



Exploring Supply Chain Resilience in the South African Telecommunications Industry

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ABSTRACT

Supply chain resilience (SCRES) is an essential consideration for organisations globally across diverse industries. Paradoxes in the SCRES literature are evident. On the one hand, more resilience is considered better while on the other hand it is acknowledged that resilience results in an additional cost to the focal organisation. The purpose of this study was to explore SCRES, specifically resources committed and predetermined in the process of achieving resilience. Twelve semi-structured interviews were conducted in the South African telecommunications industry. The main findings of this study identified the drawbacks of SCRES which include financial implications, unwillingly adopting a follower strategy and deleterious effects on customer service. The study further identified measures to prevent the over-utilisation of resources to achieve SCRES such as the learning curve, customer satisfaction and the optimal level of SCRES. Organisational strategy and return on investment (ROI) are the primary considerations for allocating resources to achieve SCRES. This study is one of the first generic qualitative studies to explore SCRES a developing country context. Managers can consider the findings of this study to develop a relevant and customer-driven SCRES strategy that would appeal to organisational shareholders.

Key phrases

Disruption; Gauteng; generic qualitative research; semi-structured interviews; South Africa; supply chain resilience and telecommunications

1. INTRODUCTION

Milton Friedman, the famous economist, once exclaimed: “There ain’t no such thing as a free lunch” (Shapiro 2008:1). This view implies that every benefit has some monetary or non-monetary cost to the beneficiary (Grossmann, Steger & Trimborn 2013:76). Supply chain (SC) disruptions are imminent and must be considered throughout the entire SC (Snyder, Atan, Peng, Rong, Schmitt & Sinsoysal 2016:90). Organisations have to consider a multitude of potential disruptions to ensure the normal functioning of the supply chain after the occurrence of such a disturbance. Supply chain resilience (SCRES) is, therefore, essential to minimise the effect of disruptions in any particular situation and maintain functionality of organisational activities after a disruptive event (Mandal 2012:48). The term SCRES is defined as an organisation’s ability to gauge, adapt and plan for unforeseen future disruptions, as well as how it will respond to and recover from such occurrences, in an attempt to regain operations to a similar or more favourable level after the disruptive event (Klibi & Martel 2012:882; Stevens & Johnson 2016:24). Considering opportunity cost, there must be some sort of implication or disadvantage associated with SCRES, as no benefit comes without “any costs” (Kelley & Pevehouse 2015:533). It is imperative to explore the drawbacks related to SCRES before committing organisational resources (Christopher & Holweg 2017:13).

Tunisini and Sebastiani (2015:302) argue that perceived end-user value and the performance of an organisation’s SC are closely related. This argument not only accentuates the significance of supply chain management (SCM), but strengthens the imperatives of reliability, responsiveness, resilience, relationships and support from the organisation in the eyes of the end-user (Christopher 2016:23-24). An organisation must manage risks stemming from various sources, both within and external to the organisation. Organisations must consider two main categories of risks that can rapidly alter the routine functions of any SC. The first category, *macro-environmental risks*, includes risks such as natural disasters, terrorism and political turbulence. The second category, *micro-environmental risks*, refers to the consideration of competitor actions, supplier activities and other recurring situations within the organisation (Ho, Zheng, Yildiz & Talluri 2015:5035).

Considering the resource-based view (RBV), it is evident that an organisation acquires a competitive advantage over rivals in the event of SC disruptions. RBW analyses and interpret internal resources of the organisation and capabilities in formulating strategy to achieve sustainable competitive advantages. Resources are seen as inputs that enable organisations to carry out its activities. Internal resources and capabilities determine strategic choices made by firms while competing in its external business environment (Madhani 2009:2). Although disruptions in the SC are imminent, it is stated that, in stable conditions, any organisation with a strong focus on resilience will be at a competitive disadvantage because resources are committed to an unforeseen future event (Christopher & Holweg 2011:68-69; Pettit, Croxton & Fiksel 2013:47). Managers must understand the significance of allocating scarce organisational resources towards achieving SCRES (Chen, Sohal & Prajogo 2016:861).

A substantial overestimation of potential risks in the SC will yield greater profits and improve decision making in a disruptive circumstance (Chopra & Sodhi 2014:73; Nooraie & Parast 2016:9). Some authors assert that SCRES realises additional indirect costs in the form of redundant resources and over-utilised resources for a particular need (Christopher & Holweg 2017:13; Ponomarov & Holcomb 2009:137). Paradoxes in the literature on how to achieve SCRES are evident. On the one hand, an overestimation of potential risks and a substantial financial investment in terms of inventory or capacity will yield superior profits and improve decision making in a disruptive event (Nooraie & Parast 2016:9). On the other hand, it is also clear that SCRES realises additional indirect costs in the form of redundant and over-utilised resources for a particular need (Christopher & Holweg 2011:69).

The aim of this generic qualitative study was to explore SCRES, specifically resources committed and predetermined in the process of achieving resilience. This study focused on organisations in the South African telecommunications industry, with head offices in Gauteng. Semi-structured interviews were conducted with senior and middle managers, who have specific knowledge of their respective supply chains.

This study aimed to answer the following research questions:

- What are the potential SC disruptions in the South African telecommunications industry?
- What are the drawbacks associated with a resilient SC?
- What measures are used to prevent the over-utilisation of resources when developing a resilient SC in the South African telecommunications industry?

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- Which criteria are considered to commit a particular resource, over another, in an attempt to mitigate the adverse effect of a potential disruptive event?

This study provides a link between effective resource allocation and the required level of SCRES within South African telecommunications organisations. It contributes to SCRES literature by being one of the first empirical studies to also explore the drawbacks of SCRES in the South African telecommunications industry. In addition measures were identified to prevent the over-utilisation of resources. This offers managers the ability to critically evaluate resource allocation within the organisation while considering customer requirements.

The next section provides a review of the literature. After that the adopted methodology is described followed by the deliberation of the findings. The last section discusses the implications for managerial and theoretical practices followed by the limitations of this study and recommendations for future research.

2. LITERATURE REVIEW

This section provides a discussion of the relevant literature.

2.1 The South African Telecommunications Industry

The South African telecommunications industry provides fixed-line and mobile telecommunication products and services, including internet access to the general population which comprises of natural and legal persons in the Republic (Independent Communications Authority of South Africa (ICASA) 2016:37). According to ICASA (2016:11), the number of fixed-line subscriptions in South Africa is approximately 3.84 million; internet and data subscriptions 47.76 million and 86.98 million mobile users. The telecommunications industry is subject to extensive legislation, competitive regulations and increased competition because of deregulation and intentional disruptions such as infrastructure vandalism or cable theft. It is furthermore exposed to significant customer demand, which makes it ideal to consider SCRES practices (ICASA 2016:21; van Zyl 2016). Before conceptualising SCRES, SCM must be understood in a modern-day business environment (Ponomarov & Holcomb 2009:125).

