found that although CAS is useful, it is not sufficient on its own to clearly explain SCRES in a developing country. A supply network can be viewed as a CAS, but it is also important to understand the context in which the network is situated. Some of the most prominent threats and adverse outcomes of SCRES strategies were caused by the distinctive political, cultural and territorial embeddedness of the supply network in a developing country. This study therefore contributes by showing that both CAS and embeddedness are needed to jointly explain SCRES. In so doing, the study extends the application of embeddedness in supply chain and operations management research, where embeddedness has been portrayed as a purely positive concept, beyond its prior primary focus on the structural and relational dimensions of network embeddedness (e.g. Choi & Kim, 2008; Bernardes, 2010; Gligor & Autry, 2012; Kim, 2014). Only Wu & Pullman (2015) have recently considered cultural embeddedness, showing it to be a facilitator in cooperative networks in a developed country context. But empirical evidence from this research shows that cultural embeddedness in a developing country can also be an inhibitor of SCRES. Further, although embeddedness had been linked to supply chain risk (e.g. Song et al., 2012; Nyaga et al., 2013), and to both adaptation and responsiveness (Uzzi, 1997), it has not previously been applied to facilitate understanding of SCRES.

Finally, data analysis using CAS and embeddedness perspectives jointly revealed the phenomenon of ‘supply chain risk migration’, whereby implementing a particular resilience strategy produced another threat, either at the same or a different point in the supply network. The ‘supply chain threat migration matrix’ is introduced below in Figure 6.1 to illustrate that, in the process of creating SCRES, a threat can migrate from one form to another and/or from one point in the supply network to another. The horizontal axis in Figure 6.1 represents the threat (T) while the vertical axis represents the point in the supply network (N), e.g. in the

upstream or downstream. The bottom left-hand quadrant (T1NA) represents the initial point NA, which is threatened by T1. An attempt is therefore made to mitigate threat T1. Threat migration may manifest in three forms, i.e. T2NA, T1NB or T2NB. The bottom right-hand quadrant, T2NA, shows the transformation of a threat T1 into another threat T2 at the same point in the network NA. For example, analysis showed that mitigating the upstream threat of raw material delays and shortages by keeping strategic stocks resulted in financial difficulties, leading to another upstream threat of loss of reputation with suppliers due to a failure to pay them (*see section 5.2.1*). The top left-hand quadrant, T1NB, shows the migration of threat T1 to a different point in the network (NB). For example, mitigating the threat of financial difficulties resulting from defaulting customers by demanding cash payments resulted in a reduced customer base and cash inflows – leading to an upstream threat of failure to pay suppliers (financial difficulties) (*see section 5.2.2*). Finally, the top right-hand quadrant, T2NB, shows the migration of a threat (T1 to T2) and of the point in the network where the threat is experienced (NA to NB). For example, analysis revealed that to mitigate the upstream threat of dishonest suppliers who adulterated products and supplied poor quality materials, some companies screened quality at suppliers' sites and conducted audits. But this caused raw material delays, which disrupted production schedules and led to the downstream threat of late delivery to customers and a reduced customer base.



*Figure 6.1: Supply Chain Threat Migration Matrix in the Continual Process of Creating Resilience*

The above discussion illustrates that in the process of creating resilience, some of the risks may not be totally eliminated – they may migrate rather than get solved. The concept of risk migration can be traced to the risk literature (e.g. Grabowski & Roberts, 1997; Alcock & Busby, 2006), but it has not previously been considered in supply chain risk and resilience research. Thus, unlike much of the available literature, which appears to view resilience as being an outcome and about responding to isolated events, this study has shown resilience to be a process of continual adaptation. This adaptation does not only apply to external events as emphasised in the literature (e.g. Rice & Caniato, 2003; Jüttner & Maklan, 2011; Johnson et al., 2013) but also to endogenous and chronic threats by also producing other threats that need further adaptations and so on. This is further supported by the relationships that emerged from the data, which were in the form of networks of conditions, threats, strategies and their outcomes at different points of the supply network (see section 5.2), meaning SCRES is not only about the network of firms but also about the causal network of threats and conditions that produce the threats, strategies and outcomes. An explanation for the prominence of this feature of the data was the embeddedness of the supply network, which produced conditions that rendered SCRES strategies ineffective or even counter-productive.

To date, no SCRES research has argued for resilience as a process, but beyond supply chain and operations management, scholars (e.g. Luthar et al., 2000), in their conceptual work, suggested that resilience in child development is a dynamic process and not a specific attribute of a child – where the latter would mean that some children can never have what it takes to be resilient, because they naturally do not possess the quality of resilience. Similarly, SCRES being revealed as a process in this research logically suggests that it is non-stationary and can be lost or gained with the passage of time. This supports Hamel & Valikangas (2003)'s conceptual analysis that resilience involves continuous reconstruction and response rather than merely responding to and rebounding from a one-off crisis.

## **6.2. Theoretical Implications**

The findings of this study have some implications for the theories used i.e. complex adaptive systems and embeddedness. The literature on complex adaptive systems earlier discussed in Chapter 2 highlights features of such a system like non-linearity. In particular, previous researchers discuss the CAS features and relate them to the features of a supply chain (e.g. Pathak et al., 2007; Wycisk et al., 2008; Hearnshaw & Wilson, 2013; Day, 2014). However, what they fail to explain is how and why a CAS becomes a system. This thesis contributed in showing that it is embeddedness that causes interconnections between different phenomena or entities to form a system. For example, it was found from the data that some firms use co-opetition as a resilience strategy, where competitors borrow raw materials from each other to mitigate raw material delays. This was reportedly facilitated by the actors' involvement in informal networks, which develop in a supportive cultural environment in which such actors are embedded. This example shows how embeddedness connects the otherwise independent firms to form a system. The findings also revealed that it is due to embeddedness that

resilience strategies produce contradictory outcomes, sometimes resulting in non-linearity e.g. where certain actions and their effects result in closed loops.

Further, as earlier mentioned this study extends the application of embeddedness framework in the supply chain and operations management literature, beyond its prior focus on the structural and relational dimensions and being portrayed only as a positive phenomenon (e.g. Choi & Kim, 2008; Bernardes, 2010; Gligor & Autry, 2012; Kim, 2014). This thesis argues that the cultural, political and territorial embeddedness can also be a hindrance or even counterproductive to supply chain and operations management. It was found for example that it is embeddedness that causes the phenomenon of risk migration earlier discussed.

### **6.3. Developing Propositions about Supply Chain Resilience**

From the above research contributions, the following propositions are developed about SCRES:

First, the findings revealed that the most important threats and conditions that affect resilience in the developing country context studied were chronic, although large scale discrete events like natural disasters were also highlighted. Further, most of the important threats (i.e. those with many links) as observed in Chapter 5 (Table 5.1) originated from within the supply chain. This shows that resilience is about chronic events and conditions, catastrophic threats as well as endogenous and exogenous events and conditions. And figure 6.1 shows that these threats may migrate across the network when attempts to mitigate them are made. This was found to be due to interconnectedness where adaptation to threats may for example result in other threats requiring more adaptation and so on. The relationships between threats, strategies and outcomes were evidently a consequence of the embeddedness

of the supply network in the context of a developing country. This leads to the following two propositions:

**Proposition 1:** *Supply chain resilience is a continual process of responding to threats and responding to the outcomes of those responses which migrate across the supply network by forming another network of causations of threats (and conditions that produce threats), strategies and outcomes.*

**Proposition 2:** *Supply chain resilience relevant conditions and capabilities are politically, culturally and geographically embedded and this embeddedness is largely what makes the supply networks and the networks of causations (of threats and conditions that produce threats; strategies and outcomes) so strongly interconnected.*

#### *Meaning of Supply Chain Resilience from the Findings*

From the propositions above, it can be concluded that supply chain resilience is a continual process. Most of the SCRES definitions identified in the extant literature have suggested that SCRES is a capability; and that it is composed of four distinct and linear stages of preparation, response, recovery and growth/ competitive advantage (e.g. Hohenstein et al., 2015). Similarly, the working definition of SCRES that was earlier put forward based on the literature in Chapter 2 emphasised capabilities in the meaning of resilience. Although there are many definitions of the term capability, the commonly cited authors like Ray et al., (2004) use the term ‘capabilities’ as the tangible and intangible assets firms use to develop and implement their strategies. This is different from ‘business processes’ which the same authors define as actions (routines or activities) that firms engage in to accomplish some business purpose or objective. SCRES is more than just a capability – capabilities have the potential for providing value (e.g. improving SCRES) but that potential can be realised only if used in business processes (e.g. Ray et al., 2004). In this particular study, the findings showed that SCRES is associated more with routines or continuous activities (or the

processes) of responding to chronic and endogenous threats than exogenous distinctive and discrete threats.

The embeddedness theoretical perspective explained how SCRES involves the process of interaction between the supply chain and the environment in which it is embedded. It is this interaction process that explains the relationships between adaptation strategies or capabilities and threats/conditions and outcomes. The findings showed that this potentially results in risk migration whereby threats shift to a different supply network fragment or new threats are created at the same or different supply network fragment. This process calls for deployment of more adaptation strategies/capabilities, and the cycle continues meaning SCRES process is continuous rather than discrete – it is not about response to a specific threat but management of risk migration. In short, based on the findings of this study, the definition of SCRES has evolved from prior emphasis on capabilities in Chapter 2 to the process perspective, in order to understand how different threats and strategies/capabilities interact and respective outcomes in the response process.

