





Supply chain disruption propagation: A study of South African fast-moving consumer goods food and beverage manufacturers

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Orientation: Supply chain disruptions have been the subject of substantial theoretical exploration, resulting from the organisational need to enable understanding and appropriate responses to increasingly frequent and severe disruptive events.

Research purpose: The purpose of this study was to explore the factors that influence disruption propagation in the South African fast-moving consumer goods (FMCG) food and beverage manufacturing sector.

Motivation for the study: Whilst disruption propagation can cause notable damage to a supply chain, little research exists on the underlying factors that cause disruptions to spread.

Research design, approach and method: The study employed a generic qualitative design. Seventeen semi-structured interviews were conducted to collect data from senior managers working in the South African FMCG food and beverage manufacturing sector. A thematic analysis approach was followed to analyse the collected data.

Main findings: This study identified silo thinking, counterparty risk and staffing as factors that cause disruption propagation. Furthermore, the findings indicate that collaboration allows for a quicker response to disruptions because of the increased visibility that decreases disruption propagation, whilst high levels of dependency contribute to disruption propagation. However, this study found that in certain situations, a high level of dependency can be beneficial and decrease disruption propagation.

Practical/managerial implications: The study offers managers insight into the nature of supply chain disruption propagation. Managers should revise and adapt disruption mitigation strategies to prevent disruption from spreading by understanding the nature of collaboration and the implications of high levels of relationship dependency.

Contribution/value-add: The study identified the factors and circumstances causing supply chain disruption propagation in the South African FMCG food and beverage sector.

Keywords: disruption propagation; supply chain collaboration; supply chain dependency fast-moving consumer goods food and beverage manufacturing industry; generic qualitative research; South Africa.

Introduction

'When the supply chain sneezes, the entire organisation catches a cold' (L. Isaacs, pers. Comm., 11 September 2020). Disruptions in a supply chain can cause notable damage. Failures in managing disruption in one organisation can easily spill over to other organisations, causing a significant impact on the supply chain. In 2017 and 2018, the South African fast-moving consumer goods (FMCG) food and beverage sector experienced significant supply chain disruptions because of an outbreak of listeriosis, a foodborne disease. The disruption had a severe effect on the prominent FMCG manufacturer Tiger Brands Ltd and other competitors in this sector (Tiger Brands Ltd 2018a:15). The organisation had to shut down factories after the listeriosis outbreak and saw a drop in financial performance as they reported a loss of R365 million for the 6 months ended 31 March 2018 (Tiger Brands Ltd 2018b:1). The disruption propagated throughout the supply chain, and as a result, it had a significant financial impact on pig farmers, with pork prices falling by 40% and pork processing facilities having to close their doors (National Agricultural Marketing Council 2019:14). Retailers were also heavily affected by having to recall 32 types of products that may have been affected by the bacteria (National Listeria Incident Management Team 2018:5). Hence, supply chain disruption propagation, which is the spreading of the disruption effect from the initial disruption location up

and down the supply chain, is of increasing interest to organisations (Han & Shin 2016:135).

Problem statement

Supply chain disruptions are ‘unplanned events that impede the flow of materials, information, services or financial resources within and between the organisations in a supply chain’ (Han & Shin 2016:135; Porterfield, Macdonald & Griffis 2012:402). Disruptions may arise from events such as natural disasters, unstable political environments, product contaminations, strikes or unexpected equipment failures (Ivanov, Dolgui & Sokolov 2019a:830; Namdar et al. 2018:2345). A minor failure in one part of the supply chain may interact unpredictably and cascade into a larger failure (Scheibe & Blackhurst 2018:43). Disruption propagation can therefore result in financial and sales losses and a drop in service levels; in some severe cases, it can stop supply chain operations altogether (Revilla & Saenz 2017:1). It is evident that the nature of a disruption, structure and dependence are the drivers of disruption propagation (Scheibe & Blackhurst 2018:43–59).

Scheibe and Blackhurst (2018:43–59) investigated disruption propagation in the manufacturing industry as a whole in the United States of America (USA). Nonetheless, generalisability cannot be applied to other sectors such as the FMCG food and beverage manufacturing sector, which has a vast amount of inherent risks. These risks include labour unrest risks, inaccurate forecasts and supplier risks (Price Waterhouse Cooper 2012:12). The FMCG food and beverage manufacturing sector is highly vulnerable to disruptions because of its nature of intense competition with high-volume product variance and holding products with a short shelf life (Mvubu & Naude 2016:274; Scholten & Schilder 2015:474). In addition, a developing country like South Africa differs from a developed country such as the USA in terms of poorly structured economic systems, poor quality of road infrastructure and a less-educated workforce (Sanchez-Rodrigues & Potter 2013:352; United Nations 2018:23). These factors increase the potential for disruptions, which increases the level of uncertainty within the supply chain. Therefore, different results can be expected when examining the factors that influence disruption propagation in this contextual setting (Diehl & Spinler 2013:316; Sanchez-Rodrigues & Potter 2013:352). This lack of contextual research represents a concerning gap in disruption propagation literature.