2.2 The Importance of End-User Value

Organisations must enhance perceived end-user value to retain profitable and loyal customers (Buell, Campbell & Frei 2016:604). End-user value is created as a result of the combination of product properties and what end-users and their immediate setting bring to the interaction with the product (Boztepe 2007:57). Ramanathan (2014:212) argues that perceived end-user value and the performance of an organisation's SC is closely related. It

is, therefore, ideal that organisational strategy ensures the enhancement of overall end-user value (Tunisini & Sebastiani 2015:302). The enhancement of end-user value underscores the saliency of SCM as well as accentuates four factors. First, it amplifies the significance of *reliability* which refers to the organisation's ability to satisfy end-user demands. Second, it requires *responsiveness* which refers to an organisation's ability to respond to customer needs in the shortest time possible. Third, it underscores *resilience* which reflects the organisation's ability to manage and survive unforeseen disruptive events. Lastly, it accentuates *relationships* which entail building long-term, mutually beneficial relationships with suppliers resulting in enhanced product quality and cost reduction (Chen, Hsieh & Wee 2016:1488; Christopher 2016:23-24). Organisations not only face fluctuating end-user demand, but also a magnitude of internal and external risks which must be duly managed (Giannakis & Papadopoulos 2016:456).

2.3 Supply Chain Risks

Supply chain risk is defined as "The likelihood and impact of unexpected macro and/or micro level events or conditions that adversely influence any part of a supply chain leading to operational, tactical, or strategic level failures or irregularities" (Ho *et al.* 2015:5035). Supply chains are prone to potential environmental hazards, regardless of the nature of the product, service or industry, from either the macro- or micro-environment. Specific sources of risk may be more influential and significant than others (Ho *et al.* 2015:5035). Macro-environmental risks are sources of uncertainty over which the focal organisation has limited or no control (Ho *et al.* 2015:5035). Ahmad, Rezaei, Sadaghiani and Tavasszy (2017:243) utilise the acronym "PESTEL" to identify several categories of macro-environmental risks:

- **Political:** Political uncertainty and governmental corruption in the host country.
- **Economic:** Fluctuations in exchange rates and economic growth.
- **Socio-cultural:** Migration of the rural population to urban environments and changing end-user demands due to the availability of information. Protest actions due to unrest or dissatisfaction are another considerable factor.
- **Technological:** Ongoing development of new products and services to enhance end-users' or working professionals' efficiency and experience.
- **Environmental:** Natural disasters such as floods and droughts.
- **Legal:** Legislative policy development and enforcement on organisations or individuals who are subject to such laws.

According to Sodhi, Son and Tang (2012:12), factors that can be controlled directly by an organisation, and which are recurring in nature, are considered as micro-environmental risks. Ho *et al.* (2015:5035) categorise micro-environmental risks as demand, supply, manufacturing and infrastructure risks. Table 1 below summarises the aforementioned four risk categories.

Table 1: Micro-environmental risks

Risk:	Description:	Author:
Demand risk	Fluctuations in customer demand due to seasonality, new product launches or market trends increase demand risks.	Manuj, Esper and Stank (2014:245)
Supply risk	The uncertainty of upstream partner activities, inefficient supplier service, insufficient supplier participation and lack of supplier communication.	Jüttner (2005:122); Ruiz-Torres, Mahmoodi and Zeng (2013:375)
Manufacturing risk	The manufacturing process relies on the supply of raw materials. Making use of more than one supplier reduces the associated risk of depleting materials to continue business activities. Inaccurate production-, raw material- or product specifications, due to insufficient communication, also contribute to manufacturing risk. Decentralising manufacturing facilities are a critical consideration to mitigate risk and ensure business continuity.	Agigi, Niemann and Kotzé (2016:5), Chiu and Choi (2016:502), Chopra and Sodhi (2014:77)
Infrastructure risk	Effective utilisation and maintenance of information technology-, transport- and financial systems are crucial to execute day-to-day business activities and mitigate infrastructure risk.	Boyens, Paulsen, Moorthy, Bartol and Shankles (2015:72); Ho <i>et al.</i> (2015:5035)

Cao (2017:62) argues that competitor risks should also be considered for micro-environmental risks, as these role players have a direct influence on the supply chain activities of the focal organisation. The impact and consequences of both macro- and micro-environmental risks should not be underestimated and must be examined carefully to initiate the applicable actions to mitigate and prepare for the adverse effects of potential disruptions (Wieland & Wallenburg 2013:310). This state of “preparedness” is known as supply chain resilience (SCRES) (Schmitt, Kumar, Steckle, Glover & Ehlen 2017:196).

3. SUPPLY CHAIN RESILIENCE

As previously stated the term SCRES is defined as an organisation’s ability to predict, plan and adapt to unforeseen future disruptions, as well as how it will respond to and recover from such occurrences to regain operations to a similar or more favourable state (Ambulkar,

Blackhurst & Grawe 2015:112; Klibi & Martel 2012:882; Stevens & Johnson 2016:24). Disruptions in the SC adversely affect shareholder value and the organisation's share price which will lead to organisational reputation concerns, diminishing customer confidence and deteriorating product or service quality (Speier, Whipple, Closs & Voss 2011:722).

A variety of components must be considered with regards to SCRES. Firstly, SC flexibility refers to the ability of the SC to source materials from more than one supplier to meet the demands of the organisation's customers in times of crisis (Azadeh, Atrchin, Salehi & Shojaei 2014:270). Secondly, redundancy is when additional manufacturing capacity or safety stock is at the disposal of the organisation to reduce the adverse effects of a disruptive event (Klibi & Martel 2012:883). Thirdly, SC visibility allows up- and downstream partners to view the SC activities from the raw material stage through to final delivery (Scholten & Schilder 2015:473). Fourthly, stakeholder collaboration refers to SC partners who work together to mutually benefit from long-term initiatives which they would not experience when working alone (Chen *et al.* 2016:2189). Lastly, agility enables the SC to react swiftly to unstable demand and supply situations (Ponis & Koronis 2012:923). Considering the aforementioned components, an organisation's SCRES strategy will be driven by the overarching deliberate strategy which is based on the financial position, financial capabilities, resource availability and risk appetite of the organisation (Kilubi 2016:614).