#### **6.4. Implications for Practice**

In addition to the research contributions discussed above, this study has provided new insights for managers wishing to make their supply chains resilient. Managers should be aware that the threats to the resilience of their supply chains are not necessarily large-scale discrete events – they are also events of continuous possibilities. Hence, they should not underestimate seemingly small but chronic events because they are capable of gradually weakening the supply network, resulting in either major consequences (due to non-linearity) or a reduced capability to respond to future catastrophic events.

Managers should also be aware of potential migration of supply chain threats when crafting strategies to build SCRES. This means their adaptation decisions, and those of

managers at other points in the supply network, contain latent threats that can potentially hinder SCRES. Rather than looking at their operation in isolation, managers should look at the supply chain holistically because actors along the chain are so interconnected. This holistic analysis is important to identify endogenous threats, which this study finds important for SCRES. This may be implemented through supply chain mapping to have a clear visibility of the entire relevant network, such that before adopting and implementing a SCRES strategy, its potential outcome and the response of other actors across the supply network are considered. Further, risk migration presupposes that managers should understand how threats and strategies are interconnected and what this could mean for their SCRES strategy implementation. The fact that SCRES strategies produce unexpected adverse outcomes informs managers that SCRES should not be viewed as a static phenomenon; and the capacity to adapt should be built into the system, so it has the flexibility to respond to different manifestations of threats.

Finally, this study is not only of relevance to managers in developing countries but also to global sourcing managers buying from developing countries. Managers in general need to be aware of the context in which their supply chains are embedded if they are to understand the potential threats and the conditions that might render their SCRES strategies ineffective or even counterproductive.

## **6.5. Limitations and Future Research Implications**

It is clear that there will always be trade-offs between breadth and depth in research. This is a case study focusing on a network of related firms in a specific context – thus the potential limitations in generalising results are acknowledged. But the in-depth information that a case study like this provides is important for generalising on theory rather than statistical generalisation, and this is important for theory building, especially on an emerging

phenomenon like SCRES, that was found to be under-explored in a developing country context. Future research could also be undertaken in other developing countries to obtain a more general insight into embedded supply networks and SCRES so as to add more validity to the findings.

Further, all firms in the network studied were manufacturing firms whereas the literature on SCRES reveals that service supply chains are still under-researched. Yet, disruptions in service supply chains can be catastrophic to human life. Further, services such as transport services, banking and finance, insurance, consultancy, telecommunications and healthcare facilitate the manufacturing sector. Thus, future research could look at the resilience of pure service supply chains and of services in manufacturing oriented supply chains to increase understanding of SCRES.

Another limitation of this study is its cross-sectional nature, which limits our understanding, such as of the process of co-evolution in building SCRES. It was found that SCRES involves continuously adapting to chronic threats as well as to the consequences of such adaptations, which depicts resilience as a dynamic process rather than a static attribute of a supply chain. This could also imply that a supply chain's resilience may not be effectively assessed based on a discrete disruptive event – but only based on a series of events over time. Future research could therefore be conducted longitudinally. This would also allow us to understand how resilience is gained or lost over time.

Further, due to continuous adaptations and co-evolution, we expect actors in a supply chain to learn from their experiences. This could mean that SCRES develops over time such that firms encountering a disruption similar to one they have experienced before can respond better than those experiencing it for the first time – a longitudinal study may also be appropriate to further investigate this conjecture. Such a study could, for example, identify vulnerable supply chains and study them several times before and after the occurrence of

successive disruptive events over a long time span to understand the effect on resilience of learning from experience.

Finally, this research identified a phenomenon of threat migration but did not provide depth for example on this process of threat migration. This should be investigated further, for example, by selecting specific threats and investigating how their mitigation transforms into different threats or transfers them to other points in the supply network. This could be through a longitudinal study across a supply network. Although clearly supply chain research shows it is not feasible to study the entire supply chain, it can be argued that a phenomenon like supply chain threat migration can best be understood by analysing a relatively larger fragment of the network across different tiers. Supply chain mapping would be important before such research is undertaken, as it was found in this research that threats and conditions – that produce threats, strategies and outcomes – form a network of causations across different points of the supply chain.

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# APPENDICES

## APPENDIX 1: Interview Guide



Lancaster University  
Management School

### Interview Guide

Name: Benjamin R Tukamuhabwa

Department: Management Science

Supervisors:

Dr. Jerry Busby

Prof. Mark Stevenson

### PART A: General information

#### ❖ *Interviewee information*

- Job Title.....
- Years spent in the position.....
- Years spent with this company.....
- Can you explain your role within this company?
- How does your role link within the supply chain decision-making processes?

#### ❖ *Company information*

- Company name: .....
- Industry sector: .....
- Business starting date: .....
- Number of employees: .....
- Average Turnover for the last two years.....
- Nature of operation (multinational or domestic).....
- If multinational, describe the mode of entry (e.g. Direct, Franchise).....
- Core business process (e.g. manufacture of ....).....
- What is the nature of your products e.g. standard, variety, customised.....
- Your major suppliers (main countries/ regions).....
- Your major customers (main countries/ regions) .....
- Strategic objectives of this company (e.g. cost leadership, differentiation, Focus on particular segment).....

### PART B: Supply Chain Threats, Resilience Strategies and Outcomes

1. Please describe the threats to your supply chains

Hint:

- Supply related threats – originating from suppliers
- Firm level threats – originating from the focal firms but affecting the upstream or downstream
- Customer related threats – originating from the downstream
- External threats – originating from outside the supply chain

2. What strategies do you apply to build resilience against each of the threats you mentioned?

Hint:

- Demand management strategies
- Supply management strategies
- Relationship management strategies
- Information management strategies
- Etc.

3. What are the outcomes of implementing each of the resilience strategies?

Hint: Whether the strategies were successful or had side effects e.g. causing more threats.

General hint: For each threat mentioned, it is probed at depth including the strategies adopted to build resilience against it and the outcomes of the strategies.

**APPENDIX 2: Firms' Responses to Each Supply Chain Threat, SCRES Strategy and Outcome, Identified from the Data**

<i>Categories</i>	<i>Respondent Firms</i>																				<b>Total Firms</b>	
	AU	BU	CU	DU	EU	FU	GU	HU	IU	JU	KU	LU	MU	NU	OU	PU	QU	RU	SU	TU		
<b>Exogenous Threats</b>																						
<i>Geopolitical Threats</i>																						
Political instabilities	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	20	
Geographical location(landlockedness)						×				×		×	×			×				×	6	
National politics		×														×					2	
Government policy		×		×		×		×	×	×			×					×			8	
Weak legal system			×									×								×	3	
Corruption		×	×			×	×	×		×	×	×	×			×				×	11	
Product counterfeiting	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	20	
In-transit raw material theft		×					×				×					×		×			5	
Communication barriers					×			×			×				×		×				5	
Natural disasters						×	×		×								×			×	5	
<i>Economic Threats</i>																						
Informal sector								×								×	×				3	
Unfair competition	×	×	×	×			×	×	×	×	×	×			×	×	×	×		×	15	
Poor transport infrastructure		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×			17	
Unstable taxation				×			×		×	×						×				×	6	
Exchange rate fluctuations		×						×	×	×								×			5	
Power shortages	×	×	×					×	×	×	×	×	×	×				×			11	
<b>Endogenous Threats</b>																						
<i>Supply-Side Threats</i>																						
Power asymmetries related threats (stronger suppliers)					×				×		×		×								4	

Long distance sourcing triggered threats	×	×	×		×	×		×		×	×	×	×	×		×		×	×		14
	AU	BU	CU	DU	EU	FU	GU	HU	IU	JU	KU	LU	MU	NU	OU	PU	QU	RU	SU	TU	
Limited local supply market	×		×		×	×		×	×	×	×	×	×	×		×	×	×	×	×	16
Product counterfeiting			×		×			×													3
Poor quality raw materials		×	×	×	×		×	×	×	×	×	×	×	×	×	×	×	×	×	×	18
Dishonest suppliers		×	×		×				×	×	×	×			×		×	×			10
Raw material delays and shortages	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	20
Financial difficulties of suppliers					×	×		×	×	×	×	×		×		×	×				10
Supplier delivery failure			×		×	×	×	×	×	×	×	×	×	×				×		×	13
Reputational risk																×	×				2
<i>Firm Level Threats</i>																					
Machine breakdowns	×		×	×		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	17
Product characteristics		×	×					×					×				×	×			6
Owner management behaviour			×							×	×	×									4
Dishonest employees	×	×			×		×	×	×	×	×	×		×		×				×	12
Insufficient skilled manpower			×		×		×	×		×	×	×	×	×		×			×		11
Poor internal coordination		×	×				×	×	×	×	×	×		×		×					10
Poor quality products		×		×		×	×	×	×	×	×	×		×	×	×	×	×		×	15
Payment threat (to suppliers/labour)	×	×	×				×	×	×	×	×	×	×	×		×		×			13
Financial difficulties (focal firm)	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×			×		17
Procurement risk		×			×				×	×			×			×					6
Industrial disputes	×						×			×	×	×						×			6
Poor customer delivery performance	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	20
<i>Demand-Side Threats</i>																					
Power asymmetries			×	×	×		×	×		×		×	×	×	×			×			11

related threats (stronger customers)	AU	BU	CU	DU	EU	FU	GU	HU	IU	JU	KU	LU	MU	NU	OU	PU	QU	RU	SU	TU	
Dishonest customers/ distributors		×	×	×		×	×	×	×	×	×	×				×		×	×	×	14
Payment threat (from customers)	×	×	×	×		×	×	×	×	×	×	×	×	×		×		×	×		16
Financial difficulties of customers					×	×				×								×			4
Order cancellations	×	×	×	×		×		×		×		×	×	×	×						11
Demand variations		×	×	×	×	×	×	×		×			×	×	×	×		×		×	14
Customer characteristics		×				×		×						×	×		×			×	7
Reputational risk		×						×			×						×				4
<b>Resilience Strategies</b>																					
<i>Relationship Management</i>																					
Co-opetition								×	×			×				×		×			5
collaboration with government		×			×	×			×	×	×		×		×	×	×	×			11
collaboration with customers	×			×				×			×	×	×	×	×						8
collaboration with suppliers	×	×	×		×				×	×		×	×	×	×	×	×		×	×	14
Informal networking					×			×		×	×					×	×				6
<i>Supply Management</i>																					
Backward integration			×			×	×					×									4
Outsourcing					×			×		×		×						×			5
Appropriate supplier selection		×			×				×	×			×		×	×			×	×	9
Alternative transportation	×											×				×					3
Multiple sourcing		×	×	×	×		×	×	×	×	×	×	×	×	×	×	×	×	×		17
Supplier development					×	×	×		×	×		×	×				×		×	×	10
Maintaining strategic stocks	×	×	×	×	×		×	×	×	×	×	×	×	×		×		×		×	16