Therefore, this generic qualitative study examines the factors affecting supply chain disruption propagation in the South African FMCG food and beverage manufacturing sector. The study expands upon previous research by Scheibe and Blackhurst (2018:43–59) by also investigating the role that supply chain collaboration has in the severity of disruption propagation in the South African FMCG food and beverage manufacturing sector. In addition, this study also explores whether a high level of dependency between supply chain members is beneficial or detrimental to the supply chain when disruption propagation occurs.

This study aims to answer the following research questions:

1. What are the factors that affect supply chain disruption propagation?
2. What role does supply chain collaboration have in the severity of disruption propagation?
3. What are the main benefits and drawbacks of a high level of dependency between the supply chain members when disruption propagation occurs?

The remainder of the article is structured as follows. Firstly, an overview of the relevant literature on disruption propagation is provided. This is followed by a reasoned discussion of the methodology used. Thereafter, the study’s findings are presented. In conclusion, the proposed directions for future research and the study’s limitations are laid out.

Literature review

The South African fast-moving consumer goods food and beverage manufacturing sector

The FMCG industry is described as the largest industry in the world, consisting of a wide variety of products (KPMG 2014:4; Mvubu & Naude 2016:274). Fast-moving consumer goods are sold in large quantities at relatively low prices (Kenton 2019). The South African FMCG food and beverage manufacturing sector, a subsector of the larger FMCG industry, operates in an unstable economy but is still projected to have positive growth in the long term (Matsoso 2018:25). This is the largest sector in the manufacturing industry and is characterised by a broad product range, high turnover and intense competition (Le Roux 2019:5; Mvubu & Naude 2016:274). This sector faces several challenges, such as the risk of product spoilage, product recalls, demand uncertainty and the fact that organisations can only keep limited safety stock (Agigi, Niemann & Kotze 2016:4; Chintapalli 2014:287). The unique challenges faced in the FMCG industry cause disruptions that can lead to a shortage of certain products in the market or a stoppage in production (Agigi et al. 2016:4; Yangfan 2013:19). The South African FMCG food and beverage manufacturing sector contributes 26% to the added value of the total manufacturing industry in South Africa and employs around 236 515 people (Le Roux 2019:5).

Factors affecting supply chain disruption propagation

Disruptions may vary in frequency and severity, and small disruptions can lead to large failures in the supply chain (Scheibe & Blackhurst 2018:49; Vagal 2019:5). Disruptions need to be localised before the disruption increases in severity and spreads to other parts of the supply chain (Ivanov, Dolgui & Sokolov 2019b:86). The impact of a disruption and the scope of the disruption propagation depend on the speed and extent of recovery actions and the supply chain’s robustness (Ivanov, Pavlov, Pavlov & Sokolov 2017:22).

The trends of rising outsourcing, reduction of the supplier base and just-in-time inventory are used by organisations to increase supply chain efficiency (Sarkar & Kumar 2015:170;

Scholten & Schilder 2015:147). However, these trends sometimes increase disruption propagation because they make it more difficult for supply chains to absorb delays and disruptions because of high levels of dependency between members (Sheffi 2015:32). Therefore, this focus on efficiency has increased the vulnerability of supply chains to disruption propagation (Sarkar & Kumar 2015:170; Stecke & Kumar 2009:195).

Several other factors influence disruption propagation. Firstly, collaboration increases visibility in the supply chain that can lead to an early awareness of a disruption, allowing members to reduce the severity of disruption propagation (Omoruyi & Akuoma 2020:175; Świerczek 2014:93). Secondly, when members in the supply chain are tightly coupled, the possibility of disruption propagation increases because of organisations being more exposed to counterparty risk and there being less room for error (Speier et al. 2011:723; Vagal 2019:6). It also means that the time available to recover from a disruption diminishes. Thirdly, the decisions that managers take during a disruption can affect other members in the supply chain in unforeseen ways and can increase the severity of disruption propagation (Ivanov et al. 2019b:93). Therefore, managers often engage in silo thinking where they are reluctant to share information, and they make decisions in the best interest of their organisation and not the supply chain as a whole (Willcock 2016:1).

Reduced inventory makes organisations more vulnerable to disruptions because they cannot absorb a disruption in supply (Jain et al. 2017:6779; Namdar et al. 2018:1). Supply chains that have short lead times experience disruptions that propagate more quickly because disruptions occur earlier at downstream facilities (Ivanov 2020:9). Disruptions that occur in the downstream supply chain are more dangerous as they cause longer delays and last longer (Ivanov 2020:9).

Supply chain collaboration

Collaboration can be defined as independent, but related, organisations working together to plan and execute supply chain operations and to share resources and capabilities to achieve mutual benefits and common goals (Hudnurkar, Jakhar & Rathod 2014:192; Ralston, Richey & Grawe 2017:2). Supply chain collaboration has become imperative in modern operations, as one organisation cannot improve the overall efficiency of the supply chain system; it requires collaboration between all the main members (Nguyen et al. 2019:591; Soosay & Hyland 2015:613). Supply chain collaboration yields a competitive advantage by sharing rewards and creating a relationship based on mutual trust, joint risks and openness (Park & Jeong 2016:98). Collaboration can improve supply chain performance through sharing, accessing and integrating relevant knowledge (Chen et al. 2017:73). Supply chain collaborative relationships are usually long-term ventures where members know each other's strengths, weaknesses and needs (Hadebe 2018:3). It is therefore apparent that collaboration enriches joint organisational performance through positive long-term relationships.

