



# Supply chain risk management capabilities during enterprise resource planning implementation: Perspectives of enterprise resource planning providers and their clients

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## ABSTRACT

**Purpose of the study:** Firms rely on information systems (IS) to improve information sharing and visibility, cut costs, and boost productivity. Enterprise resource planning (ERP) systems are being used as important strategic tools in this direction, providing competitive advantages and resulting in increased operational efficiencies. However, ERP implementation failure rates remain high because of ineffective risk management to limit supply chain disruptions during implementation. The objective of supply chain risk management (SCRM) is to enable firms to remain sustainable in the face of major disruptions. Therefore, this study aimed to determine the role of SCRM capabilities associated with ERP implementation to limit supply chain disruptions during ERP operations.

**Design/methodology/approach:** A generic qualitative research design was used to collect primary data through semi-structured interviews with fourteen ERP providers and clients in South Africa. Thematic analysis was utilised to evaluate the data.

**Findings:** The study determined that SCRM capabilities can assist firms in returning to superior operations after ERP implementation. Furthermore, the findings shed light on the specific SCRM processes used during ERP implementation, as well as identifying areas for improvement.

**Recommendations/value:** This study equips ERP providers and ERP clients with valuable insight into understanding the capabilities of SCRM in ERP implementation.

**Managerial implications:** Along with leveraging the SCRM capabilities identified, managers are advised to use formal and external assessment tools, implement a formal SCRM process, increase efforts to involve supply



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chain partners during ERP implementation and selection, and finally, incorporate a change management division to reduce disruption during ERP implementation.

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**Keywords:** Enterprise resource planning systems; generic qualitative research; implementation risk; South Africa; supply chain management; supply chain risk management capabilities

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**JEL Classification:** L14

## 1. INTRODUCTION

Enterprise resource planning (ERP) solutions can revolutionise firms by streamlining manufacturing and enhancing customer engagement (Rajan & Baral, 2015). However, many firms struggle to comprehend the reasons behind ERP system implementation failure (Bitsini, 2015). One of the most common sources of implementation failure is related to insufficient risk management (Mukwasi & Seymour, 2015). Moreover, inadequate risk management during ERP implementation could result in supply chain disruptions (Haddara, 2018). Additionally, supply chain risk management (SCRM) capabilities tend to abate the effects of these disruptions by systematically implementing risk management and mitigation approaches (Manuj *et al.*, 2014). These capabilities are essential to avoid disruptions in the information flow, as well as product or material flow from all suppliers to end users of the supply chain, which threatens a firm's supply chain objectives from being achieved (Fischer-Preßler *et al.*, 2020).

Firms invest significantly in complex IT systems, such as ERP systems, to enhance information flow within a firm (Herath & Wijenayake, 2019). While the benefits of ERP systems are significant, over two-thirds of ERP system implementations fail (Rajan & Baral, 2015). For example, a US-based company, Revlon Consumer Products LLC, whose failed ERP system implementation in 2018 cost approximately \$64 million, resulted in its shareholders being sued (Saran, 2019). Moreover, Lidl, a German supermarket chain, experienced similar issues during its failed ERP system implementation attempt. The implementation was aborted in 2018 after a seven-year-old modernisation effort that cost \$580 million (Baumann, 2020).

Risk management comprises steps associated with identifying, assessing, assigning ownership, mitigating, monitoring, and evaluating risks (Hopkin, 2017). Risk management is important to reduce risks and ensure supply chain effectiveness, even when confronting a variety of uncertainties (Ho *et al.*, 2015). Supply chain risks include disturbances in the flow of information and products or material flow from all suppliers to end users of the supply chain,

which threaten the firm's ability to achieve supply chain objectives (Fischer-Preßler *et al.*, 2020).

Moreover, most ERP systems are implemented to correct the failure of information flow within a firm (Chatzoglou *et al.*, 2016). However, while ERP systems have proven to achieve the various information requirements of many firms, they can also translate into costly errors for countless others (Ali & Miller, 2017). These errors are usually attributed to a complicated ERP implementation process, with multiple stakeholders encountering risks at various stages during the implementation process (Herath & Wijenayake, 2019). ERP implementation risks stem from an extensive mixture of hardware and software variables and various organisational, human, and political issues (Rajan & Baral, 2015; Ali *et al.*, 2023). According to Garg and Khurana (2017), team risk, technological risk, organisational risk, user risk, project performance risk, and project management risk are examples of the different risk types during ERP implementations.

Additionally, implementing an ERP system falls within a firm's physical boundaries. It is recognised as a form of technological change, while most risks associated with an implementation form part of a firm's internal supply chain risks (Gilaninia *et al.*, 2013). Even more concerning is the fact that internal supply chain risks can result in a serious disruption within a firm if not adequately addressed (Christopher, 2016). Therefore, managing such risks is essential to minimising disruption within a firm during an ERP implementation (Zendehdel Nobari *et al.*, 2020). An ERP implementation can also be affected by risks stemming from the firm's external environment (AL-Zoubi & Al-Haija, 2018). This is prevalent in developing countries, which are prone to disruptions caused by risks within the external environment (Ahmed *et al.*, 2017). Examples of these risks include the country's political conditions, poor infrastructure, economic instability, skill shortages, and cultural issues (Hasheela-Mufeti & Smolander, 2017). Bitsini (2015) concluded that South Africa is exposed to several of these risks. While these risks are external and cannot be controlled by the firm, the ERP implementation will be directly or indirectly affected by such risks (Zendehdel Nobari *et al.*, 2020). Thus, it is the responsibility of ERP implementation practitioners to mitigate the potential effects of these risks and limit the possibility of disruption during implementation (Zendehdel Nobari *et al.*, 2018). If disruptions are not managed during an ERP implementation, the operation is prone to failure (Valanarasu & Christy, 2018).

Supply chain risk management (SCRM) involves the management of risk sources by presenting viable solutions to avoid, mitigate, or minimise disruption (Heckman *et al.*, 2015).

Hence, effective SCRM capabilities should be able to identify and mitigate risks, which, in turn, reduces supply chain vulnerability, resulting in successful ERP implementation (Chowdhury & Quaddus, 2016). By leveraging their SCRM capabilities, firms can enhance their ability to control unexpected outcomes by systematically implementing risk management and mitigation approaches to reduce disruption (Manuj *et al.*, 2014). Subsequently, firms with superior SCRM capabilities tend to recover from risk impacts more efficiently and with less disruption (Ho *et al.*, 2015). When a disruption occurs within a firm, the ability to recover rapidly is essential to limit losses (Manhart, 2017). Riley *et al.* (2016) posited that by developing SCRM capabilities, firms can better address an array of supply chain risks. There have been attempts to measure these capabilities in ERP implementation; however, several research gaps remain (Fischer-Preßler *et al.*, 2020). Norrman and Wieland (2020) asserted that further research is required with regard to the best SCRM practices when implementing a new ERP system. Also, multiple studies have investigated ERP implementation risks and management capabilities (Garg & Khurana, 2017; Valanarasu & Christy, 2018; Goldston, 2019; Zendehtel Nobari *et al.*, 2020). However, researchers have called for more research regarding managing ERP implementation risks in developing countries to better understand contextual differences (Muyambi, 2019; Malik & Khan, 2020).

Thus, it is clear that increased efforts are required to reduce ERP implementation failures based on the substantial financial impact of ERP failures in developing countries (Malik & Khan, 2020). This need is further highlighted since these countries represent an enormous prospect for future ERP implementations (AL-Zoubi & Al-Haija, 2018). To date, South Africa has experienced a surge in ERP implementations and associated failures, which further highlights the need for methods to reduce implementation risks and their resulting disruptions (Bitsini, 2015; Bailey *et al.*, 2017). This study intends to fill this research gap.

This generic qualitative study explores the role of SCRM capabilities in managing and mitigating risk to limit the possibility of ERP implementation failure in South African firms. The study aims to determine the SCRM processes used by selected South African-based firms and how they can be improved upon to reduce disruptions during ERP implementation.

Considering the above, this study attempts to answer the following research questions:

1. What are the supply chain management (SCM) risks faced during an ERP implementation?
2. Which SCM risk identification methods are utilised during ERP implementation?
3. Which SCM risk assessment methods are utilised during ERP implementation?

4. Which SCM mitigation methods are utilised during ERP implementation?
5. What is the role of SCRM capabilities in ERP implementation?

This study contributes to the existing body of knowledge by investigating the role of SCRM capabilities associated with ERP implementation in a South African context. The findings shed light on the specific SCRM processes used during ERP implementation, as well as identifying areas for improvement. This study also offers ERP providers and ERP clients with a better understanding of the capabilities of SCRM during ERP implementation. As a result, ERP providers and ERP clients will garner a better understanding of the current SCRM processes and how they can be enhanced to mitigate disruptions during ERP implementation and, ultimately, reduce implementation failure.

## **2. LITERATURE REVIEW**

The literature review offers an overview of the South African ERP system provider industry and relevant literature.

### **2.1 The South African enterprise resource planning system provider industry**

South Africa has one of Africa's largest information and communications technology (ICT) markets, which is becoming an increasingly important contributor to the country's GDP (International Trade Administration, 2020). The ICT market spending in South Africa was approximately R300 billion in 2020, with spending on ERP software around R36 billion (Shanhong, 2020). Moreover, South Africa has a high potential for software penetration when compared to other regions of the world that are experiencing saturation levels (Asongu & Odhiambo, 2019).

Overall, the ERP provider industry in South Africa has been growing significantly, with ERP implementations occurring regularly (Hasheela-Mufeti & Smolander, 2017). The main drivers for ERP implementation include pressure from suppliers and customers, a need to adapt to future requirements, and various technological pressures within the industry (Hasheela-Mufeti, 2017). Most reported cases of ERP implementation are derived from associated commercial ERP providers (Hasheela-Mufeti & Smolander, 2017). Key players in the South African ERP provider market include Microsoft, SAP, Oracle, and Infor, with a scarcity of private in-house ERP providers and open-source ERP providers (Tobie *et al.*, 2016). Additionally, ERP providers in developing countries face several challenges stemming from the external environment, including political and economic instability, skill shortages, and cultural issues (Hasheela-Mufeti & Smolander, 2017). South Africa faces challenges predicated on a 25%

chronic unemployment rate, poor infrastructure, and low levels of education (Littlewood & Holt, 2018). Considering these challenges, ERP providers in South Africa are sometimes forced to abandon their business model during implementation, which could result in implementation disruption (Bitsini, 2015). This is due to the continued misjudgement of the impact of these challenges on ERP implementation, which ultimately results in delays, cost overruns, and failures (Gopaul, 2016).

## **2.2 ERP systems**

Thousands of firms of varying sizes have widely implemented ERP systems across many industries and countries (Peng & Gala, 2014). An ERP system is a customisable and integrated information system that streamlines business processes to maintain company-wide data storage in a centralised database (Gopaul, 2016). The data from the centralised database is fed into modular applications that support practically all of the company's business activities along all business units and functions (Haddara, 2018). These business units include SCM, human resources, accounting and finance, and customer services (Garg & Khurana, 2017). Moreover, firms implement ERP systems in search of improved information flow between their departments (Zendehdel Nobari *et al.*, 2020; Pandey & Kumar, 2023). Additionally, most firms expect their ERP systems to improve process efficiency, reporting, decision-making, and customer responsiveness while reducing operational costs (Haddara, 2018). A successfully integrated ERP system provides a competitive advantage by implementing innovative business strategies that increase operational control and visibility (Rajan & Baral, 2015). Since many firms continue to pursue global expansion, there is an increased demand for ERP systems to offer increased collaboration, communication, and visibility throughout the firms' supply chain due to heightened customer demands and competition (Goldston, 2019).