Buying instead of making (temporarily)					×	×	×					×						×			5
	AU	BU	CU	DU	EU	FU	GU	HU	IU	JU	KU	LU	MU	NU	OU	PU	QU	RU	SU	TU	
Effective contracting	×	×	×	×	×		×		×	×		×	×		×	×					12
Local sourcing			×	×					×	×	×		×			×		×			8
Order splitting													×			×					2
Enhancing proximity to suppliers												×	×								2
Procurement management	×		×		×				×	×		×	×	×		×				×	10
Quality management		×				×			×				×			×		×			6
Exclusive sourcing	×					×															2
Inter-branch stock transfer	×	×											×								3
<i>Demand Management</i>																					
Creating customer flexibility		×						×		×	×	×		×	×		×	×	×		10
Customer incentives	×			×	×		×	×		×		×			×			×	×		10
Inventory management		×								×			×	×	×		×				6
Product recalls		×		×		×	×	×	×	×	×	×				×	×	×		×	13
Demand forecasting	×			×									×			×					4
<i>Information Management</i>																					
Risk communication	×	×	×	×	×			×	×	×	×	×	×	×	×	×	×		×		16
Market intelligence	×	×					×		×		×	×		×	×	×		×		×	11
Increasing product knowledge		×	×	×							×	×		×	×	×	×	×			10
Improving visibility	×	×	×	×					×	×		×	×							×	9
Using information communication technology		×						×	×	×		×	×								6
<i>Product Management</i>																					
Manufacturing flexibility				×						×			×	×	×	×	×				7
Ensuring product security	×	×		×						×			×			×		×		×	8

<i>Financial Management</i>																					
Borrowing from customers											×										1
	AU	BU	CU	DU	EU	FU	GU	HU	IU	JU	KU	LU	MU	NU	OU	PU	QU	RU	SU	TU	
Effective credit management																×		×			2
Insurance			×		×						×				×	×		×			6
<i>Human resource management</i>																					
Employee training		×			×			×			×	×	×			×			×		8
<b>Outcomes</b>																					
Confidentiality risk												×				×					2
Limited flexibility to switch suppliers	×	×								×						×					4
Poor customer delivery performance										×						×					2
Supplier complacency													×								1
Raw material delays and shortages										×			×							×	3
Financial difficulties (focal firm)	×			×	×	×	×		×	×		×	×			×					10
Stock theft							×	×				×									3
Reputational risk		×						×													2
Poor quality raw materials								×	×	×	×					×			×		6
Product counterfeiting																×					1
Loss of control					×					×											2
Distributor complacency																	×				1
Reduced customer base		×		×																	2
Labour turn-over			×								×	×	×								4

### APPENDIX 3: Number of Firms Identifying the Threats, Strategies & Outcomes

Exogenous Threats	No. of Firms	Endogenous Threats	No. of Firms	Resilience Strategies	No. of Firms	Outcomes	No. of Firms
<b><i>Geopolitical Threats</i></b>		<b><i>Supply-Side Threats</i></b>		<b><i>Relationship Management</i></b>		Confidentiality risk	2
Political instabilities	20	Power asymmetries related threats (stronger suppliers)	4	Co-opetition	5	Limited flexibility to switch suppliers	4
Geographical location(landlockedness)	6	Long distance sourcing triggered threats	14	Collaboration with government	11	Poor customer delivery performance	2
National politics	2	Limited local supply market	16	Collaboration with customers	8	Supplier complacency	1
Government policy	8	Product counterfeiting	3	Collaboration with suppliers	14	Raw material delays and shortages	3
Weak legal system	3	Poor quality raw materials	18	Informal networking	6	Financial difficulties (focal firm)	10
Corruption	11	Dishonest suppliers	10	<b><i>Supply Management</i></b>		Stock theft	3
Product counterfeiting	20	Raw material delays and shortages	20	Backward integration	4	Reputational risk	2
In-transit raw material theft	5	Financial difficulties of suppliers	10	Outsourcing	5	Poor quality raw materials	6
Communication barriers	5	Supplier delivery failure	13	Appropriate supplier selection	9	Product counterfeiting	1
Natural disasters	5	Reputational risk	2	Alternative transportation	3	Loss of control	2
<b><i>Economic Threats</i></b>		<b><i>Firm Level Threats</i></b>		Multiple sourcing	17	Distributor complacency	1
Informal sector	3	Machine breakdowns	17	Supplier development	10	Reduced customer base	2
Unfair competition	15	Product characteristics	6	Maintaining strategic stocks	16	Labour turn-over	4
Poor transport infrastructure	17	Owner management behaviour	4	Buying instead of making (temporarily)	5		
Unstable taxation	6	Dishonest employees	12	Effective contracting	12		
Exchange rate fluctuations	5	Insufficient skilled manpower	11	Local sourcing	8		
Power shortages	11	Poor internal coordination	10	Order splitting	2		
		Poor quality products	15	Enhancing proximity to suppliers	2		
		Payment threat (to suppliers/labour)	13	Procurement management	10		
		Financial difficulties (focal firm)	17	Quality management	6		
		Procurement risk	6	Exclusive sourcing	2		
		Industrial disputes	6	Inter-branch stock transfer	3		
		Poor customer delivery performance	20	<b><i>Demand Management</i></b>			
		<b><i>Demand-Side Threats</i></b>		Creating customer flexibility	10		

		Power asymmetries related threats (stronger customers)	11	Customer incentives	10		
				Inventory management	6		
		Dishonest customers/ distributors	14	Product recalls	13		
		Payment threat (from customers)	16	Demand forecasting	4		
		Financial difficulties of customers	4	<b>Information Management</b>			
		Order cancellations	11	Risk communication	16		
		Demand variations	14	Market intelligence	11		
		Customer characteristics	7	Increasing product knowledge	10		
		Reputational risk	4	Improving visibility	9		
				Using information communication technology	6		
				<b>Product Management</b>			
				Manufacturing flexibility	7		
				Ensuring product security	8		
				<b>Financial Management</b>			
				Borrowing from customers	1		
				Effective credit management	2		
				Insurance	6		
				<b>Human resource management</b>			
				Employee training	8		

**APPENDIX 4: Table Showing Links Into And Out Of the Nodes Forming a Network of Conditions, Threats, Strategies & Outcomes with Corresponding Data Sources (Firms/Interviewees)**

**T – threat/condition, S – strategy, O – outcomes**

	<b>Links into the Node</b>		<b>Links out of the Node</b>	<b>Supply Network Fragment</b>	<b>Data Source (Firms /Interviewees)</b>
T	Long distance sourcing	T	Raw material delays and shortages	Focal firm-Supplier, Focal firm-Customer	AU (MKTG), FU(CMGR), BU(DWMG), CU(PSCO, MKTG), KU(MKTG, GENL), JU(SMKT,PLMO, RMKT), PU(PROM), SU (APRO, FACE), MU(COMP, SCMG), RU (SMGR), LU(PROC), HU(MKTG), NU(INVG),BU(DWMG)
T	Limited local supply market	T	Long distance sourcing	Focal firm-Supplier	SU(FACE, APRO), KU(GENL, MKTG), LU(PROC), CU(MKTG), AU(MKTG), EU(PROM), HU(PROM, MKTG), JU(PLMO, MAND), NU(INVG), MU(SCMG), RU (SMGR)
T	Limited local supply market	S	Effective contracting	Focal firm-Supplier	PU(PROC),
T	Limited local supply market	S	Order splitting	Focal firm-Supplier	PU(PROC),
T	Raw material delays and shortages	S	Order splitting	Focal firm-Supplier	PU(PROM),
T	Financial difficulties (focal firm)	S	Order splitting	Focal firm-Customer	MU(COMP)
T	Long distance sourcing	S	Local sourcing	Focal firm-Supplier	KU (MKTG)
S	Local sourcing	T	Poor quality raw materials	Focal firm-supplier	KU (MKTG), IU(BRMG),JU(SMKT),PU(PROC)
S	Local sourcing	T/O	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	DU (MAOF). PU(PROC)
T	Poor quality raw materials	S	Supplier development	Focal firm-Supplier	TU(CSMG),