Collaboration consists of several elements, such as information sharing, incentive alignment, resource sharing and decision synchronisation. Collaboration leads to more efficient supply chains because of reduced inventory levels and increased cost savings; improved supply chain capabilities, such as better forecast accuracy; reduced uncertainty; and increased inventory visibility (Ramanathan & Gunasekaran 2014:252; Tuli & Shankar 2015:2458; Um & Kim 2019:1). Similarly, collaboration increases the visibility of demand and allows for a better replenishment process through joint decision-making (Chen et al. 2017:10). Collaboration also allows organisations to improve their financial performance by combining their resources and capabilities that can lead to greater economies of scale and reduced production costs (Um & Kim 2019:1; Uvet et al. 2020:4; Wang et al. 2015:1929). Implementing collaboration in a supply chain has become an important strategic tool for organisations within the supply chain to manage the bullwhip effect (Hudnurkar et al. 2014:197; Omoruyi & Akuoma 2020:175). Scholten and Schilder (2015:474) and Wieland and Wallenburg (2013:304) found that collaboration increases visibility and communication in the supply chain and therefore is important to improve responsiveness and mitigate the effect of disruption propagation. This is because of supply chain members having sufficient time to respond because of early awareness of the disruption, thereby lessening its impact (Muddada 2010:35). However, collaboration causes increased dependency between members in the supply chain, which increases disruption propagation to occur (Świerczek 2014:93).

If collaboration is not implemented correctly, it can be problematic throughout the supply chain (Herczeg, Akkerman & Hauschild 2018:19). When the number of supply chain members increases, the collaboration becomes more complex because the organisations may not all have compatible systems of information exchange (Plugge & Bouwman 2015:3). Therefore, collaboration can become costly as it will require changing of systems and subsequent training (Hadebe 2018:28). Supply chain collaboration requires sharing sensitive information at a strategic and tactical level that could lead to losing trade secrets (Davis 2015:20). This is a common reason why organisations are reluctant to trust and share information with one another (Ralston et al. 2017:6; Ramesh, Banwet & Shankar 2010:190). A misalignment of internal processes or organisational goals between members in the supply chain is one of the biggest barriers to successful collaboration (Gabler, Richey & Stewart 2017:133; Ralston et al. 2017:5). Asymmetrical relationships often occur when organisations are not equally dependent on each other and do not share equally in the benefits of collaboration.

It is evident that organisations need to participate in collaborative initiatives to maximise supply chain benefits. However, collaboration is only successful when both parties benefit and the entire value chain operates more efficiently. Organisations must critically evaluate the overall effect that collaboration has on disruption propagation and compare the mitigating effect whilst considering the increased levels of dependency.

Levels of dependency in supply chain relationships

Supply chain systems have increased in complexity and become more dependent on one another because of information systems becoming more advanced (Tang et al. 2016:59). Kim and Henderson (2015:116) found that the main benefit of high levels of dependency is that it allows members to facilitate joint value creation at low risk of opportunism. However, Scheibe and Blackhurst (2018:50) and Świerczek (2014:93) have found that it increases disruptions occurring and propagating. In recent years, organisations have reduced their supply bases to develop more meaningful relationships with suppliers that lead to competitive advantage and more collaborative relationships (Andjelković & Milovanović 2020:5; Kamalahmadi & Mellat-Parast 2016:4). Whilst close relationships between suppliers and customers can be advantageous, they may also lead to organisations being more exposed to counterparty risk.

Counterparty risk takes place when an organisation's suppliers may also be suppliers to a competitor or an organisation in a different industry (Jorion & Zhang 2009:2054). This means that an organisation's supplier may be part of several supply chains (Vagal 2019:6). A disruption that occurs at one link in the supply chain affects other links in hidden ways (Jorion & Zhang 2009:2054). It is impossible for a single organisation to be aware of all interconnections through which it can be affected (Scheibe & Blackhurst 2018:51). Organisations rarely look further than their first or second tier and focus rather on one interconnection within a supply chain. This happens because obtaining information about supply chain members' relationships with further tiers is often impossible because of confidentiality agreements (Scheibe & Blackhurst 2018:50; Vagal 2019:6). Organisations are therefore ignorant of disruptions that may arise from unseen relationships. Counterparty risk may also occur when supply chain members fail to share important information with each other (Vagal 2019:6).

Ultimately, two core factors that influence disruption propagation are evident in the literature, namely, supply chain collaboration and level of dependency in supply chain relationships. The extent of collaboration between supply chain members and subsequent supply chain visibility influences the awareness of disruptions and the rate at which members can address the propagation thereof (Omoruyi & Akuoma 2020:175). Additionally, the level of dependency amongst supply chain members can affect the degree to which members are vulnerable to counterparty risk and the potential disruption propagation that follows (Vagal 2019:6). The FMCG food and beverage manufacturing sector faces unique challenges that cause disruption, creating the possibility for disruption propagation to occur (Agigi et al. 2016:4).

Methodology

Research design

This study adopted a generic qualitative research design as the researchers had some prior knowledge about the topic

that they wanted to expand on from the participants' perspectives (Percy, Kostere & Kostere 2015:78). This research design was further deemed suitable as this study attempted to explore the subjective experiences and opinions of participants, relating to the factors that influence supply chain disruption propagation in the South African FMCG food and beverage sector. Data were collected through conducting semistructured interviews with multiple, information-rich participants who were strategically selected through purposeful sampling strategies.