### **2.2.1 ERP implementation**

Implementing an ERP system is a challenging task, determined by the size, scope, and complexity of a firm's processes (Ahmed *et al.*, 2017). These challenges, coupled with a complicated ERP implementation process, can be disruptive (Mukwasi & Seymour, 2015). Overall, the cost of ERP implementation has a significant financial impact on businesses; thus, ERP implementation failure rates remain high (Ram *et al.*, 2013; Altamony *et al.*, 2016; Malik & Khan, 2020; Rajapakse & Thushara, 2023). Nonetheless, firms continue to strive for the benefits of a successfully implemented ERP, which includes the following: increased efficiency; customer service; flexibility; communication; better decision-making; accurate transactions; and competitive advantage (Ayani *et al.*, 2021). The ERP implementation life

cycle includes processes from the beginning of the implementation until the complete stabilisation of the system (AboAbdo *et al.*, 2019). These processes can be segmented into three fundamental stages: pre-implementation, implementation, and post-implementation (Gopaul, 2016). Effective management during these three stages is essential in ensuring a successful ERP implementation (Ali & Miller, 2017). These three stages of ERP implementation are discussed below.

### **2.2.1.1 Pre-implementation stage**

Pre-implementation is a significant stage, because vendor selection and strategies will directly affect the implementation process and its outcome (Herath & Wijenayake, 2019). This stage includes ERP vendor selection, which is essential because the entire implementation could fail if the firm chooses an unfit ERP vendor (Haddara, 2018). Additionally, vendor selection considerations include the potential ERP vendor's support and serviceability, the vendor's industry knowledge and experience, the market position of the vendor, and affordability compared to competitors within the market (Hsu *et al.*, 2015). Once the ERP vendor is selected, management must develop a strategy to facilitate implementation, supply preliminary training to staff, anticipate resistance from staff and determine the speed at which the ERP is to be adopted (Harun & Mansor, 2019). Extensive preparations by firms during the pre-implementation stage will increase the probability of success during the next stage, the implementation stage (Mdimba *et al.*, 2017).

The implementation stage is typically a highly complex, lengthy, and expensive process comprising activities that impact all functional areas and business processes within a firm (Rajan & Baral, 2015). These activities are critical to the implementation's success and include business process reengineering (BPR), constant communication, user involvement, project management, client consultation, education, and training (Gopaul, 2016; Malik & Khan, 2020). Firms should also typically plan for resource availability and assess their preparedness for the alterations that ERP implementation will introduce (Herath & Wijenayake, 2019). This usually involves top management awareness and involvement and sufficient support for each user during the implementation process (Haddara, 2018). Furthermore, establishing an implementation team is vital to ensure effective management of various aspects, such as end-user satisfaction and understanding, as well as the level of BPR required during implementation (AboAbdo *et al.*, 2019). Firms typically take one of two approaches to implementation: either proposing a one-time implementation strategy in which they execute a complete transfer from a legacy system to a new system instantaneously or contemplating a

gradual replacement of the legacy system (Ali & Miller, 2017). If these implementation approaches are synchronised with the business strategy during the implementation stage, the ERP implementation is more likely to succeed (Tarhini *et al.*, 2015).

### **2.2.1.2 Post-implementation stage**

Once the implementation stage is successfully completed, the go-live date signals the start of the post-implementation stage (Tian & Xu, 2015). The post-implementation performance relies significantly on the two preceding steps; for example, incorrect ERP selection during the pre-implementation stage would result in a potentially poor ERP performance measured during post-implementation (Ram *et al.*, 2013). Furthermore, the incorrect composition of the implementation team, coupled with insufficient training for end users during the implementation stage, would result in a low perceived level of ERP performance in the post-implementation stage (AboAbdo *et al.*, 2019). While in the post-implementation phase, firms complete essential processes, such as determining ERP dependability, ERP utilisation, ERP data integrity, and, most importantly, evaluating overall implementation performance (Malik & Khan, 2020; Singh *et al.*, 2023). Implementation performance can be broken down into firm-based performance variables and individual-based performance variables (Hsu *et al.*, 2015). Firm-based post-implementation performance variables include firm productivity, competitiveness, and efficiency (Mdimba *et al.*, 2017). At the same time, individual-based performance variables include user performance, user satisfaction, or an individual's desire to use the ERP system (Rajan & Baral, 2015). In order to ensure these performance variables are favourable essential activities, continual post-implementation audits are required (Gopaul, 2016).

## **2.2.2 ERP system implementation risks**

Enterprise resource planning (ERP) systems have been expanding beyond the firms' boundaries, allowing businesses to connect their internal processes with customers and suppliers (Abdellatif, 2014). As a result of this expansion, ERP implementations have become more complex than ever, with risks arising from various sources (Chatzoglou *et al.*, 2016). ERP implementation risks are defined as any threat to the performance of the implementation that could jeopardise its success (Garg & Khurana, 2017). Moreover, ERP implementation risks can stem from the firm's internal and external environment (AL-Zoubi & Al-Haija, 2018). Internal ERP implementation risks are within the ambit of the firms' control as they fall within the firms' physical parameters (Ali & Miller, 2017). An ERP implementation is a form of technological change within a firm; thus, most risks are internal implementation risks (Gilaninia



*et al.*, 2013). These risk factors can be further categorised into technological, organisational, project management, user, team, and project performance risks (Garg & Khurana, 2017). Examples of these risks include the following: a lack of management strategy and structure; insufficient skill levels; a lack of technology planning integration; a lack of end user awareness; inadequate end user training; and overwhelming software system reengineering requirements (Mukwasi & Seymour, 2015). In comparison, Gopaul (2016) asserted that a lack of BPR is also a major source of internal implementation risk when it comes to ERP.

Furthermore, external ERP implementation risks stem from the firm's external environment (Tobie *et al.*, 2016). Accordingly, they are external and cannot be controlled by the firm; however, they will directly or indirectly affect the ERP implementation (Chatzoglou *et al.*, 2016). They can also be categorised into economic, political, ecological, technological, socio-cultural, and demographic risks (Zendehdel Nobari *et al.*, 2020). Examples of risks include political conditions, poor infrastructure, economic instability, skill shortages, and cultural issues (Hasheela-Mufeti & Smolander, 2017; Malik & Khan, 2020). Also, external ERP implementation risks are exacerbated in developing countries such as South Africa due to their uncertain business environments (Bitsini, 2015; Mukwasi & Seymour, 2015).

Therefore, a risk management framework must mitigate these risks to reduce ERP implementation failure (Ali & Miller, 2017). Approximately 60% to 90% of ERP implementations fail to produce the intended benefits (Harun & Mansor, 2019). Researchers distinguish between two types of ERP implementation failures, namely, complete failure and partial failure (Malik & Khan, 2020). An implementation that is wholly abandoned is a clear example of a completely failed implementation (Muyambi, 2019). Similarly, when a perceived solution is not implemented, it can also be classified as a completely failed implementation (Gopaul, 2016). A partially failed implementation, however, survives the implementation life cycle, but exceeds its budget and timeline, which leads to a process misalignment for the firm (Bailey *et al.*, 2017). The following section discusses SCRm, which can be viewed as a method to mitigate disruptions that could ultimately result in ERP implementation failure.

### **2.3 Supply chain risk management**

A significant contribution to a firm's success or failure can be attributed to its effectiveness in managing risks within its supply chain (Rogers *et al.*, 2016). Without properly managing these risks, a firm may incur financial losses as risks obstruct supply chain efficiency by restricting the free flow of information and resources within the supply chain (Rajesh *et al.*, 2015). Given

these risks and their potential negative impact on a firm's performance and operations, firms require effective mitigation, reduction, and avoidance capabilities (Urciuoli *et al.*, 2014).

### **2.3.1 The SCRM process**

The overarching goal of SCRM is to manage supply chain vulnerability, emphasising speed and frequency as well as robustness and resilience within a firm's supply chain (Rogers *et al.*, 2016). SCRM is critical in reducing a firm's supply chain risks and ensuring the efficient functioning of supply chains in the face of multiple uncertainties (Ho *et al.*, 2015). SCRM is a process involving the following: identifying risks; assessing their potential consequences; selecting the most critical risks; defining and implementing risk response plans; and monitoring and controlling them to ensure continuity (Oliveira *et al.*, 2019). Moreover, Fan and Stevenson (2018) provided evidence that the SCRM process includes risk identification, risk assessment, and risk mitigation stages. These stages manage data that can be applied to determine risk mitigation strategies and, thus, improve the overall supply chain performance (Colicchia *et al.*, 2019). The SCRM process stages are discussed below.

The SCRM process begins with risk identification, which identifies the firm's vulnerabilities and relationships between internal and external risks (Valanarasu & Christy, 2018). Accordingly, if risks are not identified, it becomes challenging to establish mitigation strategies (Fan & Stevenson, 2018). Additionally, risk identification also involves analysing areas where risks could affect the supply chain (de Oliveira *et al.*, 2017). Due to the complexity of modern supply chains, techniques or methods to help identify risks are required (Colicchia *et al.*, 2019). These methods include identifying risks, assessing potential harm to the firm and its partners, and evaluating the overall impact on the supply chain (Simba *et al.*, 2017). An effective tool that encompasses these methods is the failure modes and effect analysis (FMEA), as it enables management to regularly review procedures to determine when and how they might fail, the effects of failures, and to avoid and correct procedures before an incident occurs (Wang *et al.*, 2018). Further tools utilised in the risk identification phase include risk mapping, taxonomies, and risk checklists (Giannakis & Papadopoulos, 2016). After identifying the risks, the risk assessment stage determines the probability and consequences of these risks to the firm.

Risk assessment entails weighing the probability, frequency, and impact of disturbances in several varying scenarios (Colicchia *et al.*, 2019). The consequences of risks are calculated by the impact on a firm's performance measures, such as productivity and profitability (Ho *et al.*, 2015). Risks with severe negative impacts could result in poor quality products, unsatisfactory delivery of raw materials, and inadequate delivery performance with incorrect

specifications (Ghadge *et al.*, 2013). Risk probability, on the other hand, plots an event against its magnitude or impact if it occurred (Hopkin, 2017). By utilising risk probability and impact, firms can assign weightings to risks and determine the significant ones (Lockamy, 2014). Hence, it is vital that each risk is appropriately assessed to allow management to focus on specific areas and, thus, minimise potential failures during the mitigation phase (Luzzini & Miemczyk, 2019). The prime risk assessment tools are as follows: business impact analysis; cost/benefit analysis; environmental risk assessment; scenario analysis; and cause and consequence analysis (de Oliveira *et al.*, 2017). Berle *et al.* (2013) argued that supply chain simulations can also be an effective tool for analysing the effect of risks on a firm's production, logistics, trade, and financial performance. Thus, after completing the risk assessment stage, strategies must be developed further in the risk mitigation stage.