3.1 Supply Chain Resilience and the Resource-Based View

The resource based view refers to the ability of an organisation to deploy a set of tools or resources that are unique, scarce, neither easily copied, nor substitutable and at the focal organisation's disposal to gain a competitive advantage (Kellermanns, Walter, Crook, Kemmerer & Narayanan 2016:27). A competitive advantage is derived from the organisation's ability to function as close as possible to normal immediately, or within a short time, after a disruptive event by allocating predetermined resources towards a potential disruptive event (Carter, Kosmol & Kaufmann 2017:114). Although disruptions in SCs are inevitable, in stable SC conditions, any organisation with a strong focus on resilience will be at a *competitive disadvantage* because resources are committed to an unforeseen future event (Pettit *et al.* 2013:47). SCRES literature lacks the unambiguous identification of resource commitment towards a future disruptive event and the extent of the drawbacks related in achieving SCRES (Christopher & Holweg 2017:13; Van Der Vegt, Essens, Wahlström & George 2015:978).

3.2 Paradoxes in Supply Chain Resilience Literature

SCRES literature reveals two significant approaches which directly contradict each other. These contradictions are neither due to definitional differences nor the significance of SCRES, but rather due to modifications of how to achieve SCRES. The one approach states that a greater focus on the over-allocation of resources to achieve resilience will be beneficial to the focal organisation (Chopra & Sodhi 2014:73; Nooraie & Parast 2016:9; Speier *et al.* 2011:722), while the other approach states that achieving resilience results in additional cost to the organisation (Christopher & Holweg 2017:13; Danielewicz-Betz & Kawaguchi 2015:39; Ponomarov & Holcomb 2009; Van Der Vegt *et al.* 2015:978). Both arguments, however, accept the fact that certain specific predetermined resources must be forgone to achieve SCRES (Chopra & Sodhi 2014:73; Van Der Vegt *et al.* 2015:978). This study categorises these two approaches as “aggressive” and “conservative” to distinguish between and comprehensively understand the arguments.

3.3 An Aggressive Approach to Achieving Supply Chain Resilience

Chopra and Sodhi (2014:74) argue that more resilience is better, even though higher costs may be incurred in terms of resource investment to a specific disruptive event. Achieving superior resilience can be done by pursuing agility, collaboration, decentralisation, risk overestimation, SC segmentation or SC re-engineering, either singularly or in combination (Brandon-Jones, Squire, Autry & Petersen 2014:52; Roberta Pereira, Christopher & Lago Da Silva 2014:638). SC *agility* can be improved from two angles, namely: velocity and visibility (Jüttner & Maklan 2011:247). *Velocity* refers to the time it takes the SC to respond to and recover from a disruptive event. *Visibility* is defined as the ability of SC partners to communicate effectively through sharing information accurately and timeously from one end of the SC to the other (Hohenstein, Feisel, Hartmann & Giunipero 2015:106).

Significant resource investment in SC *collaboration* with upstream suppliers and downstream customers will result in superior forecasting, lead-times, stock replenishment and manufacturing effectiveness benefits (Soosay & Hyland 2015:614). Successful collaboration with SC partners will result in the focal organisation improving its SC visibility. The implementation of technologies such as radio frequency identification (RFID), which tracks materials and inventory throughout the SC, enhances its visibility (Sarac, Absi & Dauzere-Peres 2015:31). Another attempt to mitigate risk is to *decentralise* manufacturing and distribution facilities (Schmitt, Sun, Snyder & Shen 2015:204). Decentralisation entails an increase in inventory and resources which allows managers to enhance the *flexibility* of the SC (Yang, Aydın, Babich & Beil 2012:205). Decentralisation may be implemented at up- and downstream SC partners which will allow even greater reliability (Schmitt *et al.* 2015:204).

Overestimating SC disruptions and incurring the initial cost of preparing for a disruptive event will be less expensive than underestimating the consequences of inadequate preparation for the same future event (Chopra & Sodhi 2014:78). *Redundancy* strategies are considered to have a positive effect on risk mitigation because the focal organisation can source the required goods or services from multiple suppliers (Matsuo 2015:218). *SC segmentation* strategies arise when the organisation identifies certain homogeneous customer groups and develops a differentiated strategy to serve the identified markets with differentiated products and volumes (MacCarthy, Blome, Olhager, Srai & Zhao 2016:1710).

The process of *SC re-engineering* is whereby an organisation considers various components to improve the functionality thereof to understand the demand and supply network (Christopher 2016:232). These components include delivery strategy, decoupling point identification, SC design, strategic inventory levels, reserve capacity allocation, logistics, process identification and relationships with up- and downstream partners (MacCarthy *et al.* 2016:1711). SC re-engineering can eventually save the organisation substantial operational costs in its routine scope of business (Sarac *et al.* 2015:29). Substantial capital and human resources are required to utilise these elements to which organisations have limited resources available (Bell, Autry, Mollenkopf & Thornton 2012:158; Wieland & Wallenburg 2013:314).

3.4 A Conservative Approach towards Achieving Supply Chain Resilience

If an anticipated disruption does not occur, organisations with a strong focus on SCRES will be at a competitive disadvantage under stable market conditions (Pettit *et al.* 2013:47). It should be noted that SCRES is the desired state in every SC, but to a limited extent as the costs of resilience may surpass the benefits thereof (Christopher & Holweg 2017:13). The additional costs associated with an *agile* SC can be derived from velocity and visibility (Jüttner & Maklan 2011:248). Velocity can only be improved if the organisation has access to “reserve” capacity (i.e., property, plant and equipment) to alter manufacturing or service delivery after a disruptive event occurred at an additional cost (Araneda-Fuentes, Lustosa & Minner 2015:159). Visibility implies the utilisation of technologies, such as RFID (Hohenstein *et al.* 2015:106). The implementation of such technologies can be costly, does not have the same benefits for all SC partners and can only be implemented with the complete *collaboration* of SC partners (Sarac *et al.* 2015:32).

The *decentralisation* of manufacturing and distribution facilities will consume substantial financial resources as additional inventory, property, plant and equipment will have to be employed, which will ultimately diminish organisational cash flow (Andersson & Ostrom

2008:80). This expansion of inventory and property complicates SC activities and increases SC costs (Uçkun, Karaesmen & Savaş 2008:561). Roscoe and Baker (2014:141) argue that in the event of mergers or acquisitions, organisations should reduce the number of distribution centres which minimises the costs and complexity of SC operations. Swafford, Ghosh and Murthy (2006:173) argue that organisations that produce a greater variety of products or services have more *flexibility* than those that produce fewer products or services. The South African telecommunications industry provides mobile and fixed line services as well as internet connectivity through cabling or satellite (ICASA 2016:37).