T	Raw material delays and shortages	S	Local sourcing	Focal firm-Supplier	DU(MAOF), PU(PROC), RU(LASS), KU(MKTG)
T	Political instabilities	S	Local sourcing	Focal firm-Supplier,	KU(MKTG),JU(PROM),CU(PSCO)
S	Local sourcing			Focal firm-Supplier,	JU(MAND), MU(COMP)
S	Local sourcing	T	Product counterfeiting	Focal firm-Supplier, Focal firm-Customer	PU(PROC)
T	Long distance sourcing	S	Collaboration with suppliers	Focal firm-Supplier	CU(PSCO)
T	Financial difficulties (focal firm)	T	Raw material delays and shortages	Focal firm-Supplier, Focal firm-Customer	KU(GENL), PU(PROC), JU(PLMO),IU(FING)
T	Raw material delays and shortages	S	Maintaining strategic stocks	Focal firm-Supplier	PU(PROC, PROM), AU(MKTG), LU(PROC, ), HU(MKTG), NU(INVG), MU(SCMG), GU(SMAE), JU(SMKT), RU(LASS), IU(FING), TU(CSMG), DU(MAOF)
T	Raw material delays and shortages	S	Enhancing proximity to suppliers	Focal firm-Supplier	LU(ASMG),MU(COMP)
S	Maintaining strategic stocks	T/O	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	PU(PROC), AU(MKTG), MU(SCMG), LU(PROC), GU(SMAE), IU(BRMG), JU(PLMO),EU(PROM) `
T	Political instabilities	S	Maintaining strategic stocks	Focal firm-Supplier	CU(MKTG), BU(SSUP), TU(CSMG)
T	Limited local supply market	T	Raw material delays and shortages	Focal firm-Supplier, Focal firm-Customer	FU(CMGR)
S	Exclusive sourcing	O	Limited flexibility to switch suppliers	Focal firm-Supplier	AU(MKTG),
T	Raw material delays and shortages	S	Exclusive sourcing	Focal firm-Supplier	AU(MKTG),
T	Limited local supply market	S	Exclusive sourcing	Focal firm-Supplier	FU(CMGR)

S	Collaboration with suppliers	O	Limited flexibility to switch suppliers	Focal firm-Supplier Focal firm-Customer	AU(MKTG), JU(TMKG), BU(MERG), PU(BRMG)
O	Limited flexibility to switch suppliers	T	Raw material delays and shortages	Focal firm-Supplier	JU(TMKG),
S	Maintaining strategic stocks	T/O	Stock theft	Focal firm-Customer	HU(MKTG), LU(ASMG, WARG), GU(SMAE)
T	Limited local supply market	S	Collaboration with suppliers	Focal firm-Supplier	PU(PROC), SU(APRO), QU(PROM), IU(BRMG),
T	Raw material delays and shortages	S	Appropriate supplier selection	Focal firm-Supplier	MU(SCMG)
T	Natural disasters	T	Raw material delays and shortages	Focal firm-Supplier	TU(CSMG), GU(SMAE), QU(PROM, PROC),IU(BRMG), FU(CMGR),
T	Natural disasters	S	Maintaining strategic stocks	Focal firm-Supplier	IU(BRMG)
T	Natural disasters	T	Poor quality raw materials	Focal firm-Supplier	IU(BRMG), QU(PROM),
T	Natural disasters	T	Poor customer delivery performance	Focal firm-Supplier, Focal firm-Customer	IU(BRMG),
T	Natural disasters	S	Enhancing proximate to customers	Focal firm-Customer	IU(BRMG),
T	Poor customer delivery performance	S	Enhancing proximate to customers	Focal firm-Customer	AU(MKTG),
T	Limited local supply market	S	Supplier development	Focal firm-Supplier	TU(CSMG), IU(BRMG), FU(CMGR), SU(APRO)
T	Limited local supply market	T	Poor quality raw materials	Focal firm-Supplier	LU(ASMG)
T	Poor quality raw materials	S	Appropriate supplier selection	Focal firm-Supplier	TU(SCMG), SU(APRO, FACE), MU(SCMG, COMP),
T	Limited local supply market	S	Procurement management	Focal firm-Supplier	IU(FING)
T	Raw material delays and	S	Risk	Focal firm-Supplier,	SU(APRO), OU(SMKT), BU(SSUP),

	shortages		communication	Focal firm- Customer	CU(MKTG), QU(PROC), MU(COMP)
T	National politics	S	Risk communication	Focal firm- Supplier, Focal firm- Customer	BU(SMGR)
T	Raw material delays and shortages	S	Collaboration with suppliers	Focal firm- Supplier	OU(SMKT), BU(MERG), AU(MKTG),EU(DEPO), JU(TMKG) MU(COMP),NU(INVG), PU(PROM),QU(PROC)
S	Collaboration with suppliers	T/O	Raw material delays and shortages	Focal firm- Supplier, Focal firm- Customer	JU(PLMO)
T	Raw material delays and shortages	S	Creating customer flexibility	Focal firm- Supplier, Focal firm- Customer	RU (SMGR), SU(APRO), QU(PROC), JU(PROM), OU(SMKT),
T	Power shortages	S	Creating customer flexibility	Focal firm- Customer	NU(INVG)
T	Supplier delivery failure	S	Creating customer flexibility	Focal firm- Supplier, Focal firm- Customer	RU (SMGR)
T	Supplier delivery failure	S	Improving visibility	Focal firm- Supplier	CU(PSCO),
T	Raw material delays and shortages	T	Poor customer delivery performance	Focal firm- Customer	KU(GENL, MKTG), LU(ASMG), HU(MKTG), MU(SCMG),NU(MKTG),JU(PLMO, SMKT), BU(SSUP,DWMG),DU(MAOF), IU(FING), RU(LASS), PU(PROC)
T	Financial difficulties (focal firm)	T	Poor customer delivery performance	Focal firm- Customer	CU(PSCO), LU(ASMG),BU(SMGR), SU(FACE)
T	Poor customer delivery performance	T	Reduced customer base	Focal firm- Customer	KU(GENL), LU(ASMG), BU(SSUP)
S	Collaboration with suppliers	T	Poor customer delivery performance	Focal firm- Supplier, Focal firm- Customer	JU(PLMO)
S	Insurance	T	Poor customer delivery	Focal firm- Supplier,	PU(PROC)

			performance	Focal firm- Customer	
T	Raw material delays and shortages	S	Co-opetition	Focal firm- Supplier, Focal firm- Customer	LU(ASMG), PU(PROM), RU(LASS)
T	Machine breakdowns	S	Co-opetition	Focal firm- Customer	LU(ASMG, ASDG)
T	Unfair competition	S	Co-opetition	Focal firm- Supplier	IU(FING)
S	Co-opetition	O	Confidentiality risk	Focal firm- Supplier, Focal firm- Customer	PU(BRMG)
S	Collaboration with suppliers	O	Confidentiality risk	Focal firm- Supplier, Focal firm- Customer	PU(BRMG)
S	Collaboration with suppliers	O	Supplier complacency	Focal firm- Supplier, Focal firm- Customer	MU(COMP)
T	Dishonest customers/distribu tors	S	Co-opetition	Focal firm- Customer	LU(ASMG)
T	Dishonest customers/distribu tors	S	Improving visibility	Focal firm- Customer	DU(MAOF), JU(PROM)
T	Government policy	S	Co-opetition	Focal firm- Supplier	IU(BRMG)
T	Government policy	S	Demand forecasting	Focal firm- Customer	MU(COMP)
T	Government policy	T	Raw material delays and shortages	Focal firm- Supplier, Focal firm- Customer	DU(MAOF), FU(CMGR), MU(COMP)
T	Government policy	T	Informal sector	Focal firm- Supplier, Focal firm- Customer	HU(POMG)
T	Informal sector	T	Product counterfeiting	Focal firm- Supplier,	HU(POMG)

				Focal firm- Customer	
T	National politics	T	Informal sector	Focal firm- Supplier, Focal firm- Customer	PU(PROM)
T	Informal sector	T	Financial difficulties (focal firm)	Focal firm- Supplier, Focal firm- Customer	PU(PROM)
T	Informal sector	T	Unfair competition	Focal firm- Customer	QU(PROM)
T	Informal sector	T	Reduced customer base	Focal firm- Customer	QU(PROM)
T	Informal sector	T	Raw material delays and shortages	Focal firm- Supplier	QU(PROM)
T	Informal sector	S	Collaboration with government	Focal firm- Supplier, Focal firm- Customer	QU(PROM)
T	Dishonest suppliers	O	Confidentiality risk	Focal firm- Supplier	IU(FING), LU(ASMG)
T	Poor quality products	S	Co-opetition	Focal firm- Supplier	HU(POMG)
T	Procurement risk	T	Raw material delays and shortages	Focal firm- Supplier	BU(DWMG), IU(BRMG), MU(COMP), JU(PLMO),
T	Procurement risk	S	Maintaining strategic stocks	Focal firm- Supplier Focal firm- Customer	PU(PROC)
T	Procurement risk	T	Poor quality raw materials	Focal firm- Supplier	BU(DWMG), JU(PLMO, RMKT)
T	Procurement risk			Focal firm- Supplier	EU(PROM),
T	Procurement risk	S	Local sourcing	Focal firm- Supplier	MU(COMP),
T	Owner management behaviour	T	Procurement risk	Focal firm- Supplier	JU(PROM, RMKT, PLMO, RESG)

