

## Supply chain security orientation in the pharmaceutical industry

S. van Niekerk, W. Niemann, T. Kotzé & K. Mocke

### ABSTRACT

Supply chain security orientation is an abstract phenomenon, which, up to now, has received little research attention. The purpose of this study, therefore, was to explore the supply chain security orientation of firms participating in the South African pharmaceutical supply chain with the aim of identifying specific risks and of understanding supply chain security perceptions, the drivers of supply chain security orientation, and the moderators of supply chain security orientation. Ten participants employed within pharmaceutical organisations participated in this descriptive, qualitative study. Data was collected through semi-structured interviews. The findings indicate hijacking, syndicates and general theft as the main risks in the South African pharmaceutical supply chain. Security-related partnerships and business process backups are the most neglected aspects of supply chain security orientation within the pharmaceutical supply chain. Regarding the supply chain security orientation, insurance should be considered as a way to recover from security breaches and not just a way to recover financial losses. The main drivers of supply chain security orientation were identified as corporate governance, compliance with rules and regulations, the benefits of introducing risk management processes, and the occurrence of risk events.

**Key words:** supply chain security orientation, supply chain risk, pharmaceutical, qualitative, South Africa

### Introduction

Modern supply chains are becoming increasingly complex due to globalisation, crises and catastrophes, cost-reduction pressures, increased customer expectations

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Ms S. van Niekerk, Mr W. Niemann, Mr T. Kotzé and Mr K. Mocke are in the Department of Business Management, University of Pretoria. E-mail: Wesley.niemann@up.ac.za

and environmental volatility, all of which contribute to supply chain risk exposure (Breuer, Siestrup, Haasis & Wildebrand 2013: 332; Cantor, Blackhurst, Pan & Crum 2014: 202; Chen, Sohal & Prajogo 2013: 2186; Hoffmann, Schiele & Krabbendam 2013: 199). Initiatives such as outsourcing, supplier-base reduction, buffer reduction, just-in-time and inter-firm collaboration all result in lean supply chains, which, in turn, contribute to their fragility (Elleuch, Hachicha & Chabchoub 2014: 643; Ghadge, Dani, Chester & Kalawsky 2013: 523; Kern, Moser, Hartmann & Moder 2012: 61). The just-in-time philosophy operates well in normal circumstances; however, in abnormal circumstances, there is little room for error due to tight optimisation and lean design (Snyder, Atan, Peng, Rong, Schmitt & Sinsoysal 2016: 2). Additionally, efficiency and cost-cutting programmes enforce the reduction of redundancies and stock, thus creating aggravated risk situations (Guertler & Spinler 2015: 224). Trends such as these are adopted as a means of generating more efficient supply chains; however, they merely expand the number of vulnerability points. As a consequence, supply chains are more vulnerable and prone to disruption (Ekwall & Rolandsson 2013: 14; Kurniawan, Zailani, Iranmanesh, & Rajagopal 2017: 2).

The pharmaceutical supply chain is characterised by complexities. This is due to the intricacies of the interactions within the health-care industry between the various role players such as health-care providers, governing bodies and manufacturing firms. Therefore, more attention should be paid to the key disruptions and vulnerabilities that could occur within the pharmaceutical supply chain (Narayana, Pati & Vrat 2014: 19). The pharmaceutical industry is progressively entering new markets in order to develop new business opportunities and reduce costs through diversification of the manufacturing supply chain. As the complexity of the supply chain increases, so does the potential risk for the pharmaceutical supply chain. Such risk includes natural disasters, infrastructure failure, labour unrest, counterfeiting, political instability, supplier insolvency and procedural failures (Brooks 2014; Hintlian, Kelly, Ernst & Young 2014: 18).

Pharmaceutical firms are constantly faced with numerous security challenges such as counterfeits, theft, illegal diversion, and adulteration, all of which increase patient-safety risk (Johnson 2011). Previous reports indicate that 10% of all pharmaceutical products in the global supply chain are counterfeit, with estimates increasing to as much as 70% in developing countries (Chaudhry & Stumpf 2013: 190). In addition, when stolen medication (which was not stored, refrigerated or distributed correctly so as to maintain the quality of the product) is reintroduced into the supply chain, consumers may unknowingly receive tainted or ineffective drugs which can lead to severe health consequences and, sometimes, even death (Elrod 2012: 83).

Disruptions and related risks in the supply chain result in: devalued stock prices; decreased revenue; decreased brand equity and customer dissatisfaction; an increased number of regulatory inspections; financial penalties; a surge in shareholder apprehension; and compromised patient safety (Hintlian et al. 2014: 18; Voss & Williams 2013: 320). Given the high level of interconnectedness of supply chain members, any malfunction experienced by one member could cripple the entire supply chain (Li 2014: 283). Therefore, immediate corrective action is needed to reduce all negative effects as highlighted. In order to facilitate implementation of these corrective measures, the firm will need to be aware of, and oriented to, supply chain risk management and security (Hishamuddin, Sarker & Essam 2013: 552).

This study explored the supply chain security orientation of pharmaceutical firms in South Africa. Supply chain security orientation is defined as

a firm's organisation-wide propensity to partner, plan, adapt, collaborate and communicate, with both internal and external trading partners and governmental entities, to ensure the dual goals of: strategically preventing and responding to potential security breaches that threaten supply chain assets; and minimising risks that threaten the performance and/or continuity of supply chain operations (Autry & Bobbitt 2008: 46).

To date, there have been various studies conducted on supply chain risk management and supply chain security management. Agigi, Niemann and Kotzé (2016: 1–15), Cantor et al. (2014: 202–223), Elahi (2013: 117–131), Enyinda, Gebremikael and Ogbuehi (2014: 13–27), Hoffmann et al. (2013: 199–211), Kern et al. (2012: 60–82), Lavastre, Gunasekaran and Spalanzani (2012: 828–838), Lavastre, Gunasekaran and Spalanzani (2014: 3381–3403), Li (2014: 283–303), Meixell and Norbis (2012: 711–732), Ouabouch and Paché (2014: 329–340), Vitteková (2013: 153–158), Williams, Lueg, Taylor and Cook (2009: 595–618), and Yang and Wei (2013: 74–85) have all researched various aspects of supply chain risk and security management. Research that is specifically focused on a supply chain security orientation, which is conceptualised as a component of supply chain risk management, is scarce. Studies include the conceptual development and framework of a supply chain security orientation and the impact of a supply chain security orientation on port performance (Autry & Bobbitt 2008: 42–64; Park 2013: 1–280). Other studies have compared the supply chain security approach of food distributors internationally and domestically (Whipple, Voss & Closs 2009: 575), and have investigated the measurement and validation of supply chain security culture based on a comprehensive literature analysis (Williams, Ponder & Autry 2009: 244). Based on an investigation of the field of supply chain security, Williams, Lueg and LeMay (2008: 254) have suggested that more empirical research is required in the field, as most studies have consisted mainly of conceptual studies or have been based on secondary data.

The purpose of this study was to explore the supply chain security orientation of South African pharmaceutical companies using the framework developed by Autry and Bobbitt (2008: 42–64). Further investigation has also been suggested by Autry and Bobbitt (2008: 60) for the verification of the themes and trends identified in their study. Additionally, the specific supply chain risks were identified together with the drivers, hindrances and moderators for the implementation of supply chain security in South African pharmaceutical supply chains. Specific focus was placed on investigating the level of security awareness on the part of, and the implementation of approaches to mitigate any security breaches and risks experienced by, South African-based manufacturing, distribution and wholesale pharmaceutical organisations headquartered in Gauteng.