Overall, risk mitigation reduces the impact or likelihood of risks being realised (Hopkin, 2017). It is, thus, vital for the success of SCRM that firms assign an appropriate mitigation strategy for all the risks that have been identified and assessed (Luzzini & Miemczyk, 2019). Accordingly, firms can choose from several risk mitigation responses for risks that may impact their operations, including risk transfer, risk sharing, risk avoidance, and risk acceptance (Ghadge *et al.*, 2013). Risk mitigation strategies may also be classified as being reactive or proactive (Manhart, 2017). Reactive strategies reduce the impact of a risk after it has occurred, whereas proactive strategies reduce the probability of occurrence or associated impact of a risk within a supply chain prior to the occurrence (de Oliveira *et al.*, 2017). Reactive mitigation strategies are as follows: demand switching; speculation; dynamic pricing; contingency planning; product bundling; and information sharing. However, proactive strategies include increased tracing, tracking, and selecting dependable and quality suppliers (Rajagopal *et al.*, 2017). These mitigation strategies are critical components of ERP implementation, because they provide a method to ensure that the ERP performance meets the objectives established prior to implementation (ChePa *et al.*, 2015). Therefore, it is vital that each risk in a firm's supply chain must be evaluated and mitigated so as to be financially feasible and beneficial to the firm (Kumar Sharma & Bhat, 2014).

### **2.3.2 Supply chain risk experienced during ERP implementation**

An ERP implementation can alleviate or worsen a firm's internal supply chain risks (Fischer-Preßler *et al.*, 2020). That said, if ERP implementation risks are effectively managed, it can result in increased information sharing and visibility within a firm's supply chain, which serves as a direct means to mitigate internal supply chain risks (Riley *et al.*, 2016; Herath &

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Wijenayake, 2019). This improved information flow between departments and supply chain partners can enhance product quality, flexibility, and customer responsiveness and reduce inventory and operational costs (Gilaninia *et al.*, 2013). However, if ERP implementation risks are not effectively managed, they can result in internal disruptions within a firm, such as technological failures that prevent a firm from achieving its objectives (Park *et al.*, 2016). These supply chain disruptions can then compromise the quality of data flows related to a firm's supply chain, resulting in severe financial damage (Irakoze, 2016). These disruptions can also cause increased lead times and inaccurate stock levels within a firm's supply chain (Mukwasi & Seymour, 2015).

### **2.3.3 SCRM capabilities in ERP implementation**

An ERP system is an example of IT being frequently used in management (Fischer-Preßler *et al.*, 2020). Implementing an ERP system is becoming more complex than ever before, with ERP implementation risks developing from various sources (Chatzoglou *et al.*, 2016). With these risks in mind, implementing an ERP system will inevitably disrupt the firm's supply chain (Haddara & Hetlevik, 2016). The goal of SCRM is to utilise a robust and resilient supply chain or logistics network as it enables a firm to be sustainable in the face of major disruptions (Kwak *et al.*, 2018). Both resilience and robustness are frequently referred to as capabilities for dealing effectively with supply chain risks (Rajagopal *et al.*, 2017).

Supply chain robustness refers to the ability of the supply chain to function despite internal or external disruptions (Squire *et al.*, 2014), while supply chain resilience relates to the ability of a supply chain to return to normal operating performance after being disrupted (Norrman & Wieland, 2020). Highly resilient and robust supply chains are distinguished by enhanced SCRM capabilities, which can support a firm's organisational goals and objectives by mitigating risks and achieving continuity when confronting severe disruptions (Yang *et al.*, 2021). Hence, SCRM employs both proactive and reactive strategies to reduce supply chain disruptions (Manhart, 2017). Proactive strategies necessitate a decision-maker's ability to anticipate and withstand potential future changes (Colicchia *et al.*, 2019). Supply chain agility has been noted as an essential antecedent of responsiveness (Sharma *et al.*, 2017). Supply chain agility enables firms to react efficiently and effectively to unanticipated changes in the marketplace and serves as a risk mitigation strategy to manage anticipated supply chain disruptions (Manhart, 2017). Enhanced tracking and tracing and the selection of high-quality, dependable suppliers are examples of proactive strategies (Simba *et al.*, 2017). Moreover, reactive strategies build capabilities within a supply chain to mitigate the effects of disruptions

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once it has occurred (Norrman & Wieland, 2020). Also, contingency speculation, planning, dynamic pricing, product bundling, information sharing, and demand switching are examples of reactive mitigation strategies (Rajagopal *et al.*, 2017). Agility, flexibility, responsiveness, coordination, early detection, root cause analysis, and preparedness are ideal generic strategies for proactive and reactive risk mitigation (Ghadge *et al.*, 2013; Manhart, 2017).

Manhart (2017) proffered that a firm's SCRM performance varies due to disparities in recognising the need for and developing SCRM capabilities. However, developing SCRM capabilities is often a difficult task that necessitates knowledge and experience in various fields (Raghunath & Devi, 2018). Hence, it is vital that information sharing, training, and internal integration precede a firm's SCRM capabilities (Rogers *et al.*, 2016). Thus, by leveraging these SCRM capabilities, firms can effectively control unexpected outcomes by systematically implementing risk management and mitigation approaches to reduce disruption (Manuj *et al.*, 2014). When a disruption occurs within a firm, the ability to recover rapidly is essential to limit losses (Yang *et al.*, 2021). Li *et al.* (2017) highlighted that ERP implementations are increasingly expanding from within a firm's boundaries to include supply chain partners, thus increasing the potential for disruption within a firm's supply chain. Also, firms with superior SCRM capabilities should be able to return to normal or superior operations sooner after any disruptions that have been triggered by an ERP implementation (Gopaul, 2016). This can be attributed to SCRM's ability to reduce costs and vulnerabilities and ensure business continuity during ERP implementation (Fan & Stevenson, 2018).

### 3. METHODOLOGY

A generic qualitative research design was used to create a comprehensive understanding of the role of SCRM capabilities in managing and mitigating risk to diminish the possibility of ERP implementation failure in South Africa (Percy *et al.*, 2015). This design permitted the researchers to interact with participants, quantify their experiences, and produce clear and information-rich explanations in response to the study's research questions (Leedy & Ormrod, 2014). Additionally, the research design was emergent and adaptable, allowing the researcher to realign the study with its primary purpose as required (Creswell, 2012).

This study's unit of analysis was focused on individual ERP implementation practitioners employed at the firms identified, as they were all directly involved in an ERP implementation in South Africa. Nine firms participated in the study, allowing for 14 semi-structured interviews. Of these firms, five were ERP providers, and four were ERP clients. A larger number of individuals from ERP providers were interviewed as they were deemed better suited to provide

information-rich responses given their superior experience regarding ERP implementations. The final sample size was determined using the data saturation concept proposed by Guest *et al.* (2006). This study's five key themes were developed following the tenth interview. Four additional interviews were conducted, which yielded no new information. The participants' details are provided in Table 1.

**Table 1: Participant and firm profiles**

Participant pseudonym	Job title	Gender	Firm pseudonym	ERP Implementation Practitioner type	Interview duration (min)
P1	Managing Director	Male	F1	ERP Provider	48
P2	Senior ERP Software Developer	Male	F1	ERP Provider	50
P3	Business Analyst	Male	F1	ERP Provider	53
P4	Senior Consultant	Male	F2	ERP Provider	62
P5	Pre-sales Consultant	Male	F3	ERP Provider	44
P6	Financial Director	Female	F4	ERP Client	46
P7	Financial Director	Male	F5	ERP Client	49
P8	Business Unit Manager	Male	F6	ERP Provider	57
P9	Managing Director	Male	F7	ERP Client	50
P10	Divisional Director	Male	F6	ERP Provider	62
P11	Divisional Director	Male	F6	ERP Provider	53
P12	Financial Director	Male	F8	ERP Client	46
P13	Business Process and Solutions Delivery Manager	Male	F9	ERP Provider	46
P14	ERP Project Implementation Leader	Male	F9	ERP Provider	50
<b>Average Time:</b>					<b>51 min</b>

Source: Authors' own compilation

Homogenous sampling was applied by selecting firms with similar characteristics (Creswell, 2012). Firms were selected based on the premise that they have recently been involved in an ERP implementation. Moreover, the inclusion criteria ensured that firms had ERP implementation experience in South Africa, making these firms better suited to provide

information-rich responses relevant to the study topic. Homogenous sampling and snowball sampling were utilised in order to select individual participants (Quinlan *et al.*, 2015). This entails the deliberate selection of individuals based on their meaningful similarities (Creswell, 2012). The inclusion criteria for participants from ERP clients included the following: (1) must be in senior management or overseeing ERP implementations; and (2) they must be directly involved in the ERP implementation to ensure they are well-informed and knowledgeable concerning the phenomenon under investigation. The inclusion criteria for participants from ERP providers included the following: (1) the individuals must have been highly influential in ERP implementation decision-making at the firms identified; and (2) they must have experience in ERP implementation. Once the data collection commenced, the researchers used snowball sampling, in which participants were asked to nominate other potential participants who aligned with the study's inclusion criteria (Quinlan *et al.*, 2015). The snowball technique is usually employed to reach hidden populations using the referring participants' network (Bornstein *et al.*, 2013).

The data for the study were obtained using semi-structured interviews (Bricki & Green, 2007). Semi-structured interviews are an ideal method for gathering information relevant to people's opinions and experiences in a particular industry or context (Rowley, 2012). Moreover, the open-ended questions and the adjustment of questions enabled the researchers to obtain detailed insights from ERP implementation practitioners. Prior to creating a discussion guide, a thorough literature review was conducted. Additionally, so as to ensure its suitability and effectiveness, the discussion guide was pre-tested with an experienced ERP implementation practitioner who met the study's inclusion criteria. The pre-test results were positive, with only minor changes being made to the discussion guide. The 14 semi-structured interviews lasted between 42 and 63 minutes, with an average of 51 minutes. Also, participants were encouraged to answer openly and honestly, and were assured that confidentiality and anonymity would be strictly maintained. As a further assurance, participants were asked to read and sign an informed consent form or provide verbal consent. The researchers transcribed all the interviews on the day of the interview.

The acquired data were analysed utilising a thematic analysis approach, which facilitated the systematic identification, classification, and understanding of the data's emerging themes (Braun & Clarke, 2012). Subsequently, the researchers became more familiar with the data after reading the transcriptions, which revealed early inductive codes (Creswell, 2012). The inductive codes were then integrated with deductive codes from the literature. The researchers compiled a comprehensive list of codes and then employed Atlas.ti Software Version 9 to

connect the data extracted from the transcriptions to these codes in order to identify patterns and themes. The final themes were then examined, and their applicability to the research questions was determined.

Multiple techniques were used to ensure the study's credibility, dependability, confirmability and transferability (Polit & Beck, 2012). To further ensure credibility, the participants' anonymity and confidentiality were confirmed prior to the interview to encourage a full and reliable account of events. Furthermore, participants could withdraw from the study at any time. Moreover, before the interview, respondents were advised that they were not required to answer any questions. Overall, dependability was ensured by creating a detailed overview of the participants, background, and methodology (Shenton, 2004). To help improve confirmability, the researchers designed broad, open-ended interview questions that enabled participants to provide a more open and impartial account of events. The researchers also attempted to collect as much information as possible by asking probing questions (Majid *et al.*, 2017). Transferability was ensured by providing adequate information regarding the study's context for future researchers. This should enable future researchers to determine whether the study can be applied to a different context (Shenton, 2004).