T	Owner management behaviour	T	Poor quality raw materials	Focal firm-Supplier, Focal firm-Customer	JU(RESG)
T	Raw material delays and shortages	S	Inventory management	Focal firm-Supplier	BU(DWVG), JU(PLMO), MU(COMP), OU(SMKT), QU(PROC)
T	Financial difficulties (focal firm)	S	Inventory management	Focal firm-Supplier, Focal firm-Customer	NU(INVG), OU(SMKT)
T	Owner management behaviour	T	Payment threat (to suppliers/labour)	Focal firm-Supplier	JU(PLMO)
T	Owner management behaviour	T	Poor customer delivery performance	Focal firm-Customer	CU(PSCO)
T	Poor internal coordination	T	Procurement risk	Focal firm-Supplier, Focal firm-Customer	JU(PROM, PLMO)
T	Financial difficulties (focal firm)	S	Effective contracting	Focal firm-Supplier, Focal firm-Customer	JU(PLMO), MU(COMP),
S	Effective contracting	S	Order splitting	Focal firm-Supplier, Focal firm-Customer	PU(PROM), MU(COMP),
T	Reputational risk	S	Effective contracting	Focal firm-Supplier, Focal firm-Customer	PU(PROC)
T	Poor internal coordination	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	CU(PSCO), KU(GENL), JU(PROM, TMKG)
T	Poor internal coordination	T	Payment threat (to suppliers/labour)	Focal firm-Supplier, Focal firm-Customer	CU(PSCO)
T	Owner management	T	Poor internal coordination	Focal firm-Supplier, Focal firm-	CU(PSCO), LU(ASMG)

	behaviour			Customer	
T	Insufficient skilled manpower	T	Poor internal coordination	Focal firm-Customer	GU(SMAE)
T	Poor internal coordination	T	Reduced customer base	Focal firm-Customer	CU(PSCO)
T	Poor internal coordination	T	Poor customer delivery performance	Focal firm-Customer	HU(MKTG), JU(PROM, TMKG), NU(INVG)
T	Poor internal coordination	T	Raw material delays and shortages	Focal firm-Supplier	JU(PROM)
T	Poor internal coordination	T	Communication barriers	Focal firm-Supplier	PU(PROC, BRMG)
T	Poor internal coordination	S	Using Information Communication Technology	Focal firm-Supplier, Focal firm-Customer	BU(EXMG), IU(BRMG), LU(WARG)
T	Reputational risk	S	Using Information Communication Technology	Focal firm-Supplier, Focal firm-Customer	HU(MKTG)
T	Raw material delays and shortages	S	Using Information Communication Technology	Focal firm-Supplier	IU(BRMG), MU(COMP),
S	Appropriate supplier selection	S	Using Information Communication Technology	Focal firm-Supplier	JU(PLMO)
S	Using Information Communication Technology	S	Improving visibility	Focal firm-Supplier, Focal firm-Customer	LU(WARG), MU(COMP),
T	Procurement risk	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	JU(PROM, PLMO)
T	Power asymmetries (stronger suppliers)	S	Procurement management	Focal firm-Supplier	MU(COMP),
T	Power asymmetries (stronger)	S	Effective contracting	Focal firm-Supplier	IU(BRMG)

	suppliers)				
T	Power asymmetries (stronger customers)	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	CU(MKTG),
T	Power asymmetries (stronger customers)	S	Effective contracting	Focal firm-Customer	DU(MAOF),OU(SMKT), GU(SMAE)
T	Power asymmetries (stronger customers)	S	Collaboration with customers	Focal firm-Customer	LU(ASDG)
T	Power asymmetries (stronger customers)	T	Payment threat (from customers)	Focal firm-Customer	HU(MKTG), JU(TMKG), LU(ASMG), MU(COMP), NU(INVG), RU(SMGR)
T	Payment threat (from customers)	S	Effective contracting	Focal firm-Customer	AU(MKTG), LU(ASMG)
T	Payment threat (from customers)	S	Improving visibility	Focal firm-Customer	AU(MKTG), DU(MAOF)
T	Raw material delays and shortages	S	Improving visibility	Focal firm-Supplier	IU(BRMG), MU(COMP),
S	Collaboration with customers	S	Improving visibility	Focal firm-Customer	AU(MKTG),
T	Poor quality raw materials	S	Improving visibility	Focal firm-Supplier	LU(PROC),SU(FACE)
S	Demand variations	S	Improving visibility	Focal firm-Customer	AU(MKTG),
T	Supplier delivery failure	S	Effective contracting	Focal firm-Supplier	EU(DEPO),
T	Power asymmetries (stronger customers)			Focal firm-Customer	DU(MAOF), GU(SMAE), JU(TMKG), NU(INVG), EU(DEPO), MU(COMP), RU(SMGR)
T	Power asymmetries (stronger customers)	S	Customer incentives	Focal firm-Customer	LU(ASDG),OU(SMKT), HU(MKTG),
S	Procurement	T/O	Raw material delays and	Focal firm-	JU(PLMO), MU(COMP), TU(CSMG),

	management		shortages	Supplier	
S	Procurement management			Focal firm-Supplier	CU(MKTG), NU(INVG), PU(PROC,PROM), AU(MKTG), LU(PROC), EU(PROM)
T	Power asymmetries (stronger suppliers)	T	Raw material delays and shortages	Focal firm-Supplier	EU(PROM, DEPO), MU(COMP), KU(MKTG),
T	Raw material delays and shortages	S	Buying instead of making	Focal firm-Supplier, Focal firm-Customer	FU(CMGR), GU(SMAE), RU(LASS), LU(ASMG)
T	Financial difficulties of suppliers	T	Raw material delays and shortages	Focal firm-Supplier	HU(MKTG), KU(MKTG), JU(PROM)
T	Raw material delays and shortages	S	Supplier development	Focal firm-Supplier	FU(CMGR), GU(SMAE), JU(PLMO)
T	Government policy	S	Supplier development	Focal firm-Supplier	IU(BRMG)
T	Unfair competition	S	Supplier development	Focal firm-Supplier	LU(PROC)
S	Supplier development			Focal firm-Supplier	JU(RESG), MU(SCMG)
T	Financial difficulties of suppliers	S	Supplier development	Focal firm-Supplier	FU(CMGR),QU(PROC),IU(FING), EU(PROM), TU(CSMG),
T	Financial difficulties of suppliers	S	Supplier delivery failure	Focal firm-Supplier, Focal firm-Customer.	EU(PROM), NU(INVG), HU(MKTG),LU(PROC,ASMG), EU(DEPO)
T	Supplier delivery failure	S	Insurance	Focal firm-Supplier	EU(PROM),
T	Financial difficulties of suppliers	S	Multiple sourcing	Focal firm-Supplier	PU(PROM)
T	Financial difficulties of suppliers	S	Maintaining strategic stocks	Focal firm-Supplier, Focal firm-Customer.	KU(GENL)
T	Demand	T	Financial difficulties (focal	Focal firm-Supplier,	BU(SSUP)

	variations		firm)	Focal firm- Customer	
T	Demand variations	S	Maintaining strategic stocks		EU(PROM), GU(SMAE), RU(SMGR),
T	Demand variations	S	Risk communication	Focal firm- Supplier, Focal firm- Customer	HU(POMG), JU(PLMO), AU(MKTG)
T	Unstable taxation	S	Risk communication	Focal firm- Supplier, Focal firm- Customer	JU(PROM)
T	Demand variations	S	Demand forecasting	Focal firm- Customer	DU(MAOF), PU(PROC), AU(MKTG)
S	Order splitting	S	Demand forecasting	Focal firm- Customer	PU(PROM)
T	Demand variations	S	Multiple sourcing	Focal firm- Supplier, Focal firm- Customer	JU(PROM)
T	Demand variations	S	Manufacturing flexibility	Focal firm- Customer	NU(INVG), PU(PROC), OU(SMKT)
T	Raw material delays and shortages	S	Manufacturing flexibility	Focal firm- Supplier, Focal firm- Customer	JU(MAND)
T	Poor quality products	S	Creating customer flexibility	Focal firm- Customer	BU(MERG),LU(WARG)
T	Demand variations	S	Creating customer flexibility	Focal firm- Customer	HU(POMG), RU(SMGR),
T	Demand variations	T	Poor customer delivery performance	Focal firm- Customer	TU(CSMG), FU(CMGR), GU(SMAE), EU(DEPO), JU(PROM), PU(PROM)
T	Poor customer delivery performance	S	Creating customer flexibility	Focal firm- Customer	BU(SSUP), KU(MKTG), OU(SMKT),
T	Poor customer delivery performance	S	Risk communication	Focal firm- Customer	LU(WARG), JU(PLMO)
T	Government policy	T	Demand variations	Focal firm- Customer	MU(COMP)