The study was guided by the following research questions:

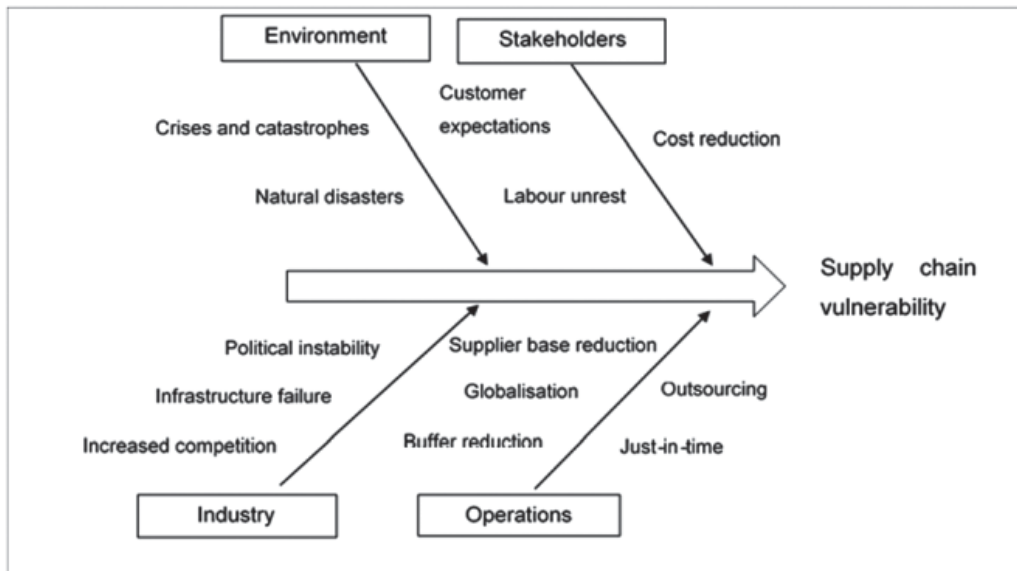
- What are the specific supply chain risks within pharmaceutical organisations?
- What is the supply chain security orientation of South African pharmaceutical organisations?
- What are the internal and external drivers in respect of the implementation of supply chain security?
- What are the moderators of supply chain security orientation in pharmaceutical supply chains?

This research contributes to the industry by addressing the level of supply chain security awareness and understanding within pharmaceutical organisations. The findings suggest that cybersecurity, creating dual responsibility, disposing of expired medicine, and the use of favourable insurance policies are all factors to consider when assessing the security of a pharmaceutical supply chain. The identification of specific supply chain risks in the South African context and the drivers of supply chain security implementation extend the knowledge base of supply chain management literature. From this, it appears that theft, hijacking and syndicates are the most significant security issues. Ensuring low employee turnover, high employee awareness of security practices, and managerial support will facilitate a heightened supply chain security orientation. Financial factors are seen as the most significant inhibitor in securing the pharmaceutical supply chain; hence sensitising managers to the significant cost implications of ensuring adequate supply chain security.

## Literature review

### Supply chain vulnerability

The efficacy and efficiency of a supply chain are dependent on internal factors such as progressiveness, collaboration, inter-firm relations, corporate culture, and management skills (Badenhorst-Weiss & Waugh 2014: 283). However, vulnerability and risks within supply chains have increased. These vulnerabilities can be broadly categorised as relating to the environment, stakeholders, industry and operations, as indicated in Figure 1.



**Figure 1:** Causes of supply chain vulnerability

Source: Aqlan (2013: 1); Badurdeen, Shauib, Wijekoon, Brown, Faulkner, Amundson, Jawahir, Goldsby, Iyengar & Boden (2014: 632)

The causes identified in Figure 1 have contributed to supply chain vulnerability. Figure 1 envisions the supply chain as a system (within a socio-economic environment) that encompasses the ability to react to hazards and cope with damage that may occur as a result (Heckmann, Comes & Nickel 2015: 125).

It has been argued that the pharmaceutical supply chain is ill-placed and lacks the ability to overcome the issues it is faced with, especially the immense financial and competitive pressures (Abdallah 2013: 63). Supply chains are also under increasing pressure from stakeholders to minimise risks due to their (the stakeholders') vested interest in a firm's success (Cantor et al. 2014: 214).

## Supply chain security orientation in the pharmaceutical industry

Pharmaceutical organisations must consider areas of compliance, as well as product integrity, product visibility and risk reduction, while simultaneously operating supply chains at full speed and low cost (Hockenberger 2014: 18). Disruptions in pharmaceutical practices can result in a chain reaction of extreme consequences, namely: increased regulatory inspections; financial penalties and a decrease in sales; a surge in shareholder apprehension; irreversible damage to a brand or reputation; and compromised safety of patients (Hintlian et al. 2014: 18). Therefore, it is essential to identify and prioritise risks, as means of overcoming supply chain vulnerability, by determining best practices for adequate configuration and adaptability within the pharmaceutical supply chain (Falkner & Hiebl 2015; Jaberidoost, Olfat, Hosseini, Kebriaeezadeh, Abdollahi, Alaeddini & Dinarvand 2015: 2).

### Pharmaceutical supply chains

If functioning optimally, the pharmaceutical supply chain supplies medicine to customers in the right quantities, at an acceptable quality, at the right times, and at an optimum price to ensure benefits for all stakeholders involved. An uninterrupted supply of medicines is one of the primary priorities of developing nations; therefore, great emphasis is placed on efficient pharmaceutical supply chains (Jaberidoost et al. 2015: 1). At every stage in the pharmaceutical supply chain, medical products are exposed to risks of “contamination, diversion, counterfeit and adulteration” (Madadi, Kurz, Taaffe, Sharp & Mason 2014: 55).

The pharmaceutical industry stringently regulates quality control, auditing, manufacturing and specifications regarding final products and raw materials (Abdallah 2013: 62). Key players within these areas include

large research and development multinationals, large generic manufacturers (drugs, medical equipment and medical supplies) and local manufacturing companies, distributors, medical service provisions, medical groups, insurance companies, government agencies, employers, government regulators and users of health care services (Elmuti, Khoury, Omran & Abou-Zaid 2013: 129).

The interconnectedness of the various players in the pharmaceutical supply chain makes the chain convoluted and complex (Enyinda et al. 2014: 13). The ultimate goal of the pharmaceutical supply chain is the delivery of materials and information in order for patients to receive the best possible care (Elmuti et al. 2013: 129), but this is often difficult to achieve owing to the risks and disruptions that the supply chain is susceptible to.

This study explores pharmaceutical manufacturing, distribution and wholesale organisations. Previous research revealed that pharmaceutical manufacturers

identified contaminated/non-conforming materials, impact on product safety, efficacy and effectiveness, counterfeits, limited traceability, the cost of complying with additional regulatory burdens, and product diversion as the primary threats in their supply chains (Chaudhry & Stumpf 2013: 191). In addition, owing to the participation of numerous secondary wholesalers and re-packers within the supply chain, the handling of prescription drugs has increased prior to such drugs reaching the end users. This situation has created a porous system and limited visibility, which, in turn, has increased the opportunity for counterfeit drugs to enter the supply chain (Chaudhry & Stumpf 2013: 191). All of these factors are indicative of the numerous risks and challenges faced by the manufacturing, distribution and wholesale organisations, and this provides ample opportunity for the investigation of the supply chain security orientation within their particular settings.