Participants were required to read and sign an informed consent form prior to the interview process. The informed consent form outlined the purpose of the study and clearly emphasised that interview data shall remain anonymous and confidential. Moreover, since the interviews were voluntary, the participants were able to withdraw from the interview process at any time. As an extra precaution to ensure confidentiality, pseudonyms were employed to anonymise the data.

#### **4. FINDINGS AND DISCUSSION**

The study identified five main themes directly related to the study's research questions. The following themes emerged from the thematic analysis process: (1) ERP SCM implementation risks; (2) ERP SCM risk identification methods; (3) ERP SCM assessment methods; (4) ERP SCM risk mitigation methods; and (5) SCRM capabilities in ERP implementation. The findings of each main theme and related sub-theme are discussed in the following sections, with verbatim quotes from the participants to support the claims made.



## 4.1 Theme 1: ERP SCM implementation risks

Research Question 1 relates to the SCM implementation risks experienced during ERP implementation. The following subsections describe internal and external risk sources experienced during implementation:

### 4.1.1 Internal ERP SCM implementation risks

Respondents noted internal ERP SCM risks as those which cause disruptions within a firm during ERP implementation. All respondents identified user risk as a source of internal SCM implementation risk. This resulted in inadequate user adoption, which ultimately caused internal supply chain disruptions due to implementation delays. User risk included insufficient training and a lack of end-user involvement during implementation, which contributed to resistance to change by end-users who felt uninvolved during the ERP implementation, as stated in the following quote:

*“No, you could see that this resistance to change was immense on this thing; there’s just no ways they wanted to change systems” (P8, male, Business Unit Manager).*

Eight respondents indicated that a lack of experienced staff on the implementation team, combined with staff turnover during implementation, contributed to team risk during implementation. Internal supply chain disruption was exacerbated by a lack of experienced staff, who lacked the skills to effectively identify and mitigate risks. Additionally, the new staff were unfamiliar with the implementation, resulting in internal supply chain disruptions because of delays caused by implementation processes having to be relearned and sometimes adjusted. Moreover, due to these team risks, poor implementation decisions were made, and staff training was required, which extended the duration of the ERP implementation disruption to business and internal supply chain operations. See the quotation below:

*“During the implementation, you could have risks, for instance, resources not being available, okay. So, or not the right spread of resources or the right knowledge in the resources being available” (P4, male, Senior Consultant).*

Respondents defined organisational risks during implementation as a misalignment between top management and staff on ERP software solution requirements and a lack of top management business knowledge. Ten respondents cited organisational risks as causing a misalignment between the ERP solution and actual business processes, which ultimately

impacted the firm's ability to service supply chain partners effectively. The following quote highlights the disconnect between top management and staff:

*"I'm going to say product manager who's actually in charge of production and inventory and everything. He said he wanted every single item in his store to be serial-number controlled. So, I said well that's not practical. And we ended up actually almost turned into a row. But he said it's my system, you will do what I say. So, we serialised everything, including nuts and bolts. How do you serialise a nut and a bolt? But he was insistent, so of course his stores manager now gets hold of this thing and says you want me to tell, when I'm pulling 25 bolts, which of the 50,000 serial numbers am I'm pulling?" (P8, male, Business Unit Manager).*

Participants identified the following project performance risks during implementation: overburdening BPR requirements to fit into the new ERP solution and ambiguous project planning. Ten participants identified these as sources of internal SCM risk, because their firms did not map the procedures and their potential impacts, resulting in uncertainty about how the supply chain would be affected. The lack of project performance planning is illustrated below:

*"If there's no standard operating procedures, if there are SOPs and procurement policies, for instance, in place, that you can always fall back and say, but we have done it in accordance with the policies and SOPs. But, if there's nothing existing that the person might come in and say, but control, alt, delete, we're going to do it this way" (P10, male, Divisional Director).*

Seven respondents identified internal communication risks as miscommunication between the ERP provider and the client and disorganised internal communication channels. This was due to communication uncertainty and a lack of communication, which resulted in internal risks taking longer to mitigate because ERP practitioners either misinterpreted the risk or were unsure of whom to report such internal risk issues. See citation below:

*"From us as a customer, and the ERP provider, which speaks IT English, is usually two very different worlds, so swearing helps a lot with them" (P9, male, Managing Director).*

During implementation the following were identified as contributors to information risks: poor data quality and an inability to accurately capture master data into the new ERP system. Ten respondents identified information risk as an internal source of SCM risk, citing instances

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where they were unable to service supply chain partners on the new ERP's go-live date due to a complete shutdown of business operations, as illustrated below:

*“There’s one instance where the guys stopped operations the morning they went live. And, the reason why they stopped it is a very stupid thing if you think of it afterwards now, but they uploaded the incorrect master data. They forgot to load the bin locations for each one of the materials” (P4, male, Senior Consultant).*

Respondents identified extensive ERP customisations and implementation practitioners' misunderstanding of implementation complexity as ERP complexity drivers. ERP complexity was mentioned by nine respondents as a major source of internal SCM risk, with companies choosing customised ERP solutions, which resulted in longer disruptions relevant to internal supply chain operations during implementation due to their more complex and lengthy implementations. See examples below:

*“If you are getting an ERP system that's customised to your company, there is a significant amount more amount of work that's needed from the developers of the ERP system because they are providing a customised programme to your company” (P7, male, Financial Director).*

#### **4.1.2 External ERP SCM implementation risks**

Respondents identified the physical environment in which the implementation takes place as a risk, which, in this study, was South Africa. Nine respondents identified the physical environment as an external ERP SCM risk, with a lack of infrastructure being the most significant risk. Hence, the firm's ability to leverage modern ERP technologies, which rely on such infrastructure to function optimally and contribute to supply chain visibility via information sharing, was indeed hampered. The following quotation exemplifies the lack of a physical Internet infrastructure, such as fibre:

*“Then you've got things like infrastructure so depending where you do... the software is, in a city where there's Fibre Internet, or is it in a remote area where you need to rely on 3G and, you know, those sorts of things. So, infrastructure can also be a risk to a project” (P5, male, Pre-sales Consultant).*

Respondents also noted that poor computer literacy coupled with a lack of education contributed to skilled labour risk within South Africa. Six participants identified that this external SCM risk resulted in poor end-user data capture and an inability to efficiently structure the new

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ERP system to maximise supply chain visibility. The following quote reflects the lack of skilled labour:

*“Unfortunately, 90% of our population that comes out of school do not even know how to operate a computer” (P7, male, Financial Director).*

The findings of Research Question 1 corroborate those of Valanarasu and Christy (2018), indicating that supply chain risks can be classified as external when they originate outside the firm's boundaries or as internal when they originate within the firm's boundaries. The study added to the literature by identifying how ERP implementation affects the supply chain by analysing internal and external SCM risks experienced during implementation. During ERP implementation, ten ERP SCM risks were identified. Eight were internal, while two were external ERP SCM risks. These findings support the literature stating that most implementation risks are internal ERP SCM implementation risks (Gilaninia *et al.*, 2013). Both the external ERP SCM risks identified are supported in the literature, stating that physical environment risk and skilled labour risk are major risk factors to consider during ERP implementation in developing countries such as South Africa (Malik & Khan, 2020).

## **4.2 Theme 2: ERP SCM risk identification methods**

In relation to Research Question 2, two sub-themes will be discussed, namely, proactive and reactive risk identification methods.

### **4.2.1 Proactive ERP SCM implementation risk identification methods**

Respondents noted proactive risk identification methods in an attempt to identify risks before their occurrence. Thirteen respondents indicated that they utilise proactive methods to identify ERP SCM implementation risks. Ten respondents identified pre-implementation meetings, during which implementation practitioners discussed the potential impact of ERP SCM risks before implementation as a proactive method. This enabled firms to identify risks before these risks could have an adverse effect on business and supply chain operations during ERP implementation, as illustrated below:

*“I would also say, like having meetings with your clients’ continuous meetings, we try and aim for many three, four or five meetings, even before we even start implementing the ERP” (P3, male, Business Analyst).*

Respondents noted that workshops, which were frequently held concurrently with pre-implementation meetings, were an effective method of proactive SCM risk identification. These activities included interactive sessions with end users to better understand business

processes and the capabilities of the ERP system to support them. This enabled ERP practitioners to identify potential risks to a firm's internal supply chain operations before the go-live date, allowing firms to mitigate risks before they disrupt the supply chain. This is evidenced by the following quotation:

*"It may require a workshop to get guys together to understand or to take the risk properly apart and make plans to reduce the risk" (P4, male, Senior Consultant).*

Risk mapping, which entailed mapping the implementation process and identifying high-risk areas before implementation, was cited by respondents as an effective proactive method. Ten respondents stated risk mapping assisted them in identifying risks before they affected the firm's supply chain and internal operations during implementation. Refer to the following quote:

*"Yeah, that's more or less, I would say it's more a map that we have created ourselves" (P9, male, Managing Director).*

#### **4.2.2 Reactive ERP SCM implementation risk identification methods**

All respondents expressed that they utilised reactive risk identification methods. These included methods put in place to identify risks once they have occurred. Respondents identified end-user involvement as an effective method for reactive identification. This included end-user testing of the ERP system following the go-live and end-user involvement in risk identification. Ten respondents cited this method as assisting in identifying risks earlier in the implementation process, allowing them to mitigate potential supply chain disruptions while resources were still available during the implementation phase. This is illustrated by the following quote:

*"But, that's also when people use the system. Other people uses the system you pick up more risks, or more stuff that's not correct. I mean, I can use it in a certain way, so the more people that use a system at the end of the day, I think, the quicker you're going to get all everything sorted out and realise where the problems is in the system" (P6, female, Financial Director).*

Respondents cited implementation practitioners' experience, which included prior implementation experience, as an effective reactive method. Thirteen respondents conveyed that their experience enabled them to discover risks early in the implementation process, limiting both internal and external supply chain risks during the implementation, as risk mitigation measures were put in place earlier. This is illustrated by the following quote:

*“Well, usually there's no, can I say, manual that we try to find in terms of managing a specific situation. It's fairly out of experience over the years that will tell you, and that you know that if you're going to be implementing certain aspects to your business, what is going to be the risk factors... what's going to be falling to the wayside because you have got staff members to think of and, you've got customers to think of” (P9, male, Managing Director).*

The study's findings on Research Question 2 support those of Giannakis and Papadopoulos (2016), who viewed risk mapping as a proactive method in ERP supply chain risk identification. This study adds to the literature by identifying pre-implementation meetings and workshops as effective methods to proactively identify ERP SCM risk during ERP implementation. Simba *et al.* (2017) confirmed that reactive methods can be used to identify ERP supply chain risks as they cited experience as a major reactive method utilised during the SCM risk identification process. This study confirms the findings of AboAbdo *et al.* (2019), who argued that end-user involvement represents a key success factor when used as a metric for reactive risk identification. However, the risk identification tools do not correspond to those identified in the literature, such as FMEA, with respondents indicating a preference for ERP implementation-specific risk identification tools (Wang *et al.*, 2018).