Sampling

The units of analysis in this study were FMCG food and beverage manufacturing organisations in South Africa. The units of observation were the senior supply chain professionals interviewed. The final sample size was based on the concept of data saturation, which means that the study continued to acquire data until no new substantive data were obtained (Fusch & Ness 2015:1408). As three consecutive interviews did not deliver any new data, saturation was reached at 17 interviews. Seventeen organisations participated in the study, which led to a total of 17 face-to-face semistructured interviews – one per participating organisation.

This study used a homogenous sampling method, a form of purposeful sampling, to select organisations with the same predetermined characteristics to a specific subgroup (Plano-Clark & Creswell 2015:174). The organisations were selected based on their belonging to the food and beverage manufacturing sector, a subgroup of the FMCG industry. The organisation should have had operations within South Africa and must have experienced supply chain disruption propagation in the last 2 years. This allowed the findings to remain highly relevant and ensured better recollection of the details of the disruption.

The following inclusion criteria were used to select the participating employees. Firstly, the employee should have been a senior supply chain practitioner who was directly involved in the decision-making process when disruption propagation occurred. Secondly, the participant needed at least 5 years of experience in a senior supply chain management role. Thirdly, they needed to have the authority to make decisions when disruptions occurred in the organisation. This enabled the participant to explain the reasoning behind the decisions made during the disruption. The FMCG food and beverage manufacturing sector typically holds products with a short shelf life and has a competitive and rapid nature (Bala & Kumar 2011:23; Scholten & Schilder 2015:474). Knowing what causes a disruption to propagate throughout the supply chain is therefore of great importance to organisations in this industry. The pseudonyms listed in Table 1 were used to protect the identity of the participants and their organisations, to encourage honest responses from the participants and to ensure anonymity.

TABLE 1: Participants' profiles.

Pseudonym	Position	Organisation	Gender	Length of interview (min)
P1	Logistics manager	O1	Male	55
P2	Procurement executive	O2	Male	53
P3	Logistics director	O3	Male	88
P4	Supply chain executive	O4	Male	73
P5	Head of supply chain	O5	Male	46
P6	Supply chain executive	O6	Male	32
P7	Group head of logistics	O7	Male	80
P8	Group procurement manager	O8	Male	76
P9	Supply chain performance manager	O9	Female	80
P10	Chief executive officer	O10	Male	30
P11	Head of procurement	O11	Male	48
P12	Supply chain manager	O12	Female	39
P13	Supply chain manager	O13	Female	55
P14	General manager of logistics	O14	Male	60
P15	Head of procurement	O15	Female	70
P16	Head of supply chain	O16	Male	93
P17	Supply chain director	O17	Male	70

Average length of interview (min) = 62.

Data collection

Semistructured interviews were used to gather data, which is suitable when an in-depth understanding of the specific topic is needed (Rowley 2012:262). The researchers developed a discussion guide from a thorough review of the literature. A pretest interview with a supply chain professional who matched the sampling criteria was conducted to verify the time required to cover all the questions and to determine whether the questions in the discussion guide were suitable (Ey, Zuo & Han 2014:150). The feedback was positive, and only slight changes were made to the questions. The semistructured interviews lasted from 32 to 93 min, with an average duration of 62 min. All interviews were conducted on online platforms such as Microsoft Teams. This was the most effective interview method during a global pandemic. All participants completed an informed consent form, were granted permission to audio-record the interviews and were assured that their identities and answers were to be kept confidential prior to the interview. The researchers transcribed all interviews by using a professional transcription service and then listened to each recording and amended the transcripts to ensure accuracy.

Data analysis

This study employed thematic analysis to analyse the data collected, as per the guidelines of Braun and Clarke (2012: 57–71). The data were analysed by identifying, organising and reporting themes found within the data set (Chapman, Hadfield & Chapman 2015:202). The researchers each conducted a preliminary exploratory analysis by reading the interview transcripts whilst listening to the audio recordings to become accustomed to the data and to assign initial inductive codes (Creswell 2012:243). This also allowed for more accurate and less biased coding, as different perspectives were considered. All researchers assigned codes to specific text segments to summarise and understand

the meaning of each segment. A master code list was then compiled, and the redundant codes were merged (Braun & Clarke 2012:63). Patterns were then identified and used to form overarching themes that were applicable to the study's research questions.

Trustworthiness

Lincoln and Guba (1985:289–331) developed criteria that, if met, indicate that a qualitative study is trustworthy. These criteria are credibility, transferability, dependability and confirmability and are referred to as the 'gold standard' for determining the quality and trustworthiness of a qualitative study (Polit & Beck 2012:583). The credibility of this study was enhanced by using appropriate methods, such as emphasising the confidentiality of the participants' answers and informing the participants that they could withdraw from the study (Baxter, Courage & Caine 2015:237). To ensure transferability, the researchers provided detailed descriptions of the context in which the study took place, the methodology employed and the inclusion criteria used (Yilmaz 2013:320). Dependability was ensured by providing detailed descriptions of the research procedures used, allowing readers to follow and evaluate the research process (Bloomberg & Volpe 2018:163). This study therefore conducted an audit trail that enabled the researchers to describe all research decisions and show why these decisions were made (Thomas & Magilvy 2011:153). Confirmability in the study was achieved by using open-ended questions during the interviews, which allowed the participant to answer the questions regarding their own opinions (DeJonckheere & Vaughn 2019:2).