### **The South African pharmaceutical industry**

South Africa has the largest pharmaceutical market within sub-Saharan Africa, which was estimated to be worth R39.3 billion in 2015 (Minnie 2015: 5). The South African pharmaceutical market consists of public and private sectors. The public-sector market is characterised by high demand and low prices due to low-level funding, while drug prices in the private-sector resemble those in the developing world. South Africa is heavily reliant on imports, mainly from partners in the European Union. However, there is an increase in the importation of generic products from India (Gauteng Growth Development Agency 2014: 5). Several multinational organisations have an established presence within the South African market and continue to dominate the industry (Gauteng Growth Development Agency 2014: 3).

### **Pharmaceutical supply chain risks**

Risks within supply chains encompass anything affecting information or material that flows from the initial supplier to the end customers (Elleuch et al. 2014: 642) and may be described by way of terms such as “disruptions”, “uncertainties” or “disturbances”. Disruption of the supply chain refers to events that hinder material flows, thereby causing “abrupt cessation of the movement of goods” (Hishamuddin et al. 2013: 552), which can be either internal or external – natural disasters, labour unrest, terrorism, political instability, and transportation failure are examples of supply chain disruptions (Hishamuddin et al. 2013: 552). Supply chain risk can be defined as the “potential loss for a supply chain in terms of its target values of efficiency and effectiveness evoked by uncertain developments of supply chain

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characteristics whose changes were caused by the occurrence of triggering-events” (Heckmann et al. 2015: 130). Risks identified within the pharmaceutical supply chain include counterfeits, theft, illegal diversion and adulteration, as indicated in Table 1.

**Table 1:** Pharmaceutical supply chain risks

Supply chain risk	Definition/explanation
Counterfeiting	“Medicines that are deliberately and fraudulently produced and/or mislabelled with respect to identity and/or source to make [them] appear to be a genuine product” (Pharmaceutical Security Institute 2015). Both branded and generic products fall within this definition.
Theft	This entails the illegal taking of goods. “Theft may occur anywhere within the supply chain, such as at a manufacturer’s premises, freight forwarders, distribution centres, warehouses, pharmacies or hospitals” (Pharmaceutical Security Institute 2015).
Illegal diversion	Illegal diversion exists when products have been approved and are intended for sale in a specific country, but, through illegal interception, are instead sold in another country. Illegal diversion also occurs when discounted medicines are diverted from a specific group of consumers to another group that purchases the medicines in an unregulated market.
Adulteration	“Any drug that is not recognised in an official compendium is adulterated if it fails to meet the strength, purity or quality which it purports or is represented to possess” (US Food and Drug Administration 2015).

Source: Pharmaceutical Security Institute (2015); US Food and Drug Administration (2015)

The risks identified in Table 1 could have severe consequences for pharmaceutical firms and patients. Counterfeit products, for example, often contain harmful composites, including “road paint, floor wax, shoe polish or carcinogens” (Degardin, Roggo & Margot 2014: 171). In addition, disruptions significantly impact costs and patient care (Enyinda et al. 2014: 14). Risk management could help identify risks that may jeopardise the success or existence of an organisation. Failing to recognise imminent risks or misjudging their severity could lead to loss of customers, damaging liability claims, environmental damage and bankruptcy (Falkner & Hiebl 2015: 1).

### Supply chain risk and security management

Risk management consists of the full range of activities performed by an organisation as a means of dealing with potential and realised risks. It is insufficient to merely have risk management strategies within organisations. Active engagement in risk management practices is critical in order to address the convergence of major risks (Elahi 2013: 120). Supply chain risk management, that is, the recognition and



mitigation of risks by supply chain managers, is a means of reducing overall supply chain vulnerability (Ellinger, Chen, Tian & Armstrong 2015: 477). Tang (2006: 453) defines supply chain risk management as “the management of supply chain risks through coordination or collaboration among the supply chain partners, so as to ensure profitability and continuity”, thus focusing on the development of new approaches to the management of supply chain disruptions. The stages of supply chain risk management include risk identification, risk analysis, risk management and risk monitoring (Enyinda et al. 2014: 16–17; Hoffmann et al. 2013: 199; Kern et al. 2012: 63–66).

Previously, security issues predominantly focused on the domain of a single facility or enterprise. Rarely have the security activities of members and their impact on the performance of a supply chain at a strategic level been considered (Li 2014: 283). Supply chain security is an element of supply chain risk management and aims to “prevent man-made attacks, such as theft, damage or destruction of products and assets” (Markmann, Darkow & Von der Gracht 2013: 1817). Through the implementation of supply chain risk management, organisations can monitor expected hazards and control possible risks, thereby improving the efficiency of the supply chain (Jaberidoost et al., 2015: 2). Supply chain security is defined as

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 (Closs & McGarrell 2004: 8).

The concept of supply chain security is not an isolated idea and should be implemented across the value chain and borders (countries, departments, competitors, customers and transportation modes), while awareness should be integrated at every point of interaction (Leong 2014: 85).

Previous research has highlighted the importance of integrated and holistic approaches within supply chains, as a narrow view of a single firm cannot ensure an examination of the many interrelationships (Kern et al. 2012: 62). Further, it has been suggested that “a truly holistic, integrated approach should be taken to manage risk with the intent of creating value” (Bates, Lai & Lau 2012: 667), thus facilitating acceptance that multiple approaches are required as a means of preventing the occurrence of risks (Lavastre et al. 2012: 832). Therefore, supply chain security orientation is considered a tool for minimising supply chain disruptions evident in pharmaceutical supply chains. Supply chain security orientation integrates both supply chain risk management and supply chain security management and incorporates practices and principles from both paradigms.

## Supply chain security orientation

Autry and Bobbitt (2008: 46) define supply chain security orientation as

a firm's organisation-wide propensity to partner, plan, adapt, collaborate, and communicate, both internally and with external trading partners and governmental entities, toward the dual goals of strategically preventing and responding to potential security breaches threatening supply chain assets and the minimisation of risks that threaten the performance and/or continuity of supply chain operations.