### **4.3 Theme 3: ERP SCM risk assessment methods**

In relation to Research Question 3, two sub-themes will be discussed: risk assessment scales and risk assessment tools.

#### **4.3.1 Risk assessment scales**

Respondents stated that assessment scales aided them in prioritising risks associated with ERP implementation in their supply chain. While analysing risk assessment scales, ten respondents assisted in identifying three interconnected variables: risk likelihood, risk impact, and risk prioritisation. Risk impact was described as the severity of the risk if it materialised, whereas risk prioritisation was defined as determining the criticality of the risk by the trade-off between the risk's impacts versus its likelihood of occurrence. According to respondents, these risk assessment scales determined which ERP SCM risks would cause the most disruption to internal supply chain operations during ERP implementation by assessing the risk's likelihood, impact if it occurred, and, ultimately, its level of criticality. The following quotation demonstrates the utilisation of the assessment scales:

*“So, we’ve got a definition there, we’ve got a risk matrix, which actually identify whether the likelihood and the impact of that risk. So, if the likelihood is low, we’ll give it a one. And again, that is lower given a one, and we multiply the two by each other to get to a final figure. So, if you have two likelihoods, and it’s out of five, okay, if the likelihood is very high, it’s five, and if the impact is very high, it’s also five, and then it will give you a rating of 25” (P4, male, Senior Consultant).*

However, two respondents disagreed with the formal risk assessment scales, suggesting that risks should be treated equally during implementation. This is illustrated in the following quote:

*“You know, I’m going to say risk is a risk, and you need to identify it and figure out what you’re going to do with it, whether you ignore it or whether you put something in place to try and prevent it” (P8, male, Business Unit Manager).*

#### **4.3.2 Assessment tools**

Assessment tools were defined as tools that assist respondents in adequately evaluating risks during the implementation process. Thirteen respondents indicated that they utilised internal risk assessment tools to gauge the risks associated with ERP implementation. These tools helped assess any internal ERP SCM risks and their impact on internal supply chain operations during ERP implementation. Eleven out of thirteen respondents indicated these were informal tools. The following quotation exemplifies this point:

*“We manage challenges using a project management tool. It’s nothing formal. It’s literally just, you know, a board that you either manage physically or digitally, where you manage your risks, based on criticality and lead time ...there’s no real logical automatic way where you can quantifiably, you know, prioritise one thing over another in those levels” (P13, male, Business Process and Solutions Delivery Manager).*

None of the respondents mentioned using external assessment tools when implementing an ERP. Respondents cited that firms preferred to focus on assessment tools internally rather than externally. External assessment tools are vital in assessing the effects of ERP SCM risks on external supply chain partners and operations during ERP implementation.

The study's findings regarding Research Question 3 confirm that the identified risk assessment scales are aligned with the risk assessment literature, which employs the conventional risk impact and likelihood scales (Lockamy, 2014). However, since the assessment tools were informal and internal, they contradict those described in the literature:

business impact analysis; cost/benefit analysis; environmental risk assessment; scenario analysis; and cause and effect analysis, which are more formal and externally focused (de Oliveira *et al.*, 2017). Participants noted that the assessment scales and tools were solely internal, with no mention of external assessment tools and scales used to assess the impact of ERP implementation on supply chain partners.

#### **4.4 Theme 4: ERP SCM risk mitigation methods**

In relation to Research Question 4, three sub-themes will be discussed: flexible mitigation methods, redundant assessment methods, and risk mitigation criteria.

##### **4.4.1 Flexible ERP SCM implementation risk mitigation methods**

Respondents indicated that flexible mitigation methods allowed them to respond to unexpected risks by reducing the impact and likelihood of SCM risks faced during ERP implementation. Seven respondents highlighted that a development system was critical, because it enabled the implementation of ERP customisations on a development platform before transferring them to the live ERP system. This was deemed an effective method of mitigating risks before they disrupted business and supply chain operations, as it allowed ERP practitioners to test the development system and mitigate prior to their manifestation in the live system. This is supported by the following quote:

*“No, it's basically through the prototyping for us is on a high level is our second phase of the implementation. So, that will basically run from there till after the go-live, to keep that as a sandpit environment” (P11, male, Divisional Director).*

Respondents noted the use of parallel systems as an effective, flexible mitigation method, as it included running the new ERP system with the legacy ERP system for a specified period. Eight respondents mentioned that these allowed firms to continue operating even if the new ERP implementation failed as firms could fall back on the legacy ERP system, thus minimising supply chain disruption during failure. Consider the following example:

*“I think running two systems parallel for a certain period might be a good way to mitigate all the supply chain risks” (P6, female, Financial Director).*

Extensive testing before the go-live, including user acceptance testing, was cited as a flexible mitigation method. This included ensuring that end users were satisfied with the proposed ERP system solution before implementation. Ten participants stated that this prevented SCM risks from affecting the firm's business operations and external supply chain partners after the



go-live date, because end users' ERP system requirements for servicing supply chain partners were met prior to implementation. The quotation below illustrates this point saliently:

*"I think by testing and proper testing; a lot of the problems can actually get eliminated before it actually goes live. So, I would say testing is just one of the very base methods that you, that you actually want to use to try and eliminate as much as possible before you start with it" (P9, male, Managing Director).*

Respondents identified a super user as a flexible mitigation method, which included assigning a responsible individual from both the ERP provider and the ERP client. Eleven respondents proffered that because of the super user mitigating SCM risks during implementation, ERP implementation lead times were shortened, and disruptions in the flow of goods and information between supply chain partners were minimised. See the supporting quotations below:

*"We were part of an implementation where we have quite strong super user, where he took a lot of ownership of the problems, a lot of small problems, where the implementation, from my perspective was a breeze. The go-live was a breeze. It was really good" (P14, male, ERP Project Implementation Leader).*

#### **4.4.2 ERP SCM implementation risk mitigation criteria**

During the ERP implementation, respondents identified several criteria to determine the most appropriate risk mitigation methods. While analysing criteria for risk mitigation during the ERP implementation, six respondents emphasised the importance of balancing mitigation cost and time. This included analysing the time required to mitigate risks during ERP implementation and the costs associated with the proposed mitigation method. If budgets were constrained and timelines were unrealistic during ERP implementation, the ability to effectively mitigate SCM risks and their impact on internal operations and supply chain partners were affected. The statement below illustrates this point very clearly:

*"If you have an implementation plan, which is overly structured, and also costed on every, if the implementation is costed on every action that takes place, then these types of implementation risks that needs to be mitigated, there's always a cost implication" (P1, male, Managing Director).*

Eight respondents identified resource availability, which included skilled human resources, as a form of mitigation criteria. This was cited as a direct factor in determining the method for

mitigating ERP SCM risks and the ability to limit the associated effects on the supply chain during implementation. Consider the following example:

*“What I've seen before is, you can't get a resource available to help you with your deployment. And, that simply just delays the project because you don't have the skills to do it yourself, because it's such a specific skill that just delays the project; it's not the functional problem, it's not the project owner problem, it's not a budget problem. It's just a resource problem we don't, we can't find people to help you” (P13, male, Business Process and Solutions Delivery Manager).*

Seven respondents affirmed that the criteria used for mitigation depended on the implementation size, with larger implementations requiring more extensive mitigation methods. This was primarily due to the increase in SCM risks and their potential to impact a firm's operations during ERP implementation. This is emphasised by the following quotation:

*“It depends on the size of the project. But if it's a big project with big companies implementing, or combining their operations into one ERP system, that testing alone could take something like eight to 12 weeks, just the testing” (P4, male, Senior Consultant).*

The study's findings on Research Question 4 are supported by literature that cites the use of flexible mitigation methods in decreasing the impact and likelihood of SCM risks (Talluri *et al.*, 2013). The study adds to the literature by identifying development systems, parallel systems, extensive software testing, and the super user as effective and flexible mitigation methods to mitigate SCM risks experienced during ERP implementation. Mitigation criteria reflected the literature's cost-benefit analysis as considerations to examine when deciding on a mitigation plan (Kumar Sharma & Bhat, 2014). This study extended the literature by identifying additional mitigation criteria for ERP implementations, including resource availability and implementation size.

#### **4.5 Theme 5: ERP SCRM capabilities**

In relation to Research Question 5, four sub-themes will be discussed: agility; responsiveness; early warning signals; and flexibility. During ERP implementation, respondents identified several capabilities pertaining to SCRM. Supply chain agility enabled firms to react efficiently and effectively to unanticipated SCM risks during ERP implementation. Eleven respondents cited agility in their ability to limit internal and supply chain disruption caused by the ERP implementation. Respondents relayed that their more informal and adaptable approach to

ERP implementation facilitated their ability to respond more effectively to unexpected SCM risks. The following quotation supports this:

*“Yes, I think we’ve in a way, developed our business and our response to that in such a way that we, we are almost used to being agile in terms of really addressing some of the unexpected issues, as you know, during implementation. So that helps a lot” (P2, male, Senior ERP Software Developer).*

Responsiveness is the ability to recover from SCM risks experienced during implementation. Seven respondents noted that their ability to respond in a timely manner directly impacted their ability to limit disruptions caused by ERP SCM risks during implementation. Furthermore, respondents anticipated worst-case scenarios and built-in response capabilities, as demonstrated in the quote below:

*“But I think what we’ve done, of the, you know, of the incidents like that, is to basically more on your prototyping approach on the system as our do you how do you restore after a complete failure, you know of. And then, you must almost think of it in terms of a server room catching fire, you know, so that contingency management that you can apply in unexpected scenarios” (P11, male, Divisional Manager).*

Seven respondents noted early warning signals as an effective SCRM capability during ERP implementation. Early warning signals refer to any indications of a potential disruption that could be caused by an SCM risk during implementation. This includes detecting SCM risks early on during implementation and attempting to mitigate these risks before severely disrupting the firm's operations and supply chain. This can be validated by the following quotation:

*“So, you are looking for the early warning signs can I say, or that, then during the entire process, then you start soon as the that signal shows you, like you identify the issue as quick as possible, and then go through the entire process of them fixing it. So, you definitely look for the early, early warning signs in any risk” (P3, male, Business Analyst).*

Nine respondents cited the importance of flexibility in mitigating the impact of ERP implementation disruption on supply chain partners. Flexibility was cited as SCRM's capability to enable a firm to revert to normal or superior operations relevant to ERP post-

implementation. Flexibility also enabled timely and effective responses to SCM risks that materialised during ERP implementation. The quotation below clearly illustrates this point:

*“Yes, yes, no, the thing is, they must actually run better after the implementation is done in as shorter timeframe as possible” (P4, male, Senior Consultant).*

Despite SCRM's apparent capabilities in many of the study's firms, two firms experienced disruptions during implementation and could not resume operations afterwards. Both firms lacked formal SCRM processes, as illustrated below:

*“We previously — we had a situation where we almost had a year implementing a system that wasn't implemented properly. People lose money so, I mean, you incur the extra costs. So, every time that people have to spend on implementing or fixing the system, whatever it costs us as company, a lot of money to pay them for additional time. The customers couldn't get their information on time, with, for instance, late payments and stuff like that” (P6, female, Financial Director).*

The study's findings on Research Question 5 support the literature on the importance of SCRM's capabilities in assisting firms in returning to superior operations after ERP implementation (Gopaul, 2016). The literature further supports the capabilities identified in the study, which included agility, responsiveness, early warning signals, and flexibility (Chowdhury & Quaddus, 2016; Oliveira *et al.*, 2019). Additionally, the findings indicate that when critical components of the SCRM process are missing, firms suffer severe disruptions; thus, the ERP implementation fails. This impeded firms' ability to service supply chain partners, resulting in a ripple effect throughout the supply chain.