Tang (2006:36) argues that *overestimates* of potentially disruptive events will result in an organisation experiencing sub-par performance after the disruption and struggle to realise a noticeable benefit to justify the investment in SCRES. Natural disasters and accidents can be estimated based on historical data, while intentional disruptions, such as infrastructure vandalism, terrorism and cable theft, would have to be considered carefully by the organisation (Sheffi & Rice 2005:43). Based on these arguments, organisations should approach disruption estimations with realism and caution (Van Der Vegt *et al.* 2015:978).

Roscoe and Baker (2014:137) argue that SC *segmentation* strategies do not consider lead times to acquire inventory from suppliers which could adversely affect customer experience. Segmentation increases SC complexity (MacCarthy *et al.* 2016:1711). SC *re-engineering* will require a substantial investment of resources to drastically alter its activities to satisfy changing customer demands (Gunasekaran, Lai & Cheng 2008:552). Stevens and Johnson (2016:28) argue that continuous incremental changes to SC processes should be affected in stable market conditions. Kumar and Rahman (2014:383) argue that drastic re-engineering actions will be required in unstable market conditions. Table 2 highlights the paradoxes found in SCRES literature.

Table 2: A summary of paradoxes in the SCRES literature

Concept	Author	Aggressive approach summary	Author	Conservative approach summary
Agility	1) Jüttner and Maklan (2011:247) 2) Christopher and Peck (2004:20); Hohenstein <i>et al.</i> (2015:104) 3) Hohenstein <i>et al.</i> (2015:106); Jüttner and Maklan (2011:248)	1) SC agility can be improved from two different angles, namely velocity and visibility. 2) Velocity: The time taken to recover from a disruption, where more resources are an advantage. 3) Visibility: Sharing information accurately and on time from one end-to-end of the SC by implementing technology.	a) Araneda-Fuentes <i>et al.</i> (2015:159); Closs and McGarrell (2004:13) b) Sarac <i>et al.</i> (2015:32)	a) Velocity can only be achieved if “reserve”, unutilised capacity is available. Increased idle times and additional cost may be incurred. b) Improving visibility can be costly, does not provide the same benefits to all partner organisations and only works with complete network collaboration.
Collaboration	1) Soosay and Hyland (2015:614). 2) Sarac <i>et al.</i> (2015:31)	1) Investment in collaboration with SC partners results in operational benefits. 2) Implementing technology such as RFID improves SC visibility.	a) Sarac <i>et al.</i> (2015:32)	a) Collaboration is only possible if all up- and downstream SC partners agree to superior SC visibility.
Decentralisation	1) Schmitt <i>et al.</i> (2015:204) 2) Yang <i>et al.</i> (2012:205) 3) Schmitt <i>et al.</i> (2015:204)	1) More organisational facilities. 2) An increase in inventory and operating assets, enhancing SC flexibility. 3) Can be implemented at all SC partners, improves reliability.	a) Andersson and Ostrom (2008:80) b) Ahmad (2006:178); Uçkun <i>et al.</i> (2008:561)	a) Decentralisation leads to diminished cash flow. b) Financial resources are held-up in inventory, transport and overhead costs.

Concept	Author	Aggressive approach summary	Author	Conservative approach summary
Risk overestimation	1) Chopra and Sodhi (2014:78) 2) Matsuo (2015:218)	1) Excessive preparation will significantly mitigate the impact of a disruptive event. 2) Multiple suppliers and reserve transport capacity mitigate disruptive risks.	a) Tang (2006:36) b) Sheffi and Rice (2005:43)	a) Sub-par performance of organisations that overestimate potential disruptions. b) Natural disruptions must be based on historic data whereas intentional disruptions must be carefully forecasted.
SC segmentation	1) MacCarthy <i>et al.</i> (2016:1710) Roscoe and Baker (2014:138)	1) Differentiated SC strategies for homogeneous groups, increasing effectiveness.	a) Roscoe and Baker (2014:137) b) MacCarthy <i>et al.</i> (2016:1711).	a) Lead times to obtain inventory from suppliers are disregarded. b) Increased complexity of the overall SC and resource constraints.
SC re-engineering	1) Christopher (2016:232) Sarac <i>et al.</i> (2015:29)	1) Aligning the entire SC's activities with demand and supply expectations, saving costs in the long run.	a) Gunasekaran <i>et al.</i> (2008:552) Stevens and Johnson (2016:28)	a) Substantial investment in organisational resources and continuous incremental change in stable market conditions.

4. METHODOLOGY

The following section explains the research method applied in this study.

4.1 Research Design

This study was based on a generic qualitative research design which was utilised to explore participants' opinions realised through a series of personal and professional events to clarify the understanding of a specific concept namely SCRES (Palinkas, Horwitz, Green, Wisdom, Duan & Hoagwood 2015:534). Qualitative research is suitable to develop a better understanding of a phenomenon of which very little is known through utilising tools such as semi-structured interviews or case study research to obtain a deeper understanding of the proposed phenomenon (Leedy & Ormrod 2013:96). Semi-structured interviews were utilised to gather data from participants. These participants were employed by multiple organisations

in the telecommunications industry to improve the generalisability of this study (Leedy & Ormrod 2013:96).

4.2 Sampling

The units of analysis were large telecommunication organisations with head offices in Gauteng. A total of 12 semi-structured interviews were conducted with 12 participants from six organisations. Nine participants were spread equally over three organisations. The other three respondents each represented the remaining three organisations. Identifying an adequate number of participants for this study was guided by data saturation (Fusch & Ness 2015:1409). Data saturation is the point at which additional interviews no longer generate new information (Tran, Porcher, Tran & Ravaud 2017:72). Guest, Bunce and Johnson (2006:78) argue that 12 interviews are adequate to achieve saturation if critical content analysis is conducted after each session to determine new findings, concepts or possible saturation. No further significant information surfaced after the completion of interview number nine. Three additional interviews were conducted to ensure that data saturation had been reached. These other interviews revealed no significant codes or themes. Purposive homogenous sampling was adopted to select the appropriate organisations for this study. Homogenous sampling occurs when the researcher identifies variables with predetermined characteristics to a specific sub-group (Plano Clark & Creswell 2015:334). Inclusion criteria were identified for participating organisations, namely: being classified as a large organisation according to the South African Revenue Service (2016), which implied that these organisations would possibly own the required network infrastructure. They operate in the telecommunications industry as classified by ICASA (2016:37) and have head offices in Gauteng. Organisations were identified through a simple online search. Table 3 below identifies the profile of the participants of this study.