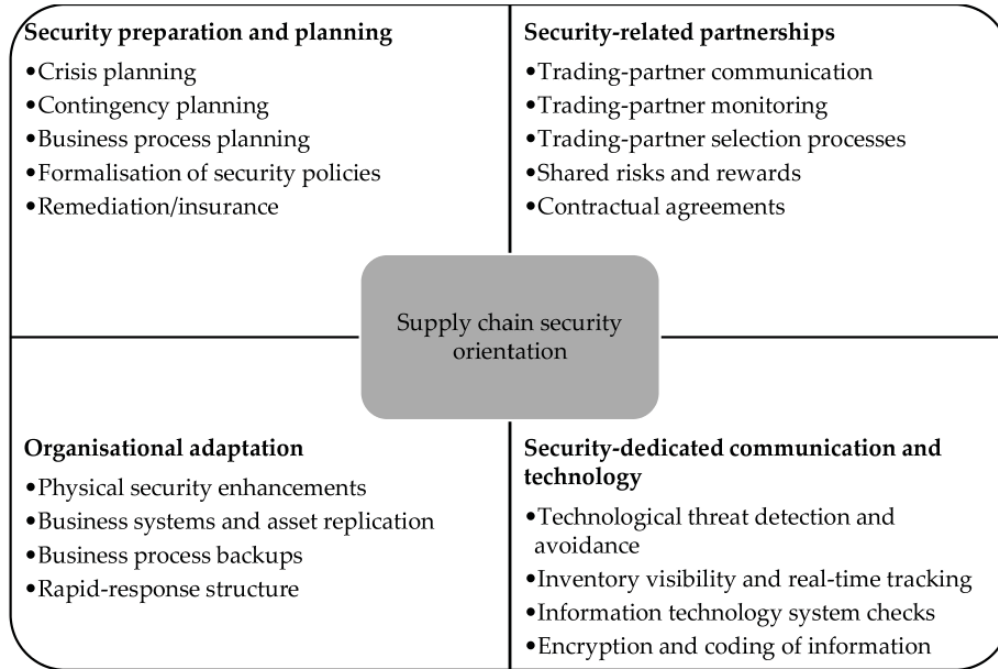
Supply chain security orientation can be expected to lead to a prompt and precise response to supply chain security issues. It is marked by: a willingness to learn from negative events; communication regarding errors; being blame-free and open; and employees being trained to recognise and respond to abnormalities within systems. Supply chain security orientation reflects a firm's collective attention to supply chain risk management and supply chain security management (Zsidisin & Ritchie 2008: 309).

### *Supply chain security orientation categories*

Based on an extensive literature review of supply chain security, Autry and Bobbitt (2008: 44–46) identified four supply chain security orientation categories, namely: security preparation and planning; security-related partnerships; organisational adaptation; and security-dedicated communication and technology. Further empirical analyses of these categories yielded themes that defined the manifestation of supply chain security orientation across the risk and security paradigms. Figure 2 illustrates the four categories and themes identified.

With regards to the security preparation and planning category, the findings of Autry and Bobbitt (2008: 50) indicate that firms adopting a supply chain security orientation were engaged in various forms of security and risk-related planning. This was mainly driven by uncertainty and risk pertaining to the loss of key assets and personnel. Business process planning sessions were used to facilitate these planning sessions. Additionally, other firms employed insurance policies as a way to reduce damaging and disruptive events. Autry and Bobbitt (2008: 51) state that, although insurance could be classified as a reactive rather than a preventative process, it was a recurring theme among participants when addressing the security/risk planning process.

The second category, security-related partnerships, explains the importance of creating and maintaining business relationships with the customer and supplier in order to manage possible supply chain security issues. Communication, the use of contractual agreements, and sharing related risks and rewards were all identified as



**Figure 2:** Supply chain security orientation categories and themes

Source: Autry & Bobbitt (2008: 49)

crucial to effectively managing supply chain security across the chain. Additionally, the respondents emphasised the importance of the supply chain partner’s dedication to supply chain security. In essence, firms with a heightened supply chain security orientation should not only expect the same of their partners in the chain, but should also assist them to create awareness of supply chain security risks.

Organisational adaptation, the third category identified by Autry and Bobbitt (2008: 52), explains that some key changes internal to the organisation may be required to secure the supply chain. The most prominent aspect mentioned was physical enhancements, like upgrading buildings with enhanced security features. Moreover, the replication of key assets and the establishment of alternative business processes in cases of security breaches are essential in adapting to crises.

The final category of supply chain security orientation relates to certain technological system measures which could be employed to reduce not only the probability of occurrence, but also the impact should a breach occur. Some key technologies mentioned were the use of radio-frequency identification (RFID), GPS and real-time transportation systems in order to detect and prevent possible

weaknesses in the supply chain. Security regarding information systems was also mentioned, with regular backups and protection of critical data all being ways to mitigate information breaches (Autry & Bobbitt 2008: 52).

### Drivers of risk and security implementation

The implementation of risk management practices and procedures has been found to increase a firm’s value, improve customer relationships, provide useful insights, and improve managerial judgement while enhancing quality and confidence in terms of investment decisions (Hudin & Hamid 2014: 163). Organisations usually adopt the existing elements from the external environment in which they operate and abide by the prevailing norms, values and rules as laid down within their industries. This is a result of isomorphism, which arises from three types of external pressure – coercive, normative and mimetic (Glenn Richey, Williams, Lueg, Taylor & Cook 2009: 598). Table 2 describes each of these three external pressures.

**Table 2:** Types of external pressure

External pressure	Description
Coercive pressure	Firms adopt the norms, values and rules within their industries out of fear of sanctions. This type of pressure results from force, persuasion and/or invitations from parties in the external environment. Such pressure normally takes the form of government regulations and laws.
Normative pressure	Normative pressures result from cultural expectations through which norms and standards are established. Conforming to these pressures occurs because of the moral and ethical obligations placed on organisations as a result of such cultural expectations.
Mimetic pressure	The desire to look like other organisations leads to mimicking of another organisation’s practices, structures or outputs. Organisations succumb to this pressure as a result of environmental uncertainty, as well as ambiguity and complexity in terms of the achievement of organisational goals.

Source: Glenn Richey et al. (2009: 598)

Findings from previous research indicate that the main drivers of supply chain security are customers, the government, competitors and society. Other studies have indicated that suppliers are also a pressure component (Glenn Richey et al. 2009: 608). A study on drivers of risk management resulted in a larger set of components being identified (Hudin & Hamid 2014: 164–165). The identified drivers of risk management adoption are set out in Table 3. The present study will, in addition, attempt to comprehend possible drivers and moderating factors pertaining to a supply chain security orientation within pharmaceutical companies.

**Table 3:** Drivers of risk management adoption

<b>Drivers of risk management adoption</b>	<b>Description</b>
Corporate governance	Findings indicate that corporate governance and shareholder value are key drivers in risk management adoption and implementation.
Compliance with rules and regulations	In some instances, risk management practices and procedures have to be implemented on a compliance basis.
Pressure from external auditors	Auditors may exert pressure on organisations to implement risk management procedures so that the organisations do not ruin their good reputation in the event of disruptions.
Characteristics of the firm and industry	Organisations with a high turnover are more likely to adopt risk management procedures and processes, since the high cost of risk management hinders the implementation thereof in low-turnover businesses.
Internal factors	Leadership within an organisation also serves as a determinant of risk management implementation.
Potential benefits of risk management	Firms that have recognised the potential benefits of risk management processes, such as the economic benefits, are more inclined to adopt risk management practices.
Business trends	Trends such as outsourcing, supplier reduction, globalisation and product variants have increased the adoption and implementation of risk management. This is due to the increased supply chain risks and vulnerabilities that accompany these new business trends.
Occurrence of risk events	Events such as 9/11, Hurricane Katrina and SARS (severe acute respiratory syndrome) have led to the adoption of risk management. Behavioural motivation increases as a result of risk perception due to such events; therefore, risk management practices and procedures are more readily adopted at such times.

Source: Hudin & Hamid (2014: 164–165).

## Research methodology

### Research design

A descriptive, qualitative research design was used in order to increase understanding and knowledge of a supply chain security orientation (Given 2008: 58; Merriam 2002: 6). This approach provided a detailed and rich depiction of the experiences of the participants and involved an exploration of multiple perspectives relating to supply chain security orientation through the identification of underlying themes to which participants gave recognition during topic discussions (Plano Clark & Creswell 2015: 289; Neergaard, Olesen, Andersen & Sondergaard 2009: 2).