## **5. CONCLUSION**

### **5.1 Discussion of the findings and theoretical implications**

This generic qualitative study aimed to ascertain the role of SCRM capabilities in managing risks to limit the possibility of ERP implementation failure. The study endeavoured to determine which SCRM processes were used and how they could be improved.

The first research question set out to investigate the SCM risks experienced during ERP implementation. The study detected ten major SCM risks during ERP implementation: eight internal and two external. These findings support the literature stating that most implementation risks are internal ERP SCM implementation risks (Gilaninia *et al.*, 2013). Internal SCM risks included user risk, team risk, organisational risk, project performance risk,

internal communication risk, information risk and, overwhelming, ERP complexity. External SCM risks included physical environment risks and skilled labour risks. These results confirm the findings of Valanarasu and Christy (2018), who proffered that SCM risks can be classified as external or internal depending on how they affect the firm.

The second research question explored the SCM risk identification methods utilised during ERP implementation. These were further classified into proactive and reactive methods. Moreover, end-user involvement and ERP practitioners' experience were identified as effective reactive identification methods. These findings are supported by the literature, which recognised end-user involvement and experience as effective reactive identification methods (Simba *et al.*, 2017; AboAbdo *et al.*, 2019). Along with existing literature on proactive detection methods, the study identified pre-implementation meetings and workshops as effective proactive identification methods. The findings demonstrate that effective proactive methods enabled firms to detect risks before any adverse effects on business and supply chain operations during ERP implementation. Finally, the study confirmed the absence of formal risk identification methods such as FMEA and taxonomies.

The third research question focused on SCM risk assessment methods employed during ERP implementation. These were further categorised into assessment scales and assessment tools. Three effective risk assessment scales were identified: risk likelihood, impact, and prioritisation. These risk assessment scales are in line with the risk assessment literature (Lockamy, 2014). Most risk assessment tools were internal and informal, with no assessment tool focusing on how SCM risks impact external supply chain partners during implementation. Respondents also admitted to not having formal assessment methods in place, which represents a critical phase in the SCRM process, because when risks are recognised, mitigation measures can be plotted. The study discovered that the assessment tools that were used did not correspond to those described in the literature. While the literature advocates for formal assessment tools, such as business impact analysis, cost-benefit analysis, environmental risk assessment, scenario analysis, and cause and effect analysis, respondents preferred informal assessment tools such as mind maps and Excel (de Oliveira *et al.*, 2017).

The fourth research question addressed the supply chain risk mitigation methods utilised during ERP implementation. These were categorised into flexible methods and mitigation criteria. The findings are supported by the literature that cites the use of flexible mitigation procedures as an effective method to decrease the impact and likelihood of SCM risks.

Additionally, the study identified the use of a development system, running parallel systems, conducting extensive software testing, and effectively using the superuser as additional flexible mitigation methods applicable to SCM risks associated with ERP implementation. These methods ultimately played an influential role in allowing SCM risks to be avoided or mitigated in a timely manner, minimising their resulting disruption during implementation. Moreover, mitigation criteria reflected the literature's cost-benefit analysis as considerations to examine when deciding on a mitigation plan (Kumar Sharma & Bhat, 2014). Additionally, this study adds to the literature by identifying additional mitigation criteria to consider when implementing an ERP system, namely, resource availability and implementation size.

The final research question investigated the role of SCRM capabilities in ERP implementation. The findings support the literature concerning the importance of SCRM capabilities in assisting firms to return to superior operations after ERP implementation (Gopaul, 2016). This study identified four main capabilities of SCRM during ERP implementation, which included agility, responsiveness, early warning signals, and flexibility. These capabilities were further supported in the literature as effective SCRM capabilities (Chowdhury & Quaddus, 2016; Oliveira *et al.*, 2019). Additionally, the significance of these findings is underscored by the fact that when critical components of the SCRM process were missing, firms experienced significant disruptions, and the ERP implementation failed. The resulting effects impeded the firm's ability to service supply chain partners, resulting in a negative cascading effect throughout the supply chain. Finally, the study adds to the literature by identifying the validity of the SCRM process and, more specifically, the role of SCRM capabilities during ERP implementation.

## 5.2 Managerial recommendations

First, and foremost, the firms in question lacked formal assessment tools. This was primarily because participants believed informal assessment tools allowed them to adapt to unexpected SCM risks and revert to mitigation in a more timely manner. However, managers need to have formal tools in place to formally assess supply chain risks and their potential impact. Formal assessment tools, such as business impact analysis, cost/benefit analysis, environmental risk assessment, scenario analysis, and cause and effect analysis, should be considered. These tools are vital to prioritise recovery efforts and assess the risks associated with ERP implementation. Second, there is little evidence of a formal SCRM approach, let alone during ERP implementation. In order to minimise risk during ERP implementation, firms would benefit from following a structured approach to managing SCM risks. A formal SCRM management

approach would provide firms with a concise framework that would enable them to respond to unexpected risks and, thus, allow them to more effectively leverage SCRM's capabilities involving agility, responsiveness, early warning signals, and flexibility. Additionally, a formal SCRM approach should be employed during ERP implementation and for general SCRM throughout the firm. This would help create firm-wide uniformity in dealing with disruptions, much like those caused by ERP implementation. Third, there appeared to be limited knowledge of the effects of ERP implementation disruptions on external supply chain partners. The majority of SCRM elements were geared toward internal business operations, with the running of parallel systems, development systems, and extensive testing cited as effective mitigation methods. In the event of a failed ERP implementation, fellow supply chain partners seemed completely unprepared for the subsequent disruption. Therefore, firms could involve supply chain partners in ERP implementation decisions and even push for new ERP-related software integration opportunities. This could be accomplished by involving key supply chain partners in ERP selection and pre-implementation meetings to help implement an ERP system that is more suited to the firm's business operations and key supply chain partners. Lastly, while end-user resistance to change was cited as a major user risk, resulting in internal disruption during ERP implementation, only one firm established a change management division to deal with changes during ERP implementation. This change management division would then assist firms by providing commonality and a single point of contact and improving the effectiveness of change management. Hence, ERP providers could adopt this form of division to reduce disruption when implementing an ERP system.

### **5.3 Limitations and directions for future research**

This study has a few limitations, which could promote further research. First, this study made use of a qualitative research design with a relatively small sample size of fourteen ERP implementation practitioners from ERP clients and ERP providers. Researchers may consider alternative research designs, such as survey research, to ascertain the nature of the interrelationships and strengths of several key constructs. Second, this study only considered managers from ERP clients and ERP providers. In the future, research can focus on obtaining the perspectives of end users. This will provide a more concise picture of SCRM's capabilities in ERP implementation from a different perspective. In conclusion, limiting the study to South African implementations limits its generalisability. Accordingly, future research should be conducted in other developing countries to broaden generalisability and validate our findings.

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## REFERENCES

- Abdellatif, H.J. 2014. ERP in higher education: A deeper look on developing countries. In Proceedings of the Lodz, Poland, 22-24 September: 73-78. [Internet: <https://ieeexplore.ieee.org/document/6998905>; downloaded on 25 April 2021].
- AboAbdo, S., Aldhoiena, A. & Al-Amrib, H. 2019. Implementing enterprise resource planning (ERP) system in a large construction company in KSA. *Procedia Computer Science*, 164:463-470. [<https://doi.org/10.1016/j.procs.2019.12.207>].
- Ahmed, N., Shaikh, A. & Sarim, M. 2017. Critical success factors plays a vital role in ERP implementation in developing countries: An exploratory study in Pakistan. *International Journal of Advanced Computer Science and Applications*, 8(10):21-29.
- AL-Zoubi, M. & Al-Hajja, A. 2018. Organization factors for ERP projects in a developing country: A case study Jordan. *International Business Research*, 11(8):1-8. [<https://doi.org/10.5539/ibr.v11n8p1>].
- Ali, M., Edghiem, F. & Alkhalifah, E.S. 2023. Cultural Challenges of ERP Implementation in Middle-Eastern Oil & Gas Sector: An Action Research Approach. *Systematic Practice and Action Research*, 36:111-140. [<https://doi.org/10.1007/s11213-022-09600-4>].
- Ali, M. & Miller, L. 2017. ERP system implementation in large enterprises – A systematic literature review. *Journal of Enterprise Information Management*, 30(4):666-692. [<https://doi.org/10.1108/JEIM-07-2014-0071>].
- Altamony, H., Al-Salti, Z., Gharaibeh, A. & Elyas, T. 2016. The relationship between change management strategy and successful enterprise resource planning (ERP) implementations: A theoretical perspective. *International Journal of Business Management and Economic Research*, 7(4):690-703.
- Asongu, S.A. & Odhiambo, N.M. 2019. Basic formal education quality, information technology, and inclusive human development in sub-Saharan Africa. *Sustainable Development*, 27(3):419-428. [<https://doi.org/10.1002/sd.1914>].
- Ayani, S., Mirzaei, M., Abbasi, N. & Moulaei, K. 2021. Enterprise resource planning in the health industry: Problems of its usage based on the extent of the countries development. *Applied Medical Informatics*, 43(1):1-13.
- Bailey, L., Seymour, L.F. & van Belle, J.-P. 2017. Impact of ERP implementation on the quality of work life of users: A sub-Saharan African study. *African Journal of Information Systems*, 9(3):192-212.
- Baumann, B. 2020. Lessons learned from the Lidl ERP failure. [Internet: <https://www.panoramaconsulting.com/lidl-erp-failure/>; downloaded on 27 March 2021].
- Berle, Ø., Norstad, I. & Asbjørnslett, B.E. 2013. Optimization, risk assessment and resilience in LNG transportation systems. *Supply Chain Management: An International Journal*, 18(3):253-264. [<https://doi.org/10.1108/SCM-03-2012-0109>].
- Bitsini, N. 2015. Investigating ERP misalignment between ERP systems and implementing organizations in developing countries. *Journal of Enterprise Resource Planning Studies*, 2015:1-12. [<https://doi.org/10.5171/2015.570821>].
- Bornstein, M.H., Jager, J. & Putnick, D.L. 2013. Sampling in developmental science: Situations, shortcomings, solutions, and standards. *Developmental Review*, 33(4):357-370. [<https://doi.org/10.1016/j.dr.2013.08.003>].
- Braun, V. & Clarke, V. 2012. Thematic Analysis. In Cooper H (Ed.), *APA Handbook of research methods in psychology* (XXX ed.). Washington, DC: American Psychological Association. pp. 57-71.
- Bricki, N. & Green, J. 2007. A Guide to Using Qualitative Research Methodology. pp. 1-37. [Internet: <https://fieldresearch.msf.org/handle/10144/84230>; downloaded on 4 July 2022].