Table 3: Profile of the participants

Participant	Gender	Job title	Organisation	Duration of interview
P1	Male	Executive: Commercial and contract management	O4	38 min.
P2	Female	Manager: Sourcing	O5	24 min.
P3	Female	Snr manager: Category manager	O5	67 min.
P4	Male	Executive: Supply chain	O4	49 min.
P5	Female	Executive: Property and procurement	O6	26 min.

Participant	Gender	Job title	Organisation	Duration of interview
P6	Male	Snr manager: Technology management & implementation	O4	44 min.
P7	Male	Snr manager: Forecasting	O6	62 min.
P8	Male	Manager: Strategy	O6	80 min.
P9	Male	Snr Manager: Networks	O5	38 min.
P10	Male	Manager: Supply Chain	O3	36 min.
P11	Male	General Manager: Supply chain	O2	57 min.
P12	Male	Manager: Accounts	O1	32 min
			Average	46 min.

Source: Author's own construction

Individual participants were also subject to homogenous sampling to acquire the required information from the sub-group who share predetermined characteristics (Plano Clark & Creswell 2015:334). Inclusion criteria for individuals comprised of the following: they must be employed as a middle or senior manager or executive; employed by a telecommunications organisation at the time of this study; and employed in an SC or SC equivalent position. Individuals at other organisations were identified through snowball sampling after which an introductory email was sent to the referred party stating the referring party's name and the purpose of this study.

4.3 Data collection

Semi-structured interviews were utilised for data collection. Twelve face-to-face semi-structured interviews were conducted at participating organisations' head offices in Gauteng. Seeking a deeper understanding of business practices, organisational activity, people's behaviour and attitudes, semi-structured interviews proved suitable to disclose the prevailing data of the issue at hand (Rowley 2012:261). A comprehensive review of SCRES literature was utilised to compile a discussion guide. A pre-test was conducted with one participant in the telecommunications industry. After reviewing the transcript of the pre-test, minor amendments were made to the discussion guide. The interviews were guided by the discussion guide. Probing questions were posed when necessary to acquire an in-depth understanding of the participant's response. On average, the interviews lasted 46 minutes with the shortest lasting 24 minutes and the longest 80 minutes. Interview recordings were transcribed by a professional transcription service. To ensure the quality and accuracy of the

transcriptions, the researcher listened to the recording while reading the transcribed interview.

4.4 Data analysis

Thematic data analysis was utilised to analyse the collected data which involves the cross-analysis of a data set to categorise, comprehend and recognise emerging themes (Vaismoradi, Jones, Turunen & Snelgrove 2016:106) and this study. This study followed the data analysis process proposed by Vaismoradi *et al.* (2016:106) which is characterised by the following sequential phases: Firstly, data familiarisation, where the researcher analysed the recordings and transcriptions. Secondly, initial code generation, which included the allocation of priori codes, developed from literature, to applicable sections in the transcriptions that matched literature. Sections that identified new findings were assigned with emerging codes. Codes that reflected the same or similar meanings or contexts were merged and redundant codes were deleted. Thirdly, theme search and development occurred when the researcher assigned codes to descriptive themes. Fourthly, reviewing and refining themes, this ensured that identified themes comprised only of the relevant codes by analysing each applicable section in the transcription. Fifthly, after reviewing all of the codes and themes, the naming of themes was finalised. Finally, the report was compiled which elaborated on the main themes and codes that emerged from this study.

4.5 Trustworthiness

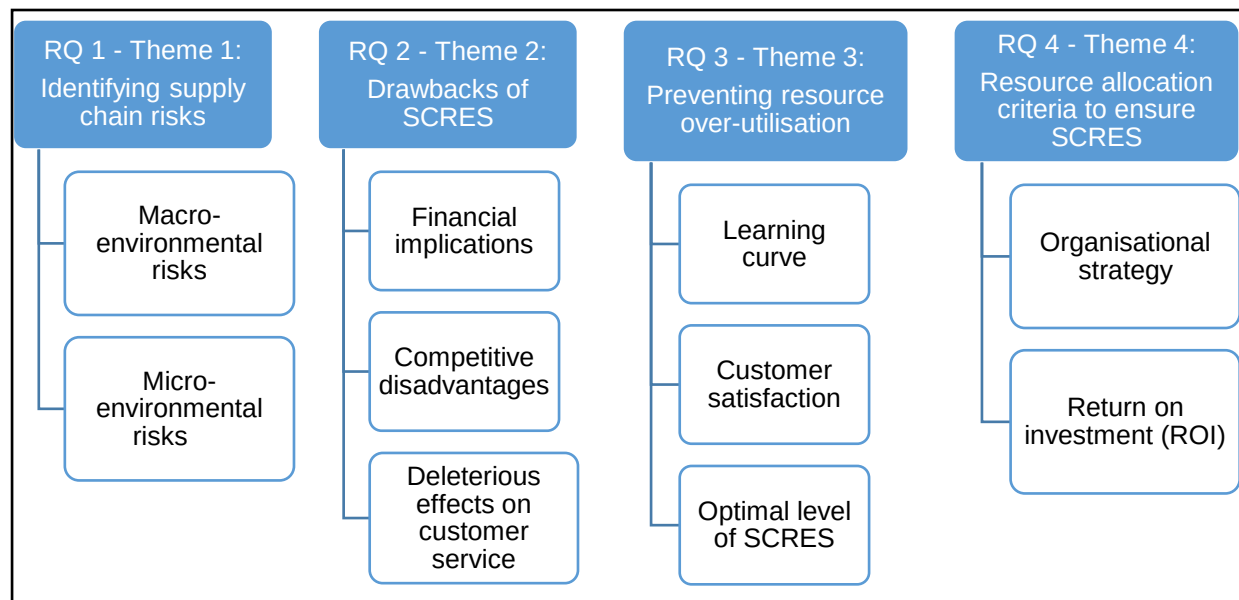
There are four principal criteria which, if met, indicate that a qualitative study is trustworthy. These criteria are conformability, credibility, dependability, transferability and authenticity. Creswell (2016:194) argues that two or three strategies should be used in a qualitative research project to ensure trustworthiness. Transferability and authenticity were ensured by providing thick and rich descriptions of the methodology, context and the applicable participants of this study (Creswell 2016:223; Liamputtong 2013:30). Credibility was achieved by ensuring the anonymity and confidentiality of the participants and the organisations they represented (Shenton 2004:67). Conformability was ensured by linking the collected data with the reviewed literature where possible (Liamputtong 2013:30). Peer debriefing with an experienced supply chain academic further ensured the trustworthiness of this study.