## Sampling

The unit of analysis for the study consisted of organisations participating in the pharmaceutical supply chain. The pharmaceutical organisations identified focus specifically on medication for consumer health care. Homogenous sampling was used to sample participants. The aim of homogenous sampling is to identify certain sites or groups based on similar characteristics or traits (Creswell 2012: 208). Participants were recruited based on their job title as well as managerial position (middle or senior management) within the identified organisations. The criterion for inclusion was a senior appointment within the field of supply chain/logistics and/or as a responsible pharmacist. Furthermore, inclusion of organisations was restricted to pharmaceutical organisations with headquarters in Gauteng, although they all have a national footprint. A total of ten semi-structured interviews were conducted. Table 4 provides a summary of the participants included in this research.

**Table 4:** Summary of participants

<b>Pseudonym</b>	<b>Position/job title</b>	<b>Years' experience in the industry</b>	<b>Organisation pseudonym</b>	<b>Type of organisation</b>	<b>Duration of interview</b>
I002	Head of Supply Chain	25 years	M001	Manufacturing	43:37
I005	Logistics and Supply Chain Manager	17 years	M002	Manufacturing	17:25
I011	Operations Manager	4 years	DW001	Distribution and wholesale	32:41
I017	Logistics Controller	7 years	M003	Manufacturing	43:11
I023	Responsible Pharmacist and Procurement	15 years	DW002	Distribution and wholesale	13:41
I031	National Risk Manager	2 years	D001	Distribution	19:25
I041	Managing Director and Responsible Pharmacist	27 years	DW003	Distribution and wholesale	32:13
I047	Head of Supply Chain	6 years	M004	Manufacturing	27:40
I059	National Risk Manager	4 years	D002	Distribution	34:25
I067	Executive Manager	20 years	DW004	Distribution and wholesale	33:49

The final sample size was based on the principle of saturation. Data saturation encompasses the continuous inclusion of new participants within the study until the data set is complete, as determined by data replication or redundancy. Thus, saturation is achieved when nothing new is added to the data already collected (Bowen 2008: 140). During the seventh interview, no new results were added to the existing themes, but three more interviews were conducted to ensure data saturation. These additional interviews yielded no new codes/themes, but merely gave rise to variations on the already identified themes and codes.

### Data collection

Data was collected through semi-structured interviews. Interviews were conducted at participants' respective workplaces, either in the participants' offices or in a meeting room. Two industry practitioners participated in the pilot study. Based on the pilot study results and feedback received, the discussion guide was amended accordingly. Interview questions relating to supply chain security orientation were asked so as to obtain information relating to participants' opinions, understanding and perceptions. Probing questions were incorporated as tools in order to obtain more detailed information. All interviews were audio-recorded and transcribed verbatim by a commercial transcription service within two days of the interview. Each interview recording was listened to twice while the transcripts were read so as to ensure accuracy. Transcripts were amended as needed in order to portray the actual interview.

### Data analysis

Thematic analysis was used to analyse the data collected in this study. Thematic analysis is a method of identifying and organising data in a systematic way with a view to finding patterns in the data (Braun & Clarke 2012: 57). Themes are the outcomes of a thematic analysis, and codes are used to label relevant data, which is later used to organise related segments of data (Braun & Clarke 2012: 57). The recordings of the interviews were transcribed and listened to several times by making notes of any ideas or concepts which came to mind. This process is referred to as "memoing" (Creswell 2012: 243). The transcribed data was then coded, which involved allocating words or phrases in order to describe a piece of data in the transcript (Creswell 2012: 243). Inductive codes were used to code the data collected. Inductive codes are developed through direct examination of the data (Nieuwenhuis 2007: 107). Lastly, the codes were used to develop themes in the data.

### Trustworthiness

Great importance is placed on data quality and on the validity thereof. Demonstration of quality and rigour for this research study was based on the criterion of trustworthiness, namely credibility, dependability, confirmability and transferability. Reliability was ensured through the implementation of dependability and transferability. Dependability occurs when another researcher can pursue the decision route implemented by the first researcher (Thomas & Magilvy 2011: 153). Dependability was achieved through detailed descriptions of the research design, implementation and data-collection procedures. Presenting detailed descriptions of the phenomenon researched as well as background data to establish the context of the study is often adequate to accomplish transferability (Shenton 2004: 73). Validity was achieved through the implementation of credibility and confirmability. Credibility refers to the accurate analysis of the meaning of data (Whittemore, Chase & Mandle 2001: 530). Therefore, it is expected that data responses and the researcher's judgement of intended meaning should correspond (Autry & Bobbitt 2008: 47–48). Peer debriefing was used to ensure credibility. Frequent sessions were scheduled with a knowledgeable supply chain scholar and qualitative-methodology expert to ensure that the relevant data was interpreted correctly (Shenton 2004: 67).

In addition, confirmability refers to a “qualitative researcher's comparable concern [with] objectivity” (Shenton 2004: 72). Research findings should be indicative of the experiences and meanings of the participants, rather than the attributes and predilections of the researcher (Shenton 2004: 72). Reflexivity was implemented to achieve confirmability (Creswell & Miller 2000: 127). Any shortcomings in the research methods implemented, as well as any beliefs, assumptions or biases which the researchers may hold, are acknowledged as limitations.

### Ethical considerations

All information received from participants was treated as strictly confidential. This research study adhered to all ethical requirements and was approved by a research ethics committee of a South African university prior to conducting fieldwork. All participants were provided with an informed-consent form, which they were required to read and sign. The informed-consent form explicitly stated that participation was voluntary and that no form of incentive(s) would be given for their participation. Further, participants could withdraw from the study at any time. All participants and organisations were given a pseudonym, thus ensuring anonymity.



## Results

### Risks in the pharmaceutical supply chain

Various risks were identified within the pharmaceutical supply chain. The specific risks that participants were concerned about are indicated in Table 5.

**Table 5:** Pharmaceutical supply chain risks identified

Risks	Participants										%
	I002	I005	I011	I017	I023	I031	I041	I047	I059	I067	
Hijacking	X	X		X	X	X	X		X		70
Syndicates	X		X	X			X		X	X	60
General theft	X			X	X				X	X	50
Counterfeits		X		X				X	X		40
Destruction of expired medicine				X		X		X		X	40
Black market	X				X					X	30

Clearly, managers in the pharmaceutical supply chain are facing major risks, the most significant of these being hijacking, syndicates and general theft. Logically, these would lead to significant financial losses. However as indicated by participant I002, these losses are amplified if one considers the time spent on preventing and/or investigating these risks:

The syndicates out there are very active. I can recall that, in my facility, I had three syndicates operating, and each syndicate would target different products and you had everything in place ... to try and break these syndicates and how they operated. I probably spent 30% of my day or my time being a policeman – doing polygraphs, doing... you name it. (I002, Head of Supply Chain)

Syndicates. Syndicates, syndicates, syndicates. So, out of experience, we've been dealing with syndicates for the past three years that have actually cost the company not a couple of hundred thousand rand but a couple of million rand. (I011, Operations Manager)

A creative solution to this issue as well as the theft problem was mentioned by participant I059:

The security company at our gate and the security company in the warehouses are not the same security company. The security company on our perimeter is South African. The guys in the warehouse at our search points are from Angola. They only speak Portuguese. They don't stay in townships. We have a housing facility for them. We take them to the housing facility and to and fro from work. So, there is no socialising and friendship-building over weekends, and watching soccer or playing rugby [or] socialising in a tavern. (I059, National Risk Manager)

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This indicates the length the organisation concerned has gone to in order to solve these issues. Essentially, the language barrier and the fact that there are no opportunities for these individuals to informally spend time together has mitigated some of the possible security issues of theft and organised syndicates.