- 
- Chatzoglou, P., Fragidis, L., Chatzoudes, D. & Symeonidis, S. 2016. Critical success factors for ERP implementation in SMEs. Gdansk, Poland, 11-14 September:1243-1252. [Internet: <https://annals-csis.org/proceedings/2016/pliks/37.pdf>; downloaded on 3 March 2022].
- ChePa, N., Jnr, B.A., Nor, R.N.H. & Murad, M.A.A. 2015. A review on risk mitigation of IT governance. *Information Technology Journal*, 14(1):1-9. [<https://doi.org/10.3923/itj.2015.1.9>].
- Chowdhury, M.M.H. & Quaddus, M. 2016. Supply chain readiness, response and recovery for resilience. *Supply Chain Management: An International Journal*, 21(6):709-731. [<https://doi.org/10.1108/SCM-12-2015-0463>].
- Christopher, M. 2016. Logistics and supply chain management. 5<sup>th</sup> ed. Edinburgh Gate, Harlow, UK: Financial Times.
- Colicchia, C., Creazza, A. & Menachof, D.A. 2019. Managing cyber and information risks in supply chains: Insights from an exploratory analysis. *Supply Chain Management: An International Journal*, 24(2):215-240. [<https://doi.org/10.1108/SCM-09-2017-0289>].
- Creswell, J. 2012. Education research: Planning, conducting and evaluating quantitative and qualitative research. 4<sup>th</sup> ed. Boston, MA: Pearson.
- de Oliveira, U.R., Marins, F.A.S., Rocha, H.M. & Salomon, V.A.P. 2017. The ISO 31000 standard in supply chain risk management. *Journal of Cleaner Production*, 151:616-633. [<https://doi.org/10.1016/j.jclepro.2017.03.054>].
- Fan, Y. & Stevenson, M. 2018. A review of supply chain risk management: Definition, theory, and research agenda. *International Journal of Physical Distribution & Logistics Management*, 48(3):205-230. [<https://doi.org/10.1108/IJPDLM-01-2017-0043>].
- Fischer-Preßler, D., Eismann, K., Pietrowski, R., Fischbach, K. & Schoder, D. 2020. Information technology and risk management in supply chains. *International Journal of Physical Distribution & Logistics Management*, 50(2):233-254. [<https://doi.org/10.1108/IJPDLM-04-2019-0119>].
- Garg, P. & Khurana, R. 2017. Applying structural equation model to study the critical risks in ERP implementation in Indian retail. *Benchmarking: An International Journal*, 24(1):143-162. [<https://doi.org/10.1108/BIJ-12-2015-0122>].
- Urciuoli, L., Mohanty, S., Hintsä, J. & Gerine Boekesteijn, E. 2014. The resilience of energy supply chains: A multiple case study approach on oil and gas supply chains to Europe. *Supply Chain Management: An International Journal*, 19(1):46-63. [<https://doi.org/10.1108/SCM-09-2012-0307>].
- Ghadge, A., Chester, M., Kalawsky, R. & Dani, S. 2013. A systems approach for modelling supply chain risks. *Supply Chain Management: An International Journal*, 18(5):523-538. [<https://doi.org/10.1108/SCM-11-2012-0366>].
- Giannakis, M. & Papadopoulos, T. 2016. Supply chain sustainability: A risk management approach. *International Journal of Production Economics*, 171:455-470. [<https://doi.org/10.1016/j.ijpe.2015.06.032>].
- Gilaninia, S., Ganjini, H. & Mahdikhannmahaleh, B.A. 2013. Difference between internal and external supply chain risks on its performance. *Nigerian Chapter of Arabian Journal of Business and Management Review*, 1(3):62-68.
- Goldston, J. 2019. Critical success factors in enterprise resource planning implementation in US manufacturing. Minneapolis, MN: Walden University. (PhD Thesis) (Unpublished) [Internet: <https://scholarworks.waldenu.edu/dissertations/6567/>; downloaded on 14 February 2022].
- Gopaul, H.R. 2016. A systematic analysis of ERP implementation challenges and coping mechanisms: The case of a large, decentralised, public organisation in South Africa. Cape Town: University of Cape Town. (MPhil Thesis) (Unpublished) [Internet: <https://open.uct.ac.za/handle/11427/22813>; downloaded on 18 March 2022].

- Guest, G., Bunce, A. & Johnson, L. 2006. How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability. *Field Methods*, 18(1):59-82. [<https://doi.org/10.1177/1525822X05279903>].
- Haddara, M. 2018. ERP systems selection in multinational enterprises: A practical guide. *International Journal of Information Systems and Project Management*, 6(1):43-57. [<https://doi.org/10.12821/ijispm060103>].
- Haddara, M. & Hetlevik, T. 2016. Investigating the effectiveness of traditional support structures & self-organizing entities within the ERP shakedown phase. *Procedia Computer Science*, 100:507-516. [<https://doi.org/10.1016/j.procs.2016.09.189>].
- Harun, A. & Mansor, Z. 2019. Individual readiness for change in the pre-implementation phase of campus enterprise resource planning (ERP) project in Malaysian public university. *International Journal of Advanced Computer Science and Applications*, 10(1):128-134.
- Hasheela-Mufeti, V. 2017. Current prospects and challenges of enterprise resource planning (ERP) adoption in developing countries. *International Science and Technology Journal of Namibia*, 9:94-106. [<https://journals.unam.edu.na/index.php/ISTJN/article/view/1210>].
- Hasheela-Mufeti, V. & Smolander, K. 2017. What are the requirements of a successful ERP implementation in SMEs? Special focus on Southern Africa. *International Journal of Information Systems and Project Management*, 5(3):5-20. [<https://doi.org/10.12821/ijispm050301>].
- Heckmann, I., Comes, T. & Nickel, S. 2015. A critical review on supply chain risk – Definition, measure and modeling. *The International Journal of Management Science*, 52:119-132. [<https://doi.org/10.1016/j.omega.2014.10.004>].
- Herath, H.M.R.P. & Wijenayake, S.I. 2019. The strategic importance of enterprise resource planning (ERP) systems implementation in the fast moving consumer goods (FMCG) industry in Sri Lanka. *International Journal of Recent Technology and Engineering*, 8(2):465-476. [<https://doi.org/10.35940/ijrte.B1104.0982S919>].
- Ho, W., Zheng, T., Yildiz, H. & Talluri, S. 2015. Supply chain risk management: A literature review. *International Journal of Production Research*, 53(16):5031-5069. [<https://doi.org/10.1080/00207543.2015.1030467>].
- Hopkin, P. 2017. Fundamentals of risk management: Understanding, evaluating and implementing effective risk management. 4<sup>th</sup> ed. Croydon, UK: Kogan Page.
- Hsu, P.-F., Yen, H.R. & Chung, J.-C. 2015. Assessing ERP post-implementation success at the individual level: Revisiting the role of service quality. *Information & Management*, 52(8):925-942. [<https://doi.org/10.1016/j.im.2015.06.009>].
- International Trade Administration. 2020. South Africa - Information Technology. [Internet: <https://www.trade.gov/knowledge-product/south-africa-information-technology>; downloaded on 24 May 2022].
- Irakoze, G. 2016. ERP implementation success framework for developing countries: Case of South African SMEs. Cape Town: University of Cape Town. (MSc Thesis) (Unpublished) [Internet: [https://open.uct.ac.za/bitstream/handle/11427/20559/thesis\\_com\\_2016\\_irakoze\\_gloria.pdf?sequence=1&isAllowed=y](https://open.uct.ac.za/bitstream/handle/11427/20559/thesis_com_2016_irakoze_gloria.pdf?sequence=1&isAllowed=y); downloaded on 19 April 2022].
- Pandey, K.R. & Kumar, P. 2023. Challenges and opportunities of ERP implementation in Indian SMEs: A case study of Jharkhand, *Materials Today*. In press. [<https://doi.org/10.1016/j.matpr.2023.02.150>].
- Kumar Sharma, S. & Bhat, A. 2014. Supply chain risk management dimensions in Indian automobile industry. *Benchmarking: An International Journal*, 21(6):1023-1040. [<https://doi.org/10.1108/BIJ-02-2013-0023>].
- Kwak, D.-W., Seo, Y.-J. & Mason, R. 2018. Investigating the relationship between supply chain innovation, risk management capabilities and competitive advantage in global supply chains. *International Journal of Operations & Production Management*, 38(1):2-21. [<https://doi.org/10.1108/IJOPM-06-2015-0390>].

- 
- Leedy, P.D. & Ormrod, J.E. 2014. Practical Research: planning and design. 10<sup>th</sup> ed. Upper Saddle River, NJ: Pearson.
- Li, Y., Wu, F., Zong, W. & Li, B. 2017. Supply chain collaboration for ERP implementation. *International Journal of Operations & Production Management*, 37(10):1327-1347. [<https://doi.org/10.1108/IJOPM-12-2015-0732>].
- Littlewood, D. & Holt, D. 2018. Social entrepreneurship in South Africa: Exploring the influence of environment. *Business & Society*, 57(3):525-561. [<https://doi.org/10.1177/0007650315613293>].
- Lockamy, A., III 2014. Assessing disaster risks in supply chains. *Industrial Management & Data Systems*, 114(5):755-777. [<https://doi.org/10.1108/IMDS-11-2013-0477>].
- Luzzini, D. & Miemczyk, J. 2019. Achieving triple bottom line sustainability in supply chains. *International Journal of Operations & Production Management*, 39(2):238-259. [<https://doi.org/10.1108/IJOPM-06-2017-0334>].
- Majid, M.A.A., Othman, M., Mohamad, S.F., Lim, S.A.H. & Yusof, A. 2017. Piloting for interviews in qualitative research: Operationalization and lessons learnt. *International Journal of Academic Research in Business and Social Sciences*, 7(4):1073-1080. [<https://doi.org/10.6007/IJARBS/v7-i4/2957>].
- Malik, M.O. & Khan, N. 2020. Analysis of ERP implementation to develop a strategy for its success in developing countries. *Production Planning & Control*, 32(12):1020-1035. [<https://doi.org/10.1080/09537287.2020.1784481>].
- Manhart, P. 2017. Supply chain risk management: Capabilities and performance. Iowa: Iowa State University. (PhD Thesis) (Unpublished) [Internet: <https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=7941&context=etd>; downloaded on 19 March 2022].
- Manuj, I., Esper, T.L. & Stank, T.P. 2014. Supply chain risk management approaches under different conditions of risk. *Journal of Business Logistics*, 35(3):241-258. [<https://doi.org/10.1111/jbl.12051>].
- Mdimba, B., Mutagahywa, B., Mohamed, J. & Mahabi, V. 2017. Conceptual framework for understanding of the pre-implementation phase of ERP projects in Tanzania. *Journal of Multi-disciplinary Engineering Science and Technology (JMEST)*, 4(9):8050-8057.
- Mitra, P. & Mishra, S. 2016. Behavioral aspects of ERP implementation: A conceptual review. *Interdisciplinary Journal of Information, Knowledge, and Management*, 11:17-30. [<https://doi.org/10.28945/3402>].
- Mukwasi, C.M. & Seymour, L.F. 2015. Interdependent enterprise resource planning risks in small and medium-sized enterprises in developing countries. Lilongwe, Malawi, 6-8 May 2015:1-10. [Internet: <https://onlinelibrary.wiley.com/doi/abs/10.1002/j.1681-4835.2016.tb00555.x>; downloaded on 3 March 2022].
- Muyambi, O. 2019. An analysis of factors affecting implementation of SAP in South Africa public sector. KwaZulu-Natal: University of KwaZulu-Natal. (MBA Thesis) (Unpublished) [Internet: <https://ukzn-dspace.ukzn.ac.za/handle/10413/17662>; downloaded on 25 March 2022].
- Norrman, A. & Wieland, A. 2020. The development of supply chain risk management over time: Revisiting Ericsson. *International Journal of Physical Distribution & Logistics Management*, 50(6):641-666. [<https://doi.org/10.1108/IJPDLM-07-2019-0219>].
- Oliveira, J.B., Jin, M., Lima, R.S., Kobza, J.E. & Montevechi, J.A.B. 2019. The role of simulation and optimization methods in supply chain risk management: Performance and review standpoints. *Simulation Modelling Practice and Theory*, 92:17-44. [<https://doi.org/10.1016/j.simpat.2018.11.007>].
- Park, K., Min, H. & Min, S. 2016. Inter-relationship among risk taking propensity, supply chain security practices, and supply chain disruption occurrence. *Journal of Purchasing and Supply Management*, 22(2):120-130. [<https://doi.org/10.1016/j.pursup.2015.12.001>].
- Peng, G.C.A. & Gala, C. 2014. Cloud ERP: A new dilemma to modern organisations? *The Journal of Computer Information Systems*, 54(4):22-30. [<https://doi.org/10.1080/08874417.2014.11645719>].