5. FINDINGS

The purpose of this study was to explore SCRES, specifically resources committed and predetermined in the process of achieving resilience. Figure 1 below summarises the four

main themes and associated sub-themes identified during data analysis and also links these to the corresponding research questions.

Figure 1: A summary of themes and related research questions



Source: Author's own construction

5.1 Identifying supply chain risks

To achieve SCRES, managers must first understand the scarcity of organisational resources and the potential risks an organisation must deal with in its macro- and micro-environment. The most significant SC risks organisations in the telecommunications industry face were identified in the subsequent section.

5.1.1 Macro-environmental risks

Ahmad *et al.* (2017:243) posit that the political, economic, socio-cultural, technological, environmental and legal (PESTEL) environments contribute towards macro-environmental risks. The data revealed that socio-cultural factors, such as labour unrest, theft and vandalism, are the most concerning factors that affect all the participating organisations:

"Labour unrest, locally it is a big issue. We have currently only one vendor who has a fibre factory in the country." (P9, male, snr manager: network procurement)

"I think the problem that you would have on your passive infrastructure is mostly theft and vandalism. We every year pay millions, I do not know what is the latest number, but it was - the last time I saw a number in the procurement committee it was "x hundred" or "y hundred" million rand that we paid to do replacement of batteries." (P11, male, general manager: SC)

Environmental factors, also known as “acts of God”, are the second most occurring factors to plague organisations in the telecommunications industry. Participants identified factors such as rain, earthquakes, lightning, wind, hurricanes, volcanic eruptions and fires. It must be noted that organisations in the South African telecommunications industry rely on international suppliers who transport goods by ship or by plane to the focal organisation. Thus, these organisations are not only subject to local weather patterns, but also other rare international weather occurrences. The data revealed that ten of the participants identified one or more concerns related to environmental factors:

“So when there are floods for example fibre cables get lifted out of the ground, technology is impacted and that certainly has a major impact on product rollout and also impact on how the technology works.” (P12, male, manager: accounts)

“... one recent case was the Icelandic volcanic ash. We used to have a contract with “S3” for microwave equipment and because of the Icelandic ash, aeroplanes were not flying from Europe for some time and that disrupted our supply chain. So acts of God can have a major impact.” (P6, male, snr manager: technology implementation)

Technological change and advancements in the telecommunications industry is another factor these organisations duly consider. Nine of the participants identified technology as a crucial consideration. This can best be described by the following quotation:

“Ideally you need to have a very lean supply chain from an inventory perspective. I mean technology changes on a daily, sometimes an hourly basis. What was considered top of the range yesterday is not top of the range today.” (P7, male, snr manager: forecasting)

It is evident from the data obtained that none of the participants is concerned with the political environment and only one participant identified that the legal environment has a notable consideration for their respective organisation:

“I think spectrum is our other or spectrum constraint is our other very big disruptive that we have. Now to maybe explain just what spectrum is about, it's that ICASA as the regulator gives you a certain band in which you are allowed to transmit your radio signals.” (P11, male, general manager: SC)

Agigi *et al.* (2016:4) identified that macro-environmental disruptions might occur up or downstream to the focal organisation with severe implications to the focal organisation if it were to repudiate such macro-environmental changes. It is evident that these organisations are

incredibly wary of macro-environmental risks in the international telecommunications industry.

5.1.2 Micro-environmental risks

Micro-environmental risks are internal to and controllable by the focal organisation and consist of demand risk, supply risk, manufacturing risk and infrastructure risk (Ho *et al.* 2015:5035). Nine of the participants expressed a major concern with the “supply risk” element as is illustrated in the quote below:

“So fibre production in the world is limited and we in Africa are about 2% of the world’s consumption. South Africa is obviously much less than that ...” “So you have got to make sure that your contracts are in place so that you can buy from the different OEMs to ensure that you have a steady supply so that you can deliver.”
(P9, male, snr manager: network procurement)

Sodhi *et al.* (2012:12) argue that factors which are recurring in nature and are controllable by the focal organisation can also be classified as micro-environmental risks. Seven of the participants were concerned with internal issues or processes in their respective organisations. Participants identified that process rigidity could be an overburden. This can best be illustrated by the following quote:

“You know if you have a too structured contract then for every single change you need to go through a change control and it’s got time delays and so on.” (P1, male, executive: commercial and contract management)

Cao (2017:62) argues that competitors must also be considered for micro-environmental risks as these industry role players influence the focal organisation’s SC activities. Two of the participants identified competitors as a micro environmental risk and can best be identified in the following quote:

“Then the other failing that we have is we don’t look, we don’t have somebody who actively looks at what innovation or strategies or tactics are being deployed throughout the world that we could potentially harness.” (P8, male, snr manager: portfolio management)

It is evident from the data that organisations are far more concerned with macro-environmental risks compared to micro-environmental risks. This study identified that organisations in the South African telecommunications industry consider both, their macro- and micro environmental risks when developing a SCRES strategy.

5.2 Drawbacks of supply chain resilience

This study identified three sub-themes related to the disadvantages associated with SCRES in the South African telecommunications industry. First, the financial implications related to SCRES as identified by Christopher and Holweg (2017:13). Second, following the leader was identified and finally, deleterious effects on customer service were identified. The latter two sub-themes are new to SCRES literature.

5.2.1 Financial implications

Unsurprisingly, the participants highlighted that achieving SCRES has financial consequences that could be questioned by shareholders. All but one participant asserted that severe financial implications would result from an over-investment in SCRES:

“I think sometimes if you get it wrong it is going to cost you a lot of money, so it will be increased costs, it is all just related to costs because all the things that you are going to put in place, if they are not really needed you know it is just increased costs.” (P10, male, SC category manager)

This outcome supports the argument by Christopher and Holweg (2017:13), that financial implications are a major consideration when developing a SCRES strategy. This is primarily a key consideration where resources are over-allocated towards a specific disruptive event.