Additionally, hijackings seem to be a major risk for the pharmaceutical supply chain, with 70% of the respondents indicating this as a serious concern. Several participants indicated this as their biggest risk in the chain:

I'm very concerned about hijackings and goods-in-transit heists. That's my main concern. (I041, Managing Director and Responsible Pharmacist)

Hijacking of, vehicles and then making that product available on the black market. The safety of those products can't be guaranteed" (I023, Responsible Pharmacist and Procurement)

Finally, a specific risk which needs mentioning pertains to the destruction of expired medicine. The need to destroy expired medicine will always be present within a pharmaceutical supply chain. Most firms see this as a component of reverse logistics, and, in essence, this becomes the responsibility of the suppliers, manufacturers or third-party waste companies. Some managers still feel that this is a "loophole" within the chain, as indicated by the following quote:

I think that destruction of goods is also an area that could be a potential loophole. Just, you know, ensuring that the goods that need to go for destruction actually do go for destruction. (I017, Logistics Controller)

In order to overcome this potential risk within the pharmaceutical supply chain, some respondents indicated that it was formal policy for someone in the firm to be present and to witness the physical destruction of expired medicines. The problem, however, is that not all firms have this sort of policy, and many rely only on a destruction certificate as proof that the medicine was destroyed. This creates a potentially significant security risk within the pharmaceutical supply chain.

### Manifestation of supply chain security perception and orientation

Previous findings indicated that the manifestation of supply chain security orientation emerged through the identification of supply chain security perceptions (Autry & Bobbitt 2008: 50). Participants in the present study were therefore requested to indicate their understanding of supply chain security. The findings indicated that the participants understood supply chain security as protecting products while ensuring their integrity, as illustrated below:

It is from the manufacturer through the whole process of transportation to the distributor, from the distributor to the ... customer, which is the seller, from the seller till the end user, [who]

will then receive the product in a state that's conducive ... for public use. (I059, National Risk Manager)

... I think it means ... the delivery of goods – any goods, in our case, medicine – in a secure manner ... to the end user. (I023, Responsible Pharmacist and Procurement)

Further, Autry and Bobbitt (2008: 49–53), as indicated earlier, identified four categories of supply chain security orientation, namely security preparation and planning, security-related partnerships, organisational adaptation, and security-dedicated communication and technology. Themes that emerged from participants' responses were accordingly grouped according to these four categories, as shown in Table 6.

**Table 6:** Identified supply chain security orientation categories

Supply chain security orientation categories	Supply chain security orientation themes	Participants									
		I002	I005	I011	I017	I023	I031	I041	I047	I059	I067
Security preparation and planning	Business continuity planning		X		X		X	X	X	X	X
	Formalisation of business procedures and policies	X	X	X	X	X	X	X	X	X	X
	Insurance				X			X			
	Regulatory compliance	X	X	X	X	X	X	X	X	X	X
	Training and development	X			X	X	X	X	X	X	X
Security-related partnerships	Trading-partner communication	X	X	X	X		X		X	X	X
	Trading-partner monitoring	X	X			X			X		
	Trading-partner selection process								X		
	Contractual agreements				X						X
	Shared risks and rewards				X				X		
Organisational adaptation	Business process backups								X	X	
	Internal security measures	X		X	X	X	X	X		X	X
	Physical security enhancements	X	X	X	X		X	X	X	X	X
	Rapid-response structure				X		X				
Security-dedicated communication and technology	Automation	X								X	
	Cybersecurity	X									
	Inventory visibility and real-time tracking	X	X	X		X	X	X	X	X	X
	Technological threat detection and avoidance	X	X		X	X	X	X			

### *Security preparation and planning themes*

Security preparation and planning themes may be described as the plans created and implemented by organisations to identify and prevent risks, as well as provide mechanisms with which such organisations can return to normal operations (Autry & Bobbitt 2008: 44). All of the participants indicated that their organisations comply with regulatory requirements and have formal business procedures in place to ensure supply chain security. Additionally, the majority of the participants provide for business continuity planning in cases of extreme security breaches. The following quotes indicate some of the security responses:

... we do have a standard operating procedure. There is a wide range of standard operating procedures from the receiving process, the dispatch process, picking, packing ... stock rotation and so forth, keeping security in mind. (I067, Executive Manager)

... we have a corporate policy ... everyone around the world has the same policy. That policy is aligned with the FDA, the EU, and what we have to do is adhere to that policy as well as to the local requirements. So, in other words, in our case it would be the MCC, the Medical Control Council ... we [adhere to] good distribution practice, good manufacturing processes, [and] good warehousing processes and security practices. (I005, Logistics and Supply Chain Manager)

And we have got a very serious training programme ... you can be here ten years but every three or four months you will have a refresher course on the same things that you have been doing for ten years. (I031, National Risk Manager)

Contrary to the findings of Autry and Bobbitt (2008: 48), when asked about preparation for, and planning of, supply chain security, only two respondents indicated insurance as a key factor in securing the supply chain. Moreover, the quote below illustrates that insurance in this context is only seen as covering financial loss and is not regarded as a key component in recovering from a security breach:

The insurance will cover the monetary aspect, but that's ... it. (I017, Logistics Controller)

### *Security-related partnership themes*

This category may be described as encompassing the relationships leveraged with supply chain partners in order to ensure the protection and safety of assets and products while facilitating supply chain continuity. Collaboration between supply chain partners has been identified as a necessity in achieving security initiatives (Autry & Bobbitt 2008: 45). Only a few participants confirmed that collaboration does exist between trading partners, as indicated below:

We collaborate with our third-party distributor because ... they are distributing [to] other multinationals as well ... we sit down once a month to have a discussion with [them] in terms of new trends, new issues and so forth. (I005, Logistics and Supply Chain Manager)

However, some participants told a completely different story, indicating that collaboration was limited or, shockingly, even non-existent. The quote below shows the extent of collaboration (or, rather, lack of it) for this particular participant:

Unfortunately, everyone fights for their own profit and I'm just going to ensure that ... my security is in place ... I don't care about ... what happens to stock once I've delivered the stock and once I've got a signed delivery note – then it becomes the new owner's responsibility. So, unfortunately, out of experience, the supply chain from manufacturing right through to the end user doesn't work together ... . (I011, Operations Manager)

Collaboration among partners in the pharmaceutical supply chain therefore needs to be improved. Only one participant mentioned stringent criteria for selecting a trading partner, specifically mentioning the partner's security orientation as a key criterion. Moreover, very few participants mentioned that they create a dual responsibility for security and risk management. Autry and Bobbitt (2008: 51) state that a key component in motivating and encouraging firms to uphold stringent security agreements is to create this dual responsibility among partners. As indicated by participant I017, a sense of shared risk and rewards is not evident within the pharmaceutical supply chain:

Yes, I definitely think that it's their [3PLs'] duty, considering the role that they play. They must, at all times, if they see a risk, ... implement something. (I017, Logistics Controller)