T	Government policy	T	Order cancellations	Focal firm-Customer	MU(COMP)
T	Demand variations	S	Buying instead of making	Focal firm-Supplier, Focal firm-Customer	GU(SMAE), EU(DEPO)
T	Financial difficulties of customers			Focal firm-Customer	EU(DEPO)
T	Financial difficulties of suppliers			Focal firm-Supplier	IU(FING)
T	Financial difficulties of customers	T	Payment threat (from customers)	Focal firm-Customer	RU(SMGR),JU(PROM)
T	Payment threat (from customers)	S	Effective credit management	Focal firm-Customer	GU(SMAE), BU(MERG), DU(MAOF), BU(SSUP) ,HU(MKTG), IU(FING), PU(PROC)
S	Collaboration with customers	S	Borrowing from customers	Focal firm-Customer	KU(MKTG),
S	Collaboration with customers	S	Increasing product knowledge	Focal firm-Customer	OU(SMKT)
T	Financial difficulties (focal firm)	S	Collaboration with customers	Focal firm-Customer	MU(COMP),
T	Dishonest customers/distributors	T	Payment threat (from customers)	Focal firm-Customer, Focal firm-Customer	KU(MKTG), CU(PSCO), PU(PROM),GU(SMAE), BU(MERG) LU(ASMG),FU(CMGR), DU(MAOF),RU(SMGR)
T	Dishonest customers/distributors	S	Customer incentives	Focal firm-Customer	JU(TMKG)
T	Payment threat (from customers)	T	Payment threat (to suppliers/labour)	Focal firm-Customer, Focal firm-Customer	LU(ASMG)
T	Dishonest customers/distributors	T	Poor customer delivery performance	Focal firm-Customer	HU(MKTG),
T	Dishonest customers/distributors	T	Reduced customer base	Focal firm-Customer	TU(CSMG), JU(PROM)

T	Dishonest customers/distributors			Focal firm-Customer	JU(PLMO), SU(FACE)
T	Dishonest customers/distributors	T	Unfair competition	Focal firm-Customer	JU(MKTG),
T	Dishonest customers/distributors	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	IU(BRMG), KU(MKTG),
T	Financial difficulties (focal firm)	T	Payment threat (to suppliers/labour)	Focal firm-Supplier, Focal firm-Customer	BU(EXMG), PU(PROC),MU(COMP),LU(ASMG), JU(MAND, PROM, PLMO),CU(PSCO), KU(MKTG), NU(INVG),
T	Payment threat (to suppliers/labour)	T	Industrial disputes	Focal firm-Supplier, Focal firm-Customer	RU(SMGR), KU(MKTG), LU(ASMG), RU(LASS),AU(MKTG),GU(SMAE), JU(PROM)
T	Industrial disputes	T	Reputational risk	Focal firm-Supplier, Focal firm-Customer	KU(MKTG),
T	Industrial disputes	T	Poor customer delivery performance	Focal firm-Customer	RU(SMGR), GU(SMAE)
T	Industrial disputes	T	Reduced customer base	Focal firm-Customer	KU(MKTG),
T	Payment threat (to suppliers/labour)	T	Poor customer delivery performance	Focal firm-Supplier, Focal firm-Customer	HU(POMG),JU(PLMO, PROM, TMKG), LU(ASMG),
T	Payment threat (to suppliers/labour)	T	Financial difficulties of suppliers	Focal firm-Supplier, Focal firm-Customer	IU(FING),JU(TMKG)
T	Payment threat (to suppliers/labour)	T	Poor quality products	Focal firm-Supplier, Focal firm-Customer	JU(PROM)
T	Poor quality products	S	Effective contracting	Focal firm-Customer	DU(MAOF)
T	Payment threat (to suppliers/labour)	T	Raw material delays and	Focal firm-Supplier	JU(PROM, TMKG), KU(MKTG), PU(PROC), CU(MKTG)

			shortages		
S	Effective credit management	T/O	Reduced customer base	Focal firm-Customer	BU(MERG,EXMG), DU(MAOF), BU(SSUP)
S	Effective credit management	T	Reputational risk	Focal firm-Customer	BU(MERG,EXMG)
S	Effective credit management			Focal firm-Customer	KU(MKTG), BU(MERG,EXMG),JU(PROM), PU(PROC,PROM),MU(SCMG),NU(INVG), RU(LASS)
T	Payment threat (to suppliers/labour)	T	Dishonest employees	Focal firm-Customer	JU(PROM,RESG)
T	Payment threat (to suppliers/labour)	S	Informal networking	Focal firm-Supplier	JU(PLMO)
S	Collaboration with suppliers	S	Improving visibility	Focal firm-Supplier	AU(MKTG)
S	Informal networking			Focal firm-Supplier	EU(DEPO),QU(PROM)
S	Informal networking	S	Co-opetition	Focal firm-Supplier	PU(PROM)
T	Communication barriers	S	Informal networking	Focal firm-Supplier	HU(POMG)
T	Communication barriers	T	Raw material delays and shortages	Focal firm-Customer	PU(PROC), KU(MKTG),
T	Communication barriers	T	Poor quality raw materials	Focal firm-Supplier	PU(PROC), HU(POMG, MKTG), EU(PROM)
T	Communication barriers	S	Risk communication	Focal firm-Supplier, Focal firm-Customer	NU(INVG)
T	Financial difficulties (focal firm)	S	Informal networking	Focal firm-Supplier, Focal firm-Customer	KU(MKTG)
T	Dishonest employees	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	BU(EXMG), KU(MKTG), JU(PROM, MAND), PU(PROM)
T	Dishonest employees	T	Stock theft	Focal firm-Customer	LU(ASMG, WARG), IU(BRMG),HU(MKTG), BU(SSUP),

					DWMG),AU(MKTG)
T	Stock theft	T	Poor customer delivery performance	Focal firm-Customer	HU(MKTG)
T	Stock theft	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	HU(MKTG)
T	Dishonest employees	T	Poor customer delivery performance	Focal firm-Customer	NU(INVG)
T	Dishonest employees			Focal firm-Customer	TU(CSMG)
T	Dishonest employees	T	Machine breakdowns	Focal firm-Supplier, Focal firm-Customer	JU(PROM)
T	Dishonest employees	T	Poor quality products	Focal firm-Customer	JU(PROM, RESG), BU(SMGR),
T	Poor quality products	S	Customer incentives	Focal firm-Customer	DU(MAOF)
T	Dishonest employees	T	Reduced customer base	Focal firm-Customer	HU(MKTG), BU(EXMG),
T	Reduced customer base	S	Customer incentives	Focal firm-Customer	AU(MKTG), GU(SMAE), RU(SMGR), SU(FACE),
T	Financial difficulties (focal firm)	S	Customer incentives	Focal firm-Customer	EU(DEPO)
T	Power shortages	T	Poor quality products	Focal firm-Customer	JU(PLMO)
T	Machine breakdowns	T	Poor customer delivery performance	Focal firm-Customer	JU(PROM), HU(MKTG), DU(MAOF),
T	Machine breakdowns	T	Poor quality products	Focal firm-Customer	JU(PROM),HU(POMG), LU(ASMG),
T	Machine breakdowns			Focal firm-Customer	PU(PROC), SU(APRO), CU(MKTG), QU(PROM), IU(BRMG),OU(SMKT)
T	Machine breakdowns	T	Reduced customer base	Focal firm-Customer	SU(FACE), LU(ASMG)

T	Payment threat (to suppliers/labour)	T	Machine breakdowns	Focal firm-Customer	JU(PROM)
T	Machine breakdowns	S	Maintaining strategic stocks	Focal firm-Supplier, Focal firm-Customer	PU(BRMG), HU(MKTG), AU(MKTG), GU(SMAE), NU(INVG), MU(SCMG), IU(FING), RU(LASS)
T	Machine breakdowns	T	Order cancellations	Focal firm-Customer	LU(ASMG)
T	Order cancellations	T	Reduced customer base	Focal firm-Customer	LU(ASMG), DU(MAOF),
T	Order cancellations	S	Effective contracting	Focal firm-Customer	CU(PSCO)
T	Order cancellations			Focal firm-Customer	PU(PROC),
T	Financial difficulties of customers	T	Order cancellations	Focal firm-Customer	FU(CMGR),
T	Machine breakdowns	S	Order splitting	Focal firm-Customer	LU(ASMG) ), NU(INVG),
T	Machine breakdowns	S	Manufacturing flexibility	Focal firm-Customer	DU(MAOF), MU(SCMG,COMP), JU(MAND)
T	Power shortages	S	Risk communication	Focal firm-Customer	CU(MKTG),
T	Machine breakdowns	S	Risk communication	Focal firm-Customer	DU(MAOF), HU(POMG),LU(ASDG)
T	Machine breakdowns	S	Collaboration with customers	Focal firm-Customer	DU(MAOF),
T	Order cancellations	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	JU(PROM, TMKG)
T	Order cancellations	T	Payment threat (to suppliers/labour)	Focal firm-Customer, Focal firm-Customer	AU(MKTG)
T	Payment threat (to suppliers/labour)	S	Risk communication	Focal firm-Supplier,	JU(PLMO), KU(MKTG)
T	Industrial disputes	T	Machine breakdowns	Focal firm-Supplier, Focal firm-	GU(SMAE)

				Customer	
T	Insufficient skilled manpower	S	Manufacturing flexibility	Focal firm-Customer	PU(PROC),
T	Insufficient skilled manpower	T	Machine breakdowns	Focal firm-Supplier, Focal firm-Customer	KU(MKTG),JU(PROM),
T	Insufficient skilled manpower	S	Employee training	Focal firm-Customer	KU(MKTG),EU(DEPO), HU(POMG), PU(PROC),LU(ASMG), SU(FACE),MU(SCMG), CU(MKTG)
S	Employee training			Focal firm-Customer	BU(SMKT)
T	Insufficient skilled manpower	T	Reduced customer base	Focal firm-Customer	EU(DEPO), NU(INVG)
T	Insufficient skilled manpower	T	Poor quality products	Focal firm-Customer	KU(MKTG)
S	Employee training	O	Labour turnover	Focal firm-Customer	LU(ASMG), KU(MKTG), MU(SCMG), CU(MKTG)
T	Power shortages	T	Machine breakdowns	Focal firm-Supplier, Focal firm-Customer	JU(PROM)
T	Power shortages	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	AU(MKTG),
T	Power shortages			Focal firm-Customer	LU(PROC), MU(COMP), RU(SMGR), HU(POMG),IU(BRMG), KU(MKTG)
T	Power shortages	T	Poor customer delivery performance	Focal firm-Customer	BU(EXMG), CU(MKTG),
T	Financial difficulties (focal firm)	T	Machine breakdowns	Focal firm-Supplier, Focal firm-Customer	JU(RESG)
T	Dishonest suppliers	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	BU(EXMG)
T	Dishonest suppliers	S	Appropriate supplier selection	Focal firm-Supplier	OU(SMKT),BU(SSUP), IU(BRMG),