5.2.2 Competitive disadvantages

The participants revealed that a strong focus on SCRES would lead to the focal organisation losing its market position to competitors and essentially become a follower in the market. This could be due to the organisation becoming too risk-averse or rigid while attempting to execute the deliberate strategy that it will not recognise emerging opportunities in the market. Considering the competitive nature of the telecommunications industry, the inability to capitalise on a first-mover advantage may negatively impact an organisation's growth potential. Nine participants were concerned about their organisation's market position:

“So business is all about being brave enough to be the guy that even starts it. I mean if you are the guy that is purely driven by the supply chain resilience you will never start nothing, you will always have to follow and therefore you will never be the leader or strive to be the leaders in our environment.” (P4, male, executive: SC)

5.2.3 Deleterious effects on customer service

This sub-theme describes a situation where there is a misalignment between organisational strategy and customer needs. In such circumstances, the organisation is so fixated on

executing its SCRES strategies that customer needs become less important than the SCRES initiatives. Again, given the nature of this industry, the costs of this “over-resilience” will be shifted to the customer’s account, even though it is not necessarily aligned with customer requirements. Eleven participants mentioned the issue of customer focus and can be best portrayed in the following quote:

“In terms of the resilience is that your - the potential impact on operations and yes, I mean lack of focus then on the actual customer. So you can be so focused on your business to make it all resilient but you forget about the customer.” (P1, male, executive: commercial and contract management)

These findings accentuate the importance of achieving a healthy balance between SCRES and an organisation’s ideal risk appetite to remain competitive in its industry. Leaning too much to either of the identified extremes will be detrimental to the organisation’s survival.

5.3 Preventing resource over-utilisation

It is crucial to determine the appropriate allocation of resources towards a potential disruptive event (Bell *et al.* 2012:158). Considering the aforementioned macro- and micro-environmental risks along with the identified drawbacks of SCRES, due diligence should be utilised when allocating organisational resources towards achieving SCRES.

This study identifies three elements utilised by telecommunications organisations to prevent the over-allocation of resources towards SCRES strategies. These elements are identified as the learning curve, customer satisfaction and the optimal level of SCRES.

5.3.1 Learning curve

Past lessons have influenced the way organisations utilise organisational resources towards achieving SCRES. The ability to critically evaluate the effectiveness and efficiencies of prior SCRES strategies and communicating the success or failure thereof throughout the organisation is vital in creating an organisation-wide propensity to SCRES. Eleven of the participants consider past occurrences when developing a SCRES strategy. This is evident in the following quote:

“Okay, how many times has it failed? So for me it is linked to failure rate and not to be funny, I think we are quite good, okay but it is because we have learnt from the past.” (P5, female, executive: procurement and property)

Organisations attempt to adequately allocate and obtain resources by developing sustainable and beneficial relationships with suppliers in such a way that these relationships will benefit both the focal organisation and the supplier. Nine participants identified that supplier

development is essential when considering the development of a SCRES strategy. This can best be described by the following quote:

“But I think the other thing that has been working for us well lately is partnership. We have also realised that in order for you to have smooth operations it doesn't help to keep people accountable with the sjambok. You have to actually form the team and work together to achieve what you need. So I think the relationship management is key for us in making sure that we are not having those issues with the service providers.” (P4, male, executive: SC)

5.3.2 Customer satisfaction

An organisation considers the impact a disruption may have, not only on itself but also on its customers. Therefore, SCRES levels will be aligned with customer satisfaction. This end-user focus is evident from the following quotes:

“I mean South Africa was always seen as being behind the curve but over the last couple of years we're more on the curve now in terms of availability of product in the market so you have to be on top of your game at all times. You can lose a lot of money very quickly if you don't have the right products at the right time for the customers.” (P7, male, snr manager: forecasting)

“... customers are looking for a same day service. So they want something, I order it now, I want it now.” (P11, male, general manager: SC)

Three participants identified that competitors play a massive role in the development of their SCRES strategy. This is being considered to ensure that the organisation does not compromise their competitive position in the marketplace. This can best be described in the following quotation:

“Then from an opportunity perspective obviously competition plays a big role there. Usually it's not just based on direct competition but it's also indirect competition, how could they affect you in that opportunity. Yes - it's just really having a risk register, an active risk register that is assessed quarterly.” (P12, male, manager: accounts)

Customer satisfaction can only be considered if a balance is achieved between end-user satisfaction and the organisational strategy. Should this not be the case, the organisation could potentially face a misalignment issue as discussed in the previous section.

5.3.3 Optimal level of supply chain resilience

Six of the participants acknowledge that there is a point above which the marginal benefit of additional SCRES is not worth pursuing and is reflected in the following quotation:

“No, my personal opinion is there will be a point where I am going to say, you know the balance between the costs and the resilience is about right and that is probably, after that - It is a no go.” (P1, male, executive: commercial and contract management)

Other participants revealed that SCRES is an ongoing process and the organisation is confronted with changing market circumstances to which it must adapt:

“Look, I think we must always improve and if we stop improving then we become irrelevant but at the same time we also understand that any additional requirements that we place on our suppliers is an additional burden that may have a financial impact on them.” (P6, male, snr manager: technology implementation)

Nine of the participants revealed that overinvestment in SCRES would be problematic for their organisations and is best reflected in the following quote:

“So you need to invest your capital in the correct place and if you are over-supplying or over-stocking a certain commodity, it is going to lie in the warehouse for next three years and in the next three years the technology will change, so you do not even require that equipment anymore.” (P9, male, snr manager: network procurement)

Taken together, these findings indicate that there are contradictions in the organisations, as some participants agreed with the concept of “resilient enough”, while others, who did not agree with this concept, indicated that overinvestment in SCRES would be problematic.

5.4 Resource allocation criteria to ensure supply chain resilience

Organisational resources are limited and must be utilised in the best possible manner to maximise end-user satisfaction and to retain loyal customers of the organisation (Buell *et al.* 2016:604). This study identified that organisational strategy and ROI are key determinants for allocating resources towards a SCRES strategy.