### *Organisational adaptation themes*

Organisational adaptation themes relate to any additional measures implemented by the organisation to further enhance the process of securing the supply chain. The major themes identified in the present study included internal security measures, physical security enhancements, rapid-response structure, and business process backups. The majority of the participants' organisations employed physical security enhancements in order to secure the supply chain. Participant I005 paints a picture of what most of these organisations look like:

Security is paramount; so everything is under camera, everyone is searched, going in and out, [and] any type of incident ... [is] logged, and so forth, and analysed. (I005, Logistics and Supply Chain Manager)

In addition to physical enhancements, internal security measures emerged as an additional theme related to the measures implemented in ensuring the integrity of employees and the monitoring and prevention of any theft within the organisation. Participants discuss this below:

You work with people; you screen them beforehand and you conduct referrals beforehand to see that the ... person you employ at least has integrity. (I067, Executive Manager)

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We do random polygraphs, we rate random polygraphs, which brings it out, shows us very, very quickly if somebody is being deceitful. (I031, National Risk Manager)

Before the vehicle is even leaving the site, we do a vetting and screening of the staff that will be on the vehicle. Even if it's a short trip or a long trip, [it] doesn't matter, the vetting of the driver would have taken place as well as [of] the assistant on the vehicle. (I059, National Risk Manager)

One main area of concern is business process backups. Most of the participants rely heavily on third-party logistics providers (3PLs) for transport and warehousing, with no formal backup in place should there be a serious security risk in any of the third-party processes or facilities.

### *Security-dedicated communication and technology themes*

Security-dedicated communication and technology comprises all technological system measures which organisations can implement to reduce the likelihood or impact of supply chain security breaches (Autry & Bobbitt 2008: 52). The themes identified include real-time tracking and automation, technological threat detection and avoidance, as well as inventory visibility. Automation emerged as an additional theme from participants' responses (as to which, see the quotes below), and this may be defined as automatic and technological equipment used within facilities, such as blister machines and automatic picking machines:

... the order is weighed and goes through different weigh stations on the conveyer belt ... the order would then know based on the plastic bin what the weight is, the weight of what product needs to go in ... we scan the product in, put in quantities and, as it goes past, it weighs – "Yes I'm supposed to have one kilo, one point one kilo, of stock in here". It weighs it; if it doesn't add up, it then diverts it for security checks. So every order, anything that the system picks up as a discrepancy, ... it's fully automated. (I002, Head of Supply Chain)

As one participant articulated, the use of automatic picking machines could greatly improve security:

Because it would obviously enhance your security to a great extent, because you limit the amount of people working in your facilities. The human contact with medication is limited ... . (I067, Executive Manager)

An additional theme that could be added to the category of security-dedicated communication and technology is cybersecurity. In today's technology-driven world, some of the most valuable and sensitive company information is stored on computers or in the Cloud. Ensuring the safety of that information should logically be included in a firm's supply chain security orientation. Sensitive information like supplier prices, types and quantities of stock on hand, and shipping routes should

not fall into the wrong hands. The impact of a cyberattack was seen on Friday, 12 May 2017, when ransomware infected more than 230 000 computers in 150 countries (Willis 2017). What is more shocking is that approximately 48 National Health Service organisations in England were affected, thereby directly impacting the pharmaceutical supply chain. Interestingly, only one participant mentioned cybersecurity as a key consideration, as indicated in the quote below:

So, not only if we're looking at the product but even [the] company itself. If we look at our data security, we look at our... I mean we just had a blitz yesterday – where people walked through the building and if they found laptops that weren't secure they actually took the laptops away. (I002, Head of Supply Chain)

### Drivers of supply chain security orientation

Specific events or phenomena drive organisations to adopt supply chain security orientation. These events or phenomena are the motivators that push an organisation to engage in security/risk management practices (Glenn Richey et al. 2009: 598). The findings of the present study suggest that corporate governance, compliance with rules and regulations, potential benefits of risk management, and the occurrence of risk events are the main drivers of supply chain security orientation. The pharmaceutical industry, being highly regulated (Abdallah 2013: 62), often faces compliance risks when failing to adhere to regulations. Thus, pharmaceutical organisations have to put in place security/risk management measures by law. Further, the study's participants acknowledged that they had a responsibility regarding patients' health and safety, which could be described as an internal drive to ensure product integrity. Industry rules and regulations are often appropriate steps that are laid down to ensure that pharmaceutical organisations meet their aforementioned responsibilities. Compliance with rules and regulations may therefore be regarded as an external driver. The following quotes illustrate the previously mentioned subthemes:

... I think the main thing is, as a global company, we have a social responsibility ... We're dealing with health ... we're dealing with human beings. So we have a responsibility to ensure that our products ... are products [that are going to] help them and are products that they expect to get – they're not counterfeit, they're not fake, they're legitimate products. (I002, Head of Supply Chain)

You also don't want the product to be out there; it's a huge compliance risk ... you know who controls that substance if it goes out ... If anyone takes it, [who's] liable for it? ... that's the big driver. (I047, Head of Supply Chain)

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The identified risks indicated in Table 5 contributed to the emergence or occurrence of risk events and constituted yet another external driver leading to the adoption of supply chain security orientation. In addition, participants recognised the benefits of securing the supply chain – an internal driver of sorts. Internally, loss of sales and brand reputation can be considered the main drivers in the adoption of supply chain security orientation. These subthemes were highlighted as follows by the participants:

... They notice there is an increase in hijackings or they notice there is an increase in groups targeting certain types of medicine or they are aware that there's going to be a strike, for example, which could lead to a criminal element. For sure, it could lead to damage of your cargo – that kind of thing ... they could decide, perhaps, that they need to ... implement security measures because of those risks ... . (I017, Logistics Controller)

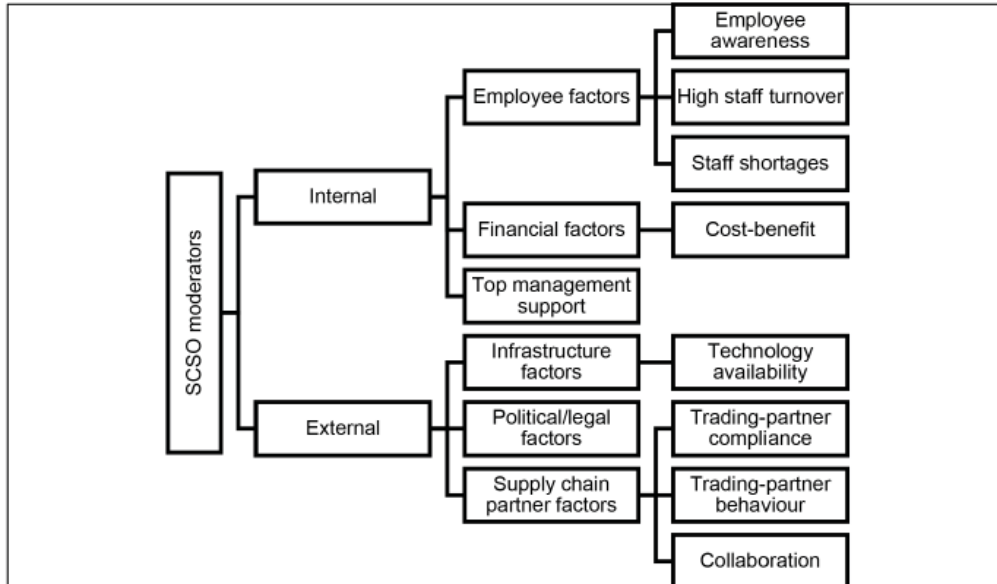
So, sales is obviously a huge driver to secure stock ... you know it is [the] company's reputation. (I047, Head of Supply Chain)

These findings are similar to previous findings. Autry and Bobbitt (2008: 53–54) identified security vulnerabilities, perceived risk, and partner directives as the main driving forces of supply chain security orientation. Security vulnerabilities are defined as the recognition of tangible risks, while perceived risk is described as the “consequences and certainty with which an undesirable event may occur” (Autry & Bobbitt 2008: 54). These relate to the occurrence of risk events subtheme. Further, security concerns/issues of trading partners have also been identified as drivers in adopting the elements of supply chain security orientation, which relate to the compliance with rules and regulations subtheme.