T	Dishonest suppliers	T	Raw material delays and shortages	Focal firm-Customer, Focal firm-Supplier	JU(PROM,SMKT,TMKG), IU(BRMG), LU(ASMG), QU(PROM)
T	Dishonest suppliers	T	Poor quality raw materials	Focal firm-Supplier,	RU(LASS), EU(PROM).JU(PLMO,PROM), IU(BRMG),BU(DWVG), QU(PROM)
T	Dishonest suppliers	S	Multiple sourcing	Focal firm-Supplier	IU(BRMG), QU(PROM), RU(LASS),
T	Payment threat (to suppliers/labour)	S	Multiple sourcing	Focal firm-Supplier	CU(MKTG)
T	Payment threat (to suppliers/labour)	S	Collaboration with suppliers	Focal firm-Supplier	JU(PLMO),
S	Collaboration with suppliers			Focal firm-Supplier	CU(MKTG), BU(EXMG)
T	Raw material delays and shortages	T	Reduced customer base	Focal firm-Customer, Focal firm-Supplier	JU(PROM), BU(EXMG,MERG), KU(MKTG),
T	Dishonest suppliers	T	Product counterfeiting	Focal firm-Supplier	EU(PROM)
T	Dishonest suppliers	T	Unfair competition	Focal firm-Customer, Focal firm-Supplier	LU(ASMG, PROC), CU(MKTG), JU(PROM, SMKT, TMKT, PLMO), IU(BRMG)
T	Unfair competition	S	Collaboration with suppliers	Focal firm-Supplier	LU(PROC)
T	Financial difficulties (focal firm)	S	Collaboration with suppliers	Focal firm-Supplier	JU(PLMO), NU(INVG)
T	Unfair competition			Focal firm-Customer	JU(MAND), AU(MKTG), DU(MAOF), OU(SMKT), HU(MKTG)
T	Unfair competition	T	Raw material delays and shortages	Focal firm-Supplier	JU(TMKT), IU(BRMG), TU(CSMG)
T	Unfair competition	T	Poor customer delivery performance	Focal firm-Customer	JU(SMKT),
T	Unfair competition	T	Reduced customer base	Focal firm-Customer	JU(PLMO)

T	Corruption	T	Reduced customer base	Focal firm-Customer	HU(MKTG)
T	Unfair competition	T	Reputational risk	Focal firm-Supplier, Focal firm-Customer	CU(MKTG)
T	Unfair competition	S	Collaboration with government	Focal firm-Customer	PU(PROM)
T	Raw material delays and shortages	S	Collaboration with government	Focal firm-Supplier,	FU(CMGR)
T	Unfair competition	S	Increasing product knowledge	Focal firm-Customer	RU(SMGR),
T	Government policy	T	Unfair competition	Focal firm-Customer	BU(EXMG, MERG),
T	Unfair competition	S	Market intelligence	Focal firm-Customer	RU(LASS),
T	Product counterfeiting	T	Reputational risk		BU(SSUP), PU(PROM)
T	Political instabilities	T	Reputational risk	Focal firm-Supplier	PU(PROC),
T	Corruption	T	Reputational risk	Focal firm-Supplier	PU(PROC),
T	Dishonest suppliers	T	Supplier delivery failure	Focal firm-Supplier,	LU(PROC, ASMG), IU(BRMG), KU(MKTG)
T	Dishonest suppliers	T	Reduced customer base	Focal firm-Supplier, Focal firm-Customer	BU(EXMG)
T	Supplier delivery failure	S	Multiple sourcing	Focal firm-Supplier	HU(MKTG), JU(PLMO), MU(SCMG), GU(SMAE), NU(INVG, MKTG), EU(DEPO)
T	Supplier delivery failure	S	Backward integration	Focal firm-Supplier	GU(SMAE), FU(CMGR)
T	Supplier delivery failure	T	Reduced customer base	Focal firm-Supplier, Focal firm-Customer	RU(SMGR),
T	Supplier delivery failure	S	Appropriate supplier selection	Focal firm-Supplier	PU(PROC), EU(PROM), MU(SCMG), TU(CSMG),

T	Supplier delivery failure	S	Risk communication	Focal firm-Supplier, Focal firm-Customer	KU(GENL)
T	Poor quality raw materials	S	Multiple sourcing	Focal firm-Customer, Focal firm-Supplier	RU(LASS), LU(ASMG), JU(PLMO), NU(INVG),
T	Multiple sourcing			Focal firm-Supplier	OU(SMKT)
T	Raw material delays and shortages	S	Multiple sourcing	Focal firm-Customer	DU(MAOF), KU(MKTG),QU(PROM),HU(POMG)
T	Limited local supply market	S	Multiple sourcing	Focal firm-Supplier	KU(MKTG), PU(PROC),SU(FACE)
T	Owner management behaviour	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	CU(PSCO), JU(PLMO), KU(GENL)
T	Exchange rate fluctuations	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	JU(PROM), HU(MKTG)
T	Exchange rate fluctuations	T	Raw material delays and shortages	Focal firm-Customer	IU(BRMG), RU(SMGR), JU(PROM)
T	Raw material delays and shortages	S	Effective contracting	Focal firm-Customer	BU(SMGR), PU(PROM),
T	Exchange rate fluctuations	T	Reduced customer base	Focal firm-Customer	BU(EXMG)
T	Poor quality products	S	Quality management	Focal firm-Supplier, Focal firm-Customer	PU(PROC), IU(BRMG),BU(SMGR)
S	Quality management			Focal firm-Supplier	RU(LASS), FU(CMGR),
S	Quality management	T/O	Raw material delays and shortages	Focal firm-Supplier	MU(COMP)
T	Poor quality products	S	Risk communication	Focal firm-Customer	PU(BRMG, PROC) ,LU(ASMG, PROC), KU(MKTG), NU(INVG), HU(POMG),

					DU(MAOF), IU(BRMG),
T	Poor quality raw materials	S	Risk communication	Focal firm-Supplier, Focal firm-Customer	DU(MAOF),BU(SSUP), IU(BRMG)
T	Poor quality raw materials	S	Collaboration with suppliers	Focal firm-Supplier	TU(CSMG), JU(PLMO),
T	Poor quality products	S	Product recalls	Focal firm-Customer	FU(CMGR), TU(SCMG), JU(PLMO), RU(SMGR), LU(ASMG, PROC), KU(MKTG), GU(SMAE), HU(POMG),DU(MAOF) QU(PROC),IU(BRMG), PU(PROC), BU(EXMG)
T	Product recalls	O	Distributor complacency	Focal firm-Customer	QU(PROC)
T	Distributor complacency	T	Poor quality products	Focal firm-Customer	QU(PROC)
T	Product recalls	T/O	Reputational risk	Focal firm-Customer	HU(POMG)
T	Poor quality products			Focal firm-Customer	RU(LASS)
T	Poor quality products	T	Reduced customer base	Focal firm-Customer	GU(SMAE), IU(FING),
T	Poor quality raw materials	T	Poor quality products	Focal firm-Customer, Focal firm-Supplier	TU(CSMG), JU(PLMO),LU(ASMG), HU(POMG), GU(SMAE) IU(FING), DU(MAOF),KU(MKTG)
T	Poor quality raw materials			Focal firm-Supplier,	BU(DWMG),NU(INVG)
T	Poor quality products	T	Reputational risk	Focal firm-Customer	HU(POMG),)
T	Poor transport infrastructure	T	Poor quality raw materials	Focal firm-Supplier	QU(PROM, PROC),OU(SMKT), DU(MAOF),
T	Corruption	T	Product counterfeiting	Focal firm-Customer	LU(ASMG), TU(CSMG) BU(EXMG)
T	Product counterfeiting	S	Increasing product knowledge	Focal firm-Supplier, Focal firm-Customer	LU(ASMG), OU(SMKT), PU(PROM), BU(SMGR), KU(MKTG), RU(SMGR), DU(MAOF),
S	Increasing product			Focal firm-	OU(SMKT), BU(SSUP), NU(INVG)