Ethical considerations

Ethical clearance to conduct this study was obtained from the University of Pretoria, Faculty of Economic and Management Sciences Research Ethics Committee (reference number: 16048467/17174491/14086230/2020). The participants were each required to read and sign the informed consent form before the interview was conducted. The form assured each participant that all information provided would be treated confidentially and anonymously and included the purpose of the study. The identities of the participants and their organisations were protected by using the pseudonyms.

Findings

In this section, this study's findings are reported per research question. As shown in Table 2, the study identified three main themes related to the study's research questions, each with several subthemes.

Theme 1: Factors that affect supply chain disruption propagation

The first research question of this study aims to understand the different factors that influence supply chain disruption propagation.

TABLE 2: Summary of themes and sub-themes.

Research Questions	Themes	Subthemes
What are the factors that affect supply chain disruption propagation in the FMCG food and beverage manufacturing sector?	Theme 1: Factors that influence disruption propagation	<ul style="list-style-type: none"> Enhanced supply chain agility Enhanced information sharing The nature of the disruption Staffing issues <ul style="list-style-type: none"> Unmotivated employees Resistance to change Silo thinking Counterparty risk
What role does supply chain collaboration have in the severity of disruption propagation in the FMCG food and beverage manufacturing sector?	Theme 2: The role of supply chain collaboration in disruption propagation	<ul style="list-style-type: none"> Joint disruption mitigation Increased visibility Supply chain members use same demand information Enhanced trust between members Enhanced supply chain relationships
What are the main benefits and drawbacks of a high level of dependency between the supply chain members when disruption propagation occurs within South Africa's FMCG food and beverage manufacturing sector?	Theme 3: Relationship dependency	<ul style="list-style-type: none"> Drawbacks <ul style="list-style-type: none"> Poor supplier performance affects organisation Poor supply chain relationships Loss of trade secrets Delayed response to disruption Benefits <ul style="list-style-type: none"> Goal alignment Access to new knowledge Prioritised supply during disruption

FMCG, fast-moving consumer goods.

Enhanced supply chain agility

Agility stems from the rapid sharing of critical information, allowing the organisation to adapt quickly to unexpected scenarios and a changing supply chain environment (Wieland & Wallenburg 2013:302). Four participants indicated that supply chain agility plays an important role in decreasing the severity of disruption propagation, as it allows for a quicker response to unexpected scenarios because of rapid sharing of critical information. This is evident in the following quotation:

'The sooner you share that information, the sooner you flag that information to the respective businesses, the better you're going to be able to adapt and be flexible in terms of your supply chain. ...' (P8, male, group procurement manager)

Enhanced information sharing

Sixteen participants mentioned that the sharing of timely and accurate information could prevent the spread of disruptions because if members are aware of possible disruption from the start, a solution can be found more quickly, thus preventing a major disruption. This is supported by the following quotation:

'Communication is the lifeblood of any business and especially supply chain. So without it you have no chance; with it you have a chance. And then it depends on capability, speed of communication, resources you have, have you anticipated and have you got alternative plans in place, mitigation.' (P10, male, chief executive officer)

Inter-relatedness of supply chain disruptions

One participant mentioned that they have experienced a strike at one of their facilities, and the factory had to be shut down. To mitigate this risk, the decision was made to reallocate the production to other factories. This decision led to unexpected bottlenecks at these factories, which shows how the mitigation of one disruption can lead to another disruption, as illustrated in the following quotation:

'We will do everything in our power to get supply; whether that means that we actually have to charter planes and air freight goods in from overseas, we will do everything in our power to keep factories continuing ... or we will reallocate work between the factories so that they can always continue.' (P15, female, head of procurement)

Inventory management

Eight participants indicated that they increased their stock levels or instructed their suppliers to increase their safety stock levels during a disruption as a buffer. This decision caused the disruption to propagate to the suppliers through increased inventory holding costs and problems with storage space in their warehouse. By doing so, the disruption can possibly spread to competitors who experience a shortage of supply because of the extra strain on the supplier, as shown in the following quotation:

'... [W]e made an allowance with our suppliers to take our stock cover higher than we usually would, to ensure that we could cover us during the COVID period and, obviously, be able to have enough buffer for any spikes in demand.' (P9, female, supply chain performance manager)

The use of backup suppliers

A common course of action to help mitigate a disruption is to make use of alternative suppliers, as indicated by four participants. However, two participants stated that the opposite may occur, and mitigation efforts may be negatively affected as changing suppliers may result in bottlenecks and other unforeseen problems, as shown in the following quotation:

'... [W]e tried to get alternative suppliers online. We do have contingency planning, but obviously again, it's a global issue. So we would say we can't buy from China, we buy from India, and all of a sudden both have the same problem. So we started looking at local suppliers of raw materials. And we also looked at alternative raw materials. So something that's similar, but maybe not exactly the same.' (P6, male, supply chain executive)