### Moderators of supply chain security

This study has established the main types of security risks in the pharmaceutical supply chain and has explored the supply chain security orientation of the pharmaceutical supply chain in the South African context. We now examine the external and internal moderators which could either facilitate or inhibit the implementation of supply chain security orientation (SCSO). Figure 3 illustrates these moderators as identified by participants.





**Figure 3:** Identified supply chain security orientation moderators

Participants identified employee, financial and top management support factors as the internal moderators. Financial factors emerged as a theme, as highlighted by the following quotes:

... I think in the ... end it is probably just finance, budgeting; these things are not easy and they are costly. And to get stuff implemented ... you cannot just go and put R10 million worth of stuff in to maybe save half a million. (I031, National Risk Manager)

Financial factors were indicated as the major internal inhibitor, followed by employee factors like high turnover, staff shortages, and lack of employee awareness of security precautions. Moreover, from participant responses, infrastructure factors, political/legal factors, and supply chain partner factors emerged as external moderators, as indicated by the following quote:

... also legislation is a bit of an issue sometimes, because, sometimes, what they're trying to do is quite onerous in terms of... if they just allowed us to do certain things from a legislative point of view, we could actually control it better. Sometimes, the legislation that they bring in has [a] negative impact and [does not create] an environment where people want your product. (I002, Head of Supply Chain)

Political/legal factors were identified as the major external inhibitor. In addition, supply chain partner factors were regarded as the major facilitator in security implementation. This was surprising considering that, in some organisations, there was almost a complete lack of collaboration with, or attention to, the supply chain partner.

## Conclusion

### Summary of the findings

The purpose of this research study was to explore the level and understanding of supply chain security orientation and of security awareness within organisations participating in the pharmaceutical supply chain. Four main themes emerged, namely the main risks within the pharmaceutical supply chain, the drivers of supply chain security orientation, supply chain security perception and manifestation, and, lastly, the moderators of supply chain security orientation. Hijacking, theft and syndicates were identified as the main risks within the South African pharmaceutical supply chain. Not only are these risks leading to significant losses, but the extra time and resources spent on preventing and mitigating these risks are also immense. Additionally, a possible red flag was identified in the form of the destruction of expired medicines. Some organisations are managing this process stringently according to the responses of several participants. This process was identified as an area where possible theft could occur, as not all organisations are physically destroying the medicines but are rather outsourcing the process.

Regarding the four categories of supply chain security orientation, the participants' responses yielded some interesting results. Firstly, most organisations were employing security preparation and planning, were compiling formal plans, and were undertaking scenario planning. However, none of the participants had considered the role of insurance from a supply chain security perspective. In other words, insurance was seen merely as a method of recovering financial losses. We accordingly propose that the pharmaceutical supply chain should consider the importance of the role of a competent insurer and of favourable insurance policies in speeding up the likelihood of recovery after a security breach. Secondly, security-related partnerships require the most attention from the pharmaceutical supply chain. There is collaboration to some extent. However many organisations still function within a silo mentality, assigning security risk to a single firm as opposed to a shared risk-and-reward approach.

Furthermore, there is a lack of business process backups, since the majority of the organisations rely heavily on a single 3PL for warehousing and transportation.

Organisations should have a backup that could be used should major security risks occur within the outside parties' operations. Thirdly, all of the organisations have adapted in order to enhance security, among other things through highly secured facilities and security processes. An interesting finding in this category was the use of internal security measures specifically regarding human resources. Random polygraphs, driver screening, and additional checks after product picking were all strategies employed internally to enhance supply chain security. Finally, almost all of the organisations employed security-dedicated communications and technology. The most prevalent were real-time information technologies and inventory tracking and tracing. Automation was identified as a possible solution to eliminate the human factor and so reduce security risks. An additional red flag which was identified in this category was cybersecurity. Only one participant mentioned this when asked to explain their understanding of supply chain security. Given the nature of pharmaceutical supply chain information and the possible outcomes should this information be leaked, more attention should be paid to this aspect of supply chain security.

The main drivers of supply chain security orientation were identified as corporate governance, compliance with rules and regulations, the benefits of introducing risk management processes, and the occurrence of risk events. A few participants indicated that only once a specific risk or security breach occurred were formal risk and security management processes put in place to manage that specific risk. This strengthens the case for the promotion of supply chain security orientation within firms, a move which would involve all players in the pharmaceutical supply chain. With more individuals considering supply chain security, risks can possibly be identified and prevented before they occur.

Within the last theme, the main moderators of supply chain security orientation were identified. Internally, employee factors (staff awareness, staff turnover and staff shortages), financial factors (cost-benefit analysis), and top management support were identified as moderators of supply chain security orientation. Externally, infrastructure (availability of the latest technology), political/legal factors, and supply chain partner factors (partner compliance, partner behaviour, and collaboration) were identified as moderators of supply chain security orientation. Political/legal factors were identified as the major external inhibitor. In addition, supply chain partner factors were regarded as the major facilitator in security implementation.

### Managerial implications

Hijackings, syndicates and theft should be a top priority for managers in the pharmaceutical supply chain, as significant losses occur due to these security risks. However, it is not enough to merely be aware of these risks. Rather, there should be a supply chain-wide responsibility to not only identify, but also prevent, such security risks. The two red flags identified, namely the process of disposing of expired medicine and cybersecurity, should be addressed in order to prevent these security risks from occurring within the pharmaceutical supply chain. Further, taking the time to select a competent insurer and a favourable insurance policy will not only assist in recovering financial losses, but can also possibly assist in speeding up the likelihood of recovery after security breaches. In addition, managers should be encouraged to consider additional initiatives for ensuring and establishing collaboration within the pharmaceutical supply chain. Finally, ensuring that there are key business process backups can assist managers to mitigate the potential impact of a major security breach.

### Limitations of the study

The first limitation of this study is the use of a small sample size. Therefore, the findings cannot be generalised to the broader pharmaceutical industry. In addition, this research study explored pharmaceutical organisations located in Gauteng only. Expanding the study to other geographical areas may yield different results. Secondly, the findings illustrate the viewpoint of the private sector only, as none of the participants were from the public health-care sector. Future research should include government entities and/or agencies participating in the pharmaceutical supply chain. Thirdly, the sample size only included participants employed within a supply chain and/or in a logistics position, as well as employees who are registered responsible pharmacists. As indicated, supply chain security orientation is a firm-wide concept; hence employees from other functional areas should be included in future research. Lastly, future research could include multiple departments within organisations in order to establish the degree of conceptualisation of supply chain security orientation among departments. Further recommendations also include a greater focus on pharmaceutical distribution and wholesalers and the specific risks and disruptions they are faced with.

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