	knowledge			Customer	
T	Demand variations	S	Increasing product knowledge	Focal firm-Customer	CU(PSCO)
T	Demand variations	S	Market intelligence	Focal firm-Customer	OU(SMKT)
T	Demand variations	S	Collaboration with customers	Focal firm-Customer	HU(POMG),
S	Collaboration with customers	S	Creating customer flexibility	Focal firm-Customer	HU(POMG), NU(INVG)
T	Raw material delays and shortages	T	Demand variations	Focal firm-Supplier, Focal firm-Customer	BU(SMGR),
T	Reputational risk	S	Increasing product knowledge	Focal firm-Customer	QU(PROC)
T	Poor quality products	S	Increasing product knowledge	Focal firm-Customer	OU(SMKT),
T	Product counterfeiting	T	Poor quality raw materials	Focal firm-Supplier	EU(PROM)
T	Government policy	T	Product counterfeiting	Focal firm-Customer	HU(POMG, MKTG)
T	Product counterfeiting			Focal firm-Customer	RU(LASS), MU(SCMG)
T	Customer characteristics	T	Product counterfeiting	Focal firm-Customer	OU(SMKT), BU(SMGR)
T	Customer characteristics	S	Demand variations	Focal firm-Customer	FU(CMGR)
T	Customer characteristics	T	Reduced customer base	Focal firm-Customer	NU(INVG), TU(CSMG)
T	Customer characteristics	T	Poor customer delivery performance	Focal firm-Customer	QU(PROC)
T	Customer characteristics	T	Order cancellations	Focal firm-Customer	BU(SSUP), HU(MKTG),NU(MKTG)
T	Product counterfeiting	S	Ensuring product security	Focal firm-Supplier, Focal firm-Customer	DU(MAOF),BU(SSUP), TU(CSMG), MU(COMP), RU(LASS), PU(PROM)
T	Dishonest	S	Ensuring product	Focal firm-	AU(MKTG)

	employees		security	Supplier, Focal firm- Customer	
T	Unfair competition	S	Ensuring product security	Focal firm- Supplier, Focal firm- Customer	JU(SMKT)
T	Product counterfeiting	S	Collaboration with government	Focal firm- Customer	OU(SMKT), BU(EXMG), KU(MKTG),
T	Product counterfeiting	S	Market intelligence	Focal firm- Customer	OU(SMKT), IU(BRMG), NU(MKTG), PU(PROM), AU(MKTG) BU(SMGR), TU(CSMG), GU(SMAE), KU(MKTG), LU(PROC),
T	Product counterfeiting	S	Multiple sourcing	Focal firm- Supplier	BU(SSUP)
T	Weak legal system	T	Product counterfeiting	Focal firm- Supplier, Focal firm- Customer	CU(PSCO),TU(CSMG)
T	Product counterfeiting	S	Risk communication	Focal firm- Customer, Focal firm- Supplier	CU(MKTG), KU(MKTG), OU(SKMT), EU(DEPO)
T	Product counterfeiting	S	Appropriate supplier selection	Focal firm- Supplier	SU(APRO), BU(SSUP)
T	Poor quality products	S	Appropriate supplier selection	Focal firm- Supplier, Focal firm- Customer	TU(CSMG),
T	Product counterfeiting	S	Product recalls	Focal firm- Supplier, Focal firm- Customer	PU(PROC)
T	Product counterfeiting	S	Reduced customer base	Focal firm- Customer	KU(MKTG)
T	Poor quality raw materials	S	Backward integration	Focal firm- Supplier	LU(ASMG)
T	Limited local supply market	S	Backward integration	Focal firm- Supplier	LU(ASMG)
T	Raw material delays and shortages	S	Backward integration	Focal firm- Supplier	CU(PSCO)

T	Raw material delays and shortages	S	Alternative transportation	Focal firm-Supplier,	AU(MKTG), PU(PROM)
T	Machine breakdowns	S	Alternative transportation	Focal firm-Supplier, Focal firm-Customer	LU(PROC)
T	Corruption	T	Unfair competition	Focal firm-Customer	GU(SMAE), BU(DWMG, EXMG, MERG), KU(MKTG), GENL),PU(PROM) JU(PLMO)
T	Corruption	S	Collaboration with government	Focal firm-Supplier, Focal firm-Customer	PU(PROM)
T	Payment threat (from customers)	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	BU(SSUP, EXMG), HU(MKTG),SU(FACE)
T	Payment threat (from customers)	S	Collaboration with government	Focal firm-Customer	MU(SCMG)
T	Corruption	T	Dishonest customers/distributors	Focal firm-Customer	LU(ASMG)
T	Corruption	T	Weak legal system	Focal firm-Supplier, Focal firm-Customer	TU(SCMG)
T	Corruption	T	Customer characteristics	Focal firm-Customer	FU(CMGR)
T	Corruption	T	Raw material delays and shortages	Focal firm-Supplier	BU(SMGR), CU(MKTG)
T	Corruption	T	Order cancellations	Focal firm-Customer	HU(MKTG)
T	Corruption	T	Poor transport infrastructure	Focal firm-Customer, Focal firm-Supplier	JU(PROM),
T	Poor transport infrastructure	T	Raw material delays and shortages	Focal firm-Customer, Focal firm-Supplier	JU(PROM), DU(MAOF), GU(SMAE), BU(SMGR), CU(PSCO), KU(MKTG), NU(MKTG),QU(PROC), IU(FING), MU(SCMG)

T	Poor transport infrastructure	S	Collaboration with government	Focal firm-Supplier, Focal firm-Customer	EU(PROM)
T	Poor transport infrastructure	S	Insurance	Focal firm-Customer, Focal firm-Supplier	OU(SMKT)
T	Poor transport infrastructure	T	In-transit raw material theft	Focal firm-Supplier	GU(SMAE), PU(PROM),
T	In-transit raw material theft	S	Insurance	Focal firm-Supplier	PU(PROC), KU(MKTG), RU(LASS)
T	Dishonest employees	T	In-transit raw material theft	Focal firm-Supplier	BU(DWMG)
T	In-transit raw material theft	S	Improving visibility	Focal firm-Supplier	BU(DWMG)
T	Poor transport infrastructure			Focal firm-Customer, Focal firm-Supplier	EU(PROM),
T	Poor transport infrastructure	T	Poor customer delivery performance	Focal firm-Customer	HU(MKTG), LU(ASMG), RU(SMGR), GU(SMAE)
T	Geographical location (Landlockedness)	T	Poor transport infrastructure	Focal firm-Customer, Focal firm-Supplier	FU(CMGR), JU(MAND), MU(SCMG)
T	Geographical location (Landlockedness)	T	Political instabilities	Focal firm-Customer, Focal firm-Supplier	TU(CSMG), PU(PROM), LU(ASMG)
T	Political instabilities	T	Raw material delays and shortages	Focal firm-Supplier	JU(PROM), QU(PROC), MU(COMP), KU(MKTG), BU(SSUP, SMGR), HU(MKTG),SU(APRO), EU(DEPO), TU(CSMG) PU(PROM), CU(PSCO), LU(ASMG)
T	Political instabilities	S	Collaboration with government	Focal firm-Customer	RU(LASS)
T	Political instabilities	T	Financial difficulties (focal firm)	Focal firm-Customer, Focal firm-Supplier	NU(INVG), PU(PROC)

T	Political instabilities	T	Reduced customer base	Focal firm-Customer	DU(MAOF), JU(RMKT), MU(COMP, SCMG), IU(FING), KU(MKTG), HU(MKTG), AU(MKTG), GU(SMAE), FU(CMGR)
T	Product characteristics	T	Poor customer delivery performance	Focal firm-Customer	HU(MKTG),
T	Product characteristics	T	Raw material delays and shortages	Focal firm-Supplier,	RU(LASS)
T	Product characteristics	T	Poor quality raw materials	Focal firm-Supplier,	CU(PSCO)
T	Product characteristics	T	Financial difficulties (focal firm)	Focal firm-Supplier, Focal firm-Customer	MU(COMP), BU(SMGR),
T	Product characteristics	T	Poor quality products	Focal firm-Supplier, Focal firm-Customer	QU(PROC),
T	Product characteristics	T	Collaboration with customers	Focal firm-Customer	QU(PROC),
T	Product characteristics	T	Demand variations	Focal firm-Customer	BU(SMGR),
T	Product characteristics	T	In-transit raw material theft	Focal firm-Supplier	RU(LASS)
T	Product characteristics	S	Insurance	Focal firm-Supplier	CU(PSCO)
T	Raw material delays and shortages	S	Inter-branch stock transfer	Focal firm-Customer	BU(SSUP, SMGR), AU(MKTG)
S	Inter-branch stock transfer	S	Procurement management	Focal firm-Customer	MU(COMP),
T	Government policy	T	Unstable taxation	Focal firm-Customer	IU(BRMG), PU(PROM), TU(CSMG), JU(PROM)
T	Unstable taxation	S	Collaboration with government	Focal firm-Customer	JU(PROM)
T	Government policy	S	Collaboration with government	Focal firm-Customer	IU(BRMG)
T	Government	T	Poor customer delivery	Focal firm-	RU(SMGR)

	policy		performance	Customer	
T	Poor customer delivery performance	S	Outsourcing	Focal firm-Customer, Focal firm-Supplier	RU(SMGR)
T	Raw material delays and shortages	S	Outsourcing	Focal firm-Supplier, Focal firm-Customer	RU(SMGR), JU(TMKG)
T	Poor transport infrastructure	S	Outsourcing	Focal firm-Customer, Focal firm-Supplier	LU(ASDG)
T	Outsourcing	O	Loss of control	Focal firm-Customer, Focal firm-Supplier	JU(TMKG),EU(PROM)
T	Financial difficulties (focal firm)	S	Outsourcing	Focal firm-Supplier, Focal firm-Customer	EU(PROM)
T	Dishonest employees	S	Outsourcing	Focal firm-Customer	HU(MKTG),
T	Poor customer delivery performance	S	Collaboration with customers	Focal firm-Customer	DU(MAOF), NU(INVG)
T	Raw material delays and shortages	T	Order cancellations	Focal firm-Supplier, Focal firm-Customer	OU(SMKT)