Staffing issues

Staffing issues have been identified as a factor of disruption propagation by three participants. Two participants indicated that unmotivated employees could contribute to disruption propagation. Unmotivated employees may not handle a disruption as effectively as they could, so every other aspect of the business can run into problems, causing a disruption to propagate more severely. This can be seen by the following quotation:

'... [Y]ou need a strong, motivated workforce as well. You can have all the systems in place. You can have the manufacturing assets that's working, but ... people are very important. You have to take them with you in terms of motivation. ...' (P8, male, group procurement manager)

Organisational resistance to change

One participant mentioned resistance to change as a factor of disruption propagation. When an organisation thinks they are supreme, they may become complacent and do not evolve

with the times. This results in them not being willing to adapt to the changing supply chain environment fast enough, causing a disruption to propagate. This is evident in the following quotation:

'[...] If you don't have the right resources and the right people at the right time ... you're believing that you can't recruit new blood, recruit new people, having a new way of thinking, get yourself challenged. You think that everything is fine and you own the world. It's a mega mistake, and then it's a big disruption.' (P16, male, head of supply chain)

Silo thinking

Silo thinking, where supply chain members and different business departments make decisions in isolation, is considered by five participants to influence the severity of disruption propagation. The sales department of a multinational organisation acted as a silo without thinking of the warehouse. They ordered stock for an upcoming promotion a week in advance, as they thought it would ensure that they received the product on time. However, this caused a disruption in the warehouse as they already phased demand a week earlier than when needed. Therefore, the milk was produced 2 weeks too early and risked perishing before the promotion started. This is illustrated in the following quotation:

'Now the stock is busy sitting in a warehouse and no one wants to buy it and it's busy aging because technically the stock was only going to start being bought by that shop from next week for the promo. The sales guys thought they're going to be clever and make it a week earlier to ensure they have stock, but it actually doesn't help us because we already take a week. We really take that assumption into account in our planning process.' (P9, female, supply chain performance manager)

Counterparty risk

Counterparty risk will increase disruption propagation because of hidden linkages or risks in the supply chain, as indicated by two participants. An organisation can unknowingly be exposed to disruption propagation because of a lack of visibility past their first-tier suppliers, which prevents them from seeing potential problems as shown in the following quotation:

'What we did not have line of sight of is our seasoning supplier's suppliers ... so most of this one supplier's suppliers are international; we couldn't get their raw materials into the country for them to, of course, do seasoning provision and then supply to us. So I think that the lesson there is [*that*] it's not deep enough in terms of information flow to just go suppliers, sometimes especially if it's as critical as something like seasoning in our process to go suppliers' suppliers, and start understanding that a little bit better.' (P3, male, logistics director)

One participant indicated that they experienced counterparty risk by their suppliers also supplying their direct competitors. This can increase disruption propagation as the organisation might not be aware of the influence that this may have on them when a disruption occurs, as seen in the following quotation:

'[...] W]hen there was the xxx disruption with regards to the factory closing for five months due to technical issues. It was a negative impact on the other members in the supply chain; our competition was affected negatively. They all had to basically either stock out on the items ...' (P15, female, head of procurement)

This study confirmed the work by Scheibe and Blackhurst (2018:49), which found that the size and severity of disruptions can grow and spread to other members when they act as a silo. This study's findings also correspond with the work by Vagal (2019:6), which states that counterparty risk can increase disruption propagation because of the risk coming from unseen relationships. The literature does not emphasise staffing issues as a factor of disruption propagation. This could be because of the geographic differences, as the South African FMCG industry is volatile and has a less-educated workforce (Diehl & Spinler 2013:316; Sanchez-Rodrigues & Potter 2013:352).

Theme 2: The role of supply chain collaboration in disruption propagation

Research question two relates to the role that supply chain collaboration plays in the severity of disruption propagation. The following subsections describe how supply chain collaboration can be beneficial in decreasing disruption propagation.

Joint disruption mitigation

Fifteen participants stated that supply chain collaboration led to members engaging in joint disruption mitigation efforts. When working together, mitigation efforts are enhanced, and the disruption can be resolved more effectively, as demonstrated by the following quotation:

'So the wider you throw the net, the more original the solutions often are, that you can carry on without it turning into a major issue.' (P5, male, head of supply chain)

Increased visibility

Collaboration increases various forms of visibility throughout the supply chain, as mentioned by 10 participants. This is attributed to members being more eager to share information and communicate more frequently if they have a good relationship with each other. More visibility results in members being in a more informed position to handle a disruption that can prevent this disruption from spreading. This is evident in the following quotation:

'I think, more than anything else, the more you collaborate, the more visibility you provide, the better things are, and the more agile and responsive you can be when disruptions do occur.' (P7, male, group head of logistics)

Supply chain members use the same demand information

Ten participants mentioned that they collaborate by sharing forecasts so that the entire supply chain uses the same demand information. This reduces the bullwhip effect and disruptions caused by wrong forecasts, which is evident in the following quotation:

'You get sales information from your customer and based on that, you are able to produce a forecast, and that forecast you align with each other. Once you have that, you know what you need to plan and also what you need to produce, and then share that information with your supplier so that your supplier also knows what he has to produce.' (P11, male, head of procurement)

Sharing forecasts can also reduce order batching and subsequently reduce disruption propagation, as order batching can exacerbate the bullwhip effect. This is supported by the following quotation:

'So it's a big deal; you tell a customer, "Listen, I've got a problem in my factory, or with supply, and we potentially will be out of stock for two or three weeks before we see a recovery." The customer could then increase their orders because they sometimes believe by ordering more, they'll get what they initially wanted.' (P17, male, supply chain director)

Enhanced trust between members

Collaboration enhances the level of trust in supply chain relationships, as discussed by eight participants. This is because of them being honest with each other and discussing any disruption as soon as it happens. Twelve participants indicated that collaboration makes them more likely to communicate a disruption. This minimises the impact of the disruption on other members as they can take the necessary preventative actions. This is clear in the following quotation:

'So you have to be honest and open and rather say, "Okay, we're out of stock and it's going to last till the end of the year," than promising them that we are working on it, that we [*will*] try to resolve it by next week and already knowing it's not going to happen.' (P11, male, head of procurement)

Enhanced supply chain relationships

All participants have a partnership relationship with both their suppliers and their customers where they make a conscious effort to meet and communicate regularly. This type of relationship encourages them to inform each other about disruptions and work together to come up with a solution that will benefit all parties involved. Through collaborating, members have more resources to mitigate disruption and limit its propagation, as shown in the following quotation:

'Collaboration is really, really important in your supply chain and where possible, try and bring your suppliers into that collaboration; try and bring your consumer into that collaboration, because that will assist you producing and getting a long-term revenue return or sustainable product in the future.' (P8, male, group procurement manager)

These findings corroborate the work of Scholten and Schilder (2015:481), as collaboration is seen to enhance communication and visibility in the supply chain. The study confirms the existing literature by Muddada (2010:39), who found that collaboration allows organisations to respond to disruptions quicker, and improves the mitigation of disruption propagation. The findings also verify the research by Hudnurkar et al. (2014:197), where collaboration, and more

specifically sharing demand information, plays an important role in managing the bullwhip effect. This study extended on the work by Scheibe and Blackhurst (2018:43–59) by finding that collaboration can be an additional factor that decreases disruption propagation.

Theme 3: Relationship dependency

The third research question of this study aims to understand the role of relationship dependency in the severity of disruption propagation. The following subsections describe the drawbacks and benefits of a high level of dependency between supply chain members when disruption propagation occurs.

Drawbacks of a high level of dependency between supply chain members

A drawback of relationship dependency is that the organisation will be affected or held accountable for the actions of their suppliers, as mentioned by 10 participants and supported by the following quotation:

'[... Y]ou know if there's a disruption on their side ... then you're screwed because you're dependent on them.' (P12, female, supply chain manager)

This can increase disruption propagation because any disruption that the supplier experiences will cause the main organisation to also experience a disruption. If the supplier engages in negative practices, the focal organisation will be held accountable and experience a disruption in reputational damage.

Five participants indicated that their organisation has a poor relationship with their suppliers or customers. This results in them not trusting one another and suspecting inaccurate information being shared, thereby hampering the organisation's ability to handle disruption propagation, as seen in the following quotation:

'We do have one or two suppliers that we are wary of. We are wary of the information that they share with us. Because of the wariness with those suppliers, we normally have not only one business continuity plan, but we have three business continuity plans in place to ensure that we have actions that we can follow.' (P15, female, head of procurement)

Furthermore, two participants mentioned that these relationships are worsened by the possibility of losing trade secrets because of so much confidential information being shared between the members. This is illustrated in the following quotation:

'The only thing is potentially too many people know your business. So your whole sort of secrecy or competitive edge can be exposed.' (P5, male, head of supply chain)

Delayed response to disruption is seen as a drawback of dependency by four participants. If an organisation is dependent on another, they may not be able to react to a disruption quickly enough because they have to consider

these members before making decisions, causing the disruption to propagate. This is supported by the following quotation:

'[...] You cannot respond as quickly as you would have wanted to because you are dependent on somebody else. ... If you are dependent on somebody and you do not have a strategic or collaborative relationship with that party in your supply chain, I think trying to mitigate the risk is going to become very difficult.' (P1, male, logistics manager)

Benefits of a high level of dependency between supply chain members

Goal alignment is a major benefit of relationship dependency, as indicated by 10 participants. If supply chain members have the same goal, they are inclined to assist each other so that they are all successful instead of an individual node acting in their own best interest. This creates a sustainable supply chain and reduces disruption propagation, as no decisions are taken that will be detrimental to other members, as seen in the following quotation:

'How do you maximise his profitability so that he's sustainable in the long-term so that when it comes to us needing that supply of potatoes, it's in fact more likely that it will be there than it won't.' (P3, male, logistics director)

Relationship dependency can be beneficial because organisations can gain access to new knowledge, as stated by eight participants. The supplier or customer will often have different expertise and a different view of the situation, which could lead to new and creative ways to solve the disruption and decrease disruption propagation. This is supported by the following quotation:

'So if anything happens, you need to understand that they stand by you. I think that would be the main benefit because that takes the business to the next level, the business between the two of you. And then ... other benefits would be you also gain experience, you gain knowledge and gain a new way of working or sorting out issues.' (P13, female, supply chain manager)