5.4.1 Organisational strategy as a determinant of resource allocation

Chopra and Sodhi (2014:74) propose various elements, such as agility, decentralisation and SC segmentation that should be considered when developing a SCRES strategy. These elements will be influenced by the organisation’s overarching or deliberate strategy. Eleven

of the participants acknowledged that the overarching organisational strategy determines the resource allocation towards achieving SCRES. This is reflected in the following quotations:

“Look, I think again we have got different products that we are rolling out the door at any time and like I said, the business is always having that top down strategy. It depends on that day what is the focus.” (P4, male, executive: SC)

“... it depends on the amount of funding. If it is an amount that requires board approval, then it is much more difficult to achieve because it means the chief executive has to justify the change in strategy to the board and then for the board to approve ...” “Whereas if it was just a project, material allocation, it is much easier to achieve because it is not at that level you know that requires board approval.” (P6, male, snr manager: technology implementation)

5.4.2 Return on investment (ROI) as a determinant of resource allocation

Eleven of the participants consider the resource allocation towards achieving SCRES to be undertaken to improve the ROI of invested resources:

“I mean at the end of the day you have got shareholders that you need to keep happy and it is making sure that you can try and map your actual risk profile and saying okay, where am I comfortable with my risk profile and what are the types of risks and where do you pin it.” (P1, male, executive: commercial and contract management)

“I do not believe that you can ever invest too much because as long as your investment shows a return, it can never be too much.” (P6, snr manager: technology implementation)

Bell *et al.* (2012:158) argue that the limited resources that an organisation has at its disposal must be allocated with diligence. Organisational strategy and ROI were the only important criteria identified by participants when considering the allocation of resources towards achieving SCRES. Participants identified the importance of maximising shareholder value, which is effectively underwritten in the deliberate strategy of the organisation. This accentuates that these traditional measures are still applicable in modern SC practices.

6. CONCLUSION

The following section provides as summary of the findings and a discussion of the theoretical and managerial implications of the study. This is followed by the limitations of the study.

6.1 Summary of findings and theoretical implications

This study aimed to explore SCRES within the South African telecommunications industry. Firstly, this study sought to identify what potential disruptions the South African telecommunications industry has to deal with. It acknowledges the macro- and micro-environmental risks identified by Ho *et al.* (2015:5035) in the telecommunications industry in South Africa. A variety of risk combinations were identified throughout the participating organisations. Organisations in the South African telecommunications industry are more concerned with macro-environmental risks than with micro-environmental risks as these organisations have to deal with a wide variety of PESTEL categories. Strikingly, these organisations mitigate micro-environmental risks by imposing strict service level agreements on sub-contractors throughout their supply chains. This study contributes towards the literature by identifying that socio-cultural factors is the most significant contributor to macro-environmental risks which plague all participating organisations in some form or another. This could be because of the dire economic conditions and the high unemployment rate in South Africa. Supply risk was identified as the dominant micro-environmental risk. The participating organisations rely on imports from international suppliers which can effectively cripple an organisation's operations if a delay is identified in the upstream SC.

Secondly, this study sought to identify the drawbacks associated with SCRES in the telecommunications industry. Financial implications were taken into consideration and therefore, corroborate the cost factor as identified by Christopher and Holweg (2017:13). The participants identified two unique drawbacks of SCRES namely "competitive " and "deleterious effects on customer service". Competitive disadvantages refer to an organisation that is rigid in its attempts to execute its deliberate strategy and potentially neglect other opportunities in the market. Alternatively, the organisation may be so risk averse that it may fear innovating new concepts or ideas, thereby effectively forcing the organisation to adopt a "follower" strategy. Harmful effects on customer service signify the organisation's ambitions to execute its deliberate strategy and ignore its customers' requirements. This misalignment will result in the organisation following its ideals while the market moves in another direction. Such a misalignment will also see the focal organisation losing customers to competitors who adhere to the immediate requirements of customers.

Thirdly, this study endeavoured to identify the measures organisations implement to prevent an over-utilisation of resources to achieve SCRES. Paradoxes in the literature are evident when considering how SCRES should be achieved (Bell *et al.* 2012:158; Chopra & Sodhi 2014:74). The participants identified that, in practice, three major considerations prevent the over-utilisation of resources to achieve SCRES. Firstly, resources are utilised in terms of the learning curve that the organisation experienced as a result of previous disruptions.

Secondly, customer satisfaction determines the utilisation of resources. Lastly, the optimal level of SCRES should be considered by organisations to avoid the over-utilisation of resources. Resources must deliver a significant contribution to shareholder satisfaction when dedicated to SCRES. These findings are unique because the alternative approaches proposed by Chopra and Sodhi (2014:73) and Christopher and Holweg (2017:13) do not reveal how resources should be utilised.

This study explored the criteria which organisations consider when making resource allocation decisions to achieve SCRES. This study revealed that the organisation's strategy plays a significant role in the allocation of resources to achieve SCRES and thus supports the arguments of Chopra and Sodhi (2014:74). The participants identified consideration for the overarching strategy of the organisation, including the strategy for various product lines or SC segments. The last element organisations consider is the ROI of a resource to satisfy shareholder value which supports the arguments of Christopher and Holweg (2011:75). Furthermore, the findings highlight that resources should be continuously monitored to deliver the required ROI or should be re-allocated if returns are unsatisfactory.

7. MANAGERIAL IMPLICATIONS

The findings of this study have three important implications for managers. First, the study identified the drawbacks associated with SCRES in the telecommunications industry. Managers would be able to obtain a balance between the optimal level of SCRES and the organisation's ability to remain competitive in the market on the one hand whilst satisfying customer requirements on the other hand. Managers should also consider that their organisation could be risk averse and lack innovation within their competitive industry. Second, managers must consider drivers of SCRES with diligence. The primary factor to consider is the organisation's learning curve. This can be done by either reflecting on events that disrupted the focal organisation's activities or replicating a scenario which a direct competitor faced. The second factor to consider is the requirements of the organisation's customers. Managers should also develop a SCRES strategy based on what the customers of the focal organisation require. This will ensure that the organisation's overarching strategy aligns, systematically, with the needs of its customers. Third, managers should consider the "resilient enough" concept objectively regular basis and align the allocation of resources according to the organisation's customers' requirements. This is to proactively alter the deliberate strategy of the organisation promptly as and when customer requirements change. Ultimately, shareholder satisfaction should be enhanced in such a way to fulfil customer requirements and retain profitable customers.

8. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

This study has three main limitations. First, only the views of large telecommunications organisations were considered. These large organisations typically own the infrastructure they require to operate in the telecommunications industry. Future research can focus on smaller firms that rely on leasing infrastructure from the aforementioned large organisations to determine the drawbacks of SCRES. Second, the study utilised a qualitative approach within a single industry which confines the generalisability and transferability of the findings to other industries. Future studies should employ a mixed methodology to involve more participants from additional industries to explore and test further drawbacks that could be associated with SCRES. Finally, this study focused on a single component of the SC. It is recommended that future research should be conducted on a focal organisation and the relevant first and second tier suppliers. This will provide a deeper insight into the drawbacks of SCRES in a holistic SC setup and not as isolated components of the greater SC.

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