- 
- Percy, W.H., Kostere, K. & Kostere, S. 2015. Generic qualitative research in psychology. *The Qualitative Report*, 20(2):76-85.
- Polit, D.F. & Beck, C.T. 2012. Nursing research: Generating and assessing evidence for nursing practice. 9<sup>th</sup> ed. Philadelphia, PA: Lippincott Williams & Wilkins.
- Quinlan, C., Babin, B., Carr, J., Griffin, M. & Zikmund, W.G. 2015. Business research methods. Hampshire, UK: Cengage Learning.
- Raghunath, K.M.K. & Devi, S.L.T. 2018. Supply chain risk management: An invigorating outlook. *International Journal of Information Systems and Supply Chain Management*, 11(3):87-104.
- Rajagopal, V., Prasanna Venkatesan, S. & Goh, M. 2017. Decision-making models for supply chain risk mitigation: A review. *Computers & Industrial Engineering*, 113:646-682. [<https://doi.org/10.1016/j.cie.2017.09.043>].
- Rajan, C.A. & Baral, R. 2015. Adoption of ERP system: An empirical study of factors influencing the usage of ERP and its impact on end user. *IIMB Management Review*, 27(2):105-117. [<https://doi.org/10.1016/j.iimb.2015.04.008>].
- Rajapakse, D.P.P.K. & Thushara, S.C. 2023. Critical Failure Factors in ERP Implementation: A Systematic Literature Review. *Journal of Business and Technology*, 7(1):65-90. [<https://doi.org/10.4038/jbt.v7i1.109>].
- Rajesh, R., Ravi, V. & Venkata Rao, R. 2015. Selection of risk mitigation strategy in electronic supply chains using grey theory and digraph-matrix approaches. *International Journal of Production Research*, 53(1):238-257. [<https://doi.org/10.1080/00207543.2014.948579>].
- Ram, J., Corkindale, D. & Wu, M.-L. 2013. Implementation critical success factors (CSFs) for ERP: Do they contribute to implementation success and post-implementation performance? *International Journal of Production Economics*, 144(1):157-174. [<https://doi.org/10.1016/j.ijpe.2013.01.032>].
- Riley J., M., Klein, R., Miller, J. & Sridharan, V. 2016. How internal integration, information sharing, and training affect supply chain risk management capabilities. *International Journal of Physical Distribution & Logistics Management*, 46(10):953-980. [<https://doi.org/10.1108/IJPDLM-10-2015-0246>].
- Rogers, H., Srivastava, M., Pawar, K.S. & Shah, J. 2016. Supply chain risk management in India – Practical insights. *International Journal of Logistics Research and Applications*, 19(4):278-299. [<https://doi.org/10.1080/13675567.2015.1075476>].
- Rowley, J. 2012. Conducting research interviews. *Management Research Review*, 35(3/4):260-271. [<https://doi.org/10.1108/01409171211210154>].
- Saran, C. 2019. SAP disruption leads to Revlon class action lawsuit. [Internet: <https://www.computerweekly.com/news/252464278/SAP-disruption-leads-to-Revlon-class-action-lawsuit>; downloaded on 20 February 2022].
- Shanhong, L. 2020. IT market spending by segment in South Africa 2015-2020, by segment. [Internet: <https://www.statista.com/statistics/468589/south-africa-it-spending-by-sector/>; downloaded on 24 May 2021].
- Sharma, N., Sahay, B., Shankar, R. & Sarma, P. 2017. Supply chain agility: Review, classification and synthesis. *International Journal of Logistics Research and Applications*, 20(6):532-559. [<https://doi.org/10.1080/13675567.2017.1335296>].
- Shenton, A.K. 2004. Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22(2):63-75. [<https://doi.org/10.3233/EFI-2004-22201>].
- Simba, S., Niemann, W., Kotzé, T. & Agigi, A. 2017. Supply chain risk management processes for resilience: A study of South African grocery manufacturers. *Journal of Transport and Supply Chain Management*, 11(1):1-13. [<https://doi.org/10.4102/jtscm.v11i0.325>].

- 
- Singh, S., Singh, S. & Misra, S.C. 2023. Post-implementation challenges of ERP system in pharmaceutical companies. *International Journal of Quality & Reliability Management*, 40(4):889-921. [<https://doi.org/10.1108/IJQRM-10-2020-0333>].
- Squire, B., Autry, C.W. & Petersen, K.J. 2014. A Contingent resource based perspective of supply chain resilience and robustness. *Journal of Supply Chain Management*, 50(3):55-73. [<https://doi.org/10.1111/jscm.12050>].
- Talluri, S., Kull, T.J., Yildiz, H. & Yoon, J. 2013. Assessing the Efficiency of Risk Mitigation Strategies in Supply Chains. *Journal of Business Logistics*, 34(4):253-269. [<https://doi.org/10.1111/jbl.12025>].
- Tarhini, A., Ammar, H., Tarhini, T. & Masa'deh, R.E. 2015. Analysis of the critical success factors for enterprise resource planning implementation from stakeholders' perspective: A systematic review. *International Business Research*, 8(4):25-40. [<https://doi.org/10.5539/ibr.v8n4p25>].
- Tian, F. & Xu, S. X. 2015. How do enterprise resource planning systems affect firm risk? Post-implementation impact. *MIS Quarterly*, 39(1):39-60.
- Tobie, A.M., Etoundi, R.A. & Zoa, J. 2016. A literature review of ERP implementation in African countries. *The Electronic Journal of Information Systems in Developing Countries*, 76(4):1-20. [<https://doi.org/10.1002/i.1681-4835.2016.tb00555.x>].
- Valanarasu, R. & Christy, A. 2018. Risk assessment and management in enterprise resource planning by advanced system engineering theory. *International Journal of Business Intelligence and Data Mining*, 13(1-3):3-14. [<https://doi.org/10.1504/IJBIDM.2018.088420>].
- Wang, W., Liu, X., Qin, Y. & Fu, Y. 2018. A risk evaluation and prioritization method for FMEA with prospect theory and Choquet integral. *Safety Science*, 110:152-163. [<https://doi.org/10.1016/j.ssci.2018.08.009>].
- Yang, J., Xie, H., Yu, G. & Liu, M. 2021. Antecedents and consequences of supply chain risk management capabilities: An investigation in the post-coronavirus crisis. *International Journal of Production Research*, 59(5):1573-1585. [<https://doi.org/10.1080/00207543.2020.1856958>].
- Zendehdel Nobari, B., Azar, A., Kazerooni, M. & Yang, P. 2020. Revisiting enterprise resource planning (ERP) risk factors over the past two decades: Defining parameters and providing comprehensive classification. *International Journal of Information Technology*, 4:1-16. [<https://doi.org/10.1007/s41870-020-00502-z>].
- Zendehdel Nobari, B., Azar, A., Rahmati, M.H., Kazerooni, M. & Ghasemi, A.R. 2018. Identifying national effective parameters in ERP Implementation risk factors in Iran by multi grounded approach. *Public Management Researches*, 11(41):5-28. [<https://doi.org/10.22111/JMR.2018.4376>].

## Appendix A

### Discussion guide

1. How do you define supply chain risk?
2. Why is it important to manage supply chain risks during ERP implementation?
  - 2.1 Do you use a supply chain risk management process to manage risks during ERP implementation?
  - 2.2 If yes, could you please tell me more about this process? How do you use the process? Is it formal or informal? Who oversees the process?
  - 2.3 If no, please explain how you manage supply chain risks during implementation and then why you may not have a process in place.
3. Can you think of any risks that could affect your firm or its supply chain faced during ERP implementation?
  - 3.1 If yes, could you elaborate on them?
  - 3.2 If no, please explain?
4. Could you think of any incidents that caused disruptions or delays in the flow of goods or information for the firm during your ERP implementation?
5. What do you believe was the cause of these disruptions or delays?
6. How do you identify potential supply chain risks that have not yet materialised during ERP implementation?

- 6.1 What methods do you use to help you identify these supply chain risks?
- 6.2 Do you make use of any risk identification processes to help you identify risks or their consequences?
- 6.3 If, yes please tell me more about this process?
- 6.4 If no, please explain?
7. Please can you walk me through the supply chain risk identification process?
- 7.1 Are there any barriers in this process?
- 7.2 If, yes please tell me more about these barriers?
- 7.3 If no, can you clarify this?
8. Do you believe it is necessary to conduct a supply chain risk assessment after a risk has been identified during ERP implementation?
- 8.1 If yes, why do you think it is necessary?
- 8.2 If no, please explain why not?
9. Do you utilise any formal procedures or methods in the assessment of supply chain risks during ERP implementation?
- 9.1 If yes, please tell me more about these methods?
- 9.2 If no, could you possibly elaborate on why not?
10. Do you believe it is necessary to mitigate supply chain risks after risks have been assessed during ERP implementation?
- 10.1 If yes, what type of mitigation strategies do you use to reduce supply chain risks or manage incidents that cause disruptions or delays during ERP implementation?
- 10.2 If no, please can you elaborate on why not?
11. What criteria are used to determine the appropriate strategy?
12. Do you think it is important to monitor and control risks to a firm's (your firms) processes caused by ERP implementations?
- 12.1 If yes, please explain why?
- 12.2 If no, please explain why?
13. Which of the above-mentioned capabilities for controlling supply chain risks during ERP implementations will lead to a faster return to normal operations following ERP implementation disruptions?