Prioritised supply from a supplier during a disruption was found as a benefit of dependency by one participant. If the supplier provides the organisation first with their available inventory, the probability of a stockout is reduced. This helps the organisation diffuse the disruption. Alternatively, it increases disruption propagation for the competitor as they unexpectedly have no supply, as seen in the following quotation:

'We do generally request our suppliers to prioritise us above the other customers. So there are certain clauses in our contracts that if there is an industry disruption, it could mean that [Participant 15] gets prioritised above another customer by the supplier just purely because of the brand and the priority. ... It could impact our competition.' (P15, female, head of procurement)

These findings confirmed the work of Kim and Henderson (2015:116), who found that high levels of dependency lead to joint value creation and cause members to act in the best interest of the supply chain as a whole. However, these findings contradict the work of Scheibe and Blackhurst

(2018:50) and Świerczek (2014:93), who stated that relationship dependency increases disruption propagation, as this study found that sometimes high levels of dependency can be beneficial and decrease disruption propagation.

Conclusion

Summary of findings and theoretical implications

The purpose of this generic qualitative study was to expand on the previous research by Scheibe and Blackhurst in the South African FMCG food and beverage manufacturing sector. More specifically, the first research question identifies the factors that influence disruption propagation in the chosen context. The findings discovered negative influences on disruption propagation, such as silo thinking and staffing issues unique to the South African context. This study confirms the findings of Vagal (2019:6), who identified counterparty risk as a factor that increases disruption propagation, as risks cannot be seen from hidden supply chain relationships.

The second research question explored the role of supply chain collaboration in the severity of disruption propagation. This study extended on the findings by Scheibe and Blackhurst (2018:43–59), which confirmed in several ways that collaboration can be beneficial in decreasing disruption propagation. The findings revealed positive influences, such as joint disruption mitigation efforts, increased visibility and enhanced supply chain relationships that should not be ignored. These findings confirm the work by Hudnurkar et al. (2014:197), who stated that sharing of demand information plays a significant role in reducing the bullwhip effect. In addition, the research found that participants become more eager to communicate possible disruptions when they are collaborating with other supply chain members because of enhanced trust in their relationships that allows them to assist each other.

The third research question aimed to identify the main benefits and drawbacks of depending on other members in the supply chain. This study found that relationship dependency can provide the benefits of goal alignment, access to new knowledge and receiving prioritised supply during a disruption. These benefits encourage participants to act in the best interest of all members, reducing disruption propagation. This confirms the work of Kim and Henderson (2015:116), who explain that depending highly on other members in the supply chain can lead to joint value creation. The drawbacks of relationship dependency are identified as organisations being held accountable for suppliers' actions, poor relationships, loss of trade secrets and delayed response to disruptions. These all contribute to the spread of disruptions. The findings of this study contradict the work of Scheibe and Blackhurst (2018:50) and Świerczek (2014:93), as they explained that high levels of dependency contribute to disruption propagation. However, this study found that in certain situations, a high level of dependency can actually be

beneficial and decrease disruption propagation. For example, if an organisation is highly dependent on a supplier for long-term success and vice versa, they will engage in joint disruption mitigation when a disruption occurs to ensure each other's survivability.

Managerial implications

The managerial implication of this study is focused on providing supply chain managers with the necessary knowledge to enable them to prevent and minimise disruption propagation. Using the findings of this study, managers can critically analyse the factors that influence disruption propagation. This analysis can lead to revising their disruption mitigation strategies to ensure that they are making the best decisions for the supply chain as a whole. This study assists supply chain managers by increasing their awareness of the positive influence that collaboration has on disruption propagation. Therefore, the findings of this study could encourage managers to collaborate with supply chain partners to gain benefits, such as enhanced trust, sharing of demand information and enhanced sharing of information. This study provides managerial insights into the importance of collaboration in creating visibility in the supply chain, which helps with the early identification of impending disruptions. This results in a decrease in the severity of disruption propagation by allowing sufficient time to coordinate supply chain resources to mitigate the disruption.

This study also creates awareness that supply chain managers must be mindful of the possible drawbacks of relationship dependency, as a high level of dependency can increase disruption propagation. In addition, this study shows managers that there are also benefits of relationship dependency. Therefore, if relationship dependency exists, organisations should encourage goal alignment and sharing of knowledge and negotiate prioritised supply. Practically, organisations should encourage supply chain managers to act in the best interest of the entire supply chain during disruptions and not to let their incentives or targets influence disruption mitigation.

Limitations and directions for future research

This study was conducted within the context of the South African FMCG food and beverage sector, whilst several other sectors exist. Therefore, to determine the transferability of this study, future research can be conducted in any other industries and sectors. This study was also mainly conducted on large multinationals. A future study can therefore be carried out on smaller organisations to determine if the findings will hold true across multiple-sized organisations. Furthermore, this study explored only the manufacturer's perspective. Researchers could therefore include upstream supplier and downstream customer perspectives in future studies to gain a better understanding of this phenomenon. This study only explored the positive influence that collaboration has on supply chain disruption propagation.

Future research could therefore expand on this study by investigating if collaboration can sometimes negatively influence the severity of disruption propagation. Finally, the nature of the research design allowed for an in-depth understanding of the underlying factors. Future studies should test the nature and strength of the various relationships and variables identified in this study with regard to collaboration and dependency. Future studies can also explore the role of managerial decision-making in disruption propagation.

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