# ENTERPRISE RISK MANAGEMENT IMPLEMENTATION CHALLENGES: A CASE STUDY IN A PETROCHEMICAL SUPPLY CHAIN

**R. Moshesh[1], W. Niemann[1*] & T. Kotzé[1]**

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*Contact details*
* Corresponding author
wesley.niemann@up.ac.za

*Author affiliations*
1 Department of Business Management, University of Pretoria, South Africa

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**ABSTRACT**

Organisations have adopted various risk management approaches to minimise or eliminate the negative impact of risk. One such approach is enterprise risk management (ERM). However, implementation challenges can render such approaches less effective. The purpose of this single case study was to explore the ERM implementation challenges in the supply chain of a petrochemical firm. Semi-structured interviews were used as a data collection method. The findings indicated that misalignment exists in the organisation between the respective key stakeholders responsible for, or influential in, ERM implementation. The study found that rigid implementation of ERM without appropriate adaptation to suit the needs and strategy of a complex supply chain of a petrochemical business impacts on its success.

**OPSOMMING**

Verskeie risikobestuursbenaderings is deur organisasies aanvaar om die negatiewe impak van risiko's te verminder of uit te skakel. Een sodanige benadering is onderneming risiko bestuur (ORB). Implementering uitdagings kan egter sulke benaderings minder effektief maak. Die doel van hierdie enkel gevallestudie was om die ORB-implementering uitdagings in die voorsieningsketting van 'n petrochemiese firma te verken. Die data-insamelingsmetode wat gebruik was is semi-gestruktureerde onderhoude. Die bevindinge toon dat daar in die organisasie 'n wanbelyning bestaan tussen die onderskeie sleutelbelanghebbendes wat verantwoordelik is vir, of invloedryk is in, ORB-implementering. Die studie het bevind dat die sukses van die ORB-implementering beïnvloed word, indien die implementering nie met die gepaste aanpassing van die behoeftes en strategie van 'n komplekse voorsieningsketting van 'n petrochemiese onderneming gepaard gaan nie.

## 1 INTRODUCTION AND PROBLEM STATEMENT

In today's interlinked global economy, businesses find themselves transacting beyond their familiar local borders. However, taking advantage of opportunities abroad exposes them to more risk, which they have to manage. The negative consequences of risk could be loss of customers, damaging liabilities, environmental damage, and bankruptcy [1]. Consequently businesses have adopted various risk management approaches, such as enterprise risk management (ERM), to manage or reduce the negative impact of risk [2].

### 1.1 Background

ERM is a risk management approach that integrates all the organisation-wide risks and takes a portfolio viewpoint of their management [3]. Risk management is important for businesses, such as petrochemicals, due to their contribution to the country's economic growth and performance. In the second quarter of 2016, the South African gross domestic product (GDP) rose by 3.3 per cent. The largest contributor was manufacturing, which grew by 8.1 per cent, with the petroleum and

chemicals subsectors being among the leading contributors [4]. A new era of competition is characterised by moving away from aggressive selling and large marketing budgets, to competition based on how well businesses manage their capabilities and competencies, such as having agile supply chains responding to market demand faster and with more flexibility than do competitors [5]. The criticality of the petrochemical sector to the local economy, a new competition era through capable supply chains, and the necessity to manage risk due to its negative impact, sparked the study's interest to analyse ERM implementation challenges in a supply chain of a South African petrochemical company.

### 1.2 Research problem

ERM implementation challenges, such as change management and resistance to change, lack of qualified personnel to implement ERM, unsupportive organisational culture, and lack of perceived value or benefits of ERM, were indentified by Zhao, Hwang and Low [10]. Renault, Agumba and Balogun [6] found that a lack of management support (including senior management), different management priorities for ERM, reluctance to discuss sensitive information, difficulties in quantifying the risks, lack of a common risk language, lack of quality data, and limited access to data were some of the top challenges in ERM implementation. The prescriptive nature of the ERM process can lead to implementation challenges, as it fails to cater for some entities whose needs would have been better served by a flexible or customised risk management framework [7-8]. Consequently ERM provides very comprehensive guidance only for some key principles, with businesses expected to work the guidelines out by themselves [9].

A gap exists in the aforementioned literature, as only general views on the implementation challenges of ERM were presented. The literature failed to indicate whether the identified ERM implementation challenges are experienced in all sectors, or only in specific ones, as organisations have different objectives — they have different levels of risk tolerance and diversified risk appetites [11]. It further failed to indicate whether an entity's selection of the risk management style and framework, such as ERM, is influenced by its business model or design [12]. Because ERM implementation challenges were studied within the context of business experiences in different locations, a gap exists about whether ERM implementation experiences are influenced by industry, and about the geographical locations of those implementing entities [10].

As far as could be determined through a database and journal search using search engines such as Emerald, EBSCOHost, and Google Scholar, no previous studies have examined the implementation challenges of ERM in a supply chain of a petrochemical company in South Africa; this is despite the function's earlier indicated importance to the business's competitiveness and the criticality of the sector to the South African economy. The purpose of this single case study was to analyse ERM implementation challenges within the context of a supply chain of a single petrochemical firm in South Africa. The study sought to answer the following central research question: What are the challenges experienced in the implementation of ERM as a risk management approach in a supply chain of a South African petrochemical company?

The next section provides a review of the relevant literature, the research methodology, and the findings. This is followed by a summary of the theoretical and practical implications. The article concludes with the limitations of the study and recommendations for future research.

## 2 LITERATURE REVIEW

### 2.1 Risk management

'Risk' is defined as a combination of the probability or frequency of an event and its consequences, which are usually negative [13]. It is also referred to as uncertainty concerning the occurrence of a loss, and the magnitude of such loss [14]. Soltanizadeh, Zaleha, Rasid, Golshan, Khairuzzaman and Ismail [15] define risk as an event that causes a negative impact and can counteract value creation. What is common about these definitions is that risk entails an element of unpredictability, and an undesirable outcome such as a loss. From a business perspective, risk can have an undesirable adverse impact on its operations, strategy, competitiveness, finances, reputation, and compliance obligations; hence the need for risk management [16]. A risk management process would therefore

seek to eliminate, reduce, and control risks, and enhance benefits through maximising the potential for success and minimising the probability of future losses [16].

## 2.2 Supply chain risk management

A supply chain consists of logistics, distribution, materials management, inventory control, freight, the procurement function, and a series of activities associated with each of these elements [17]. Supply chain management seeks to achieve links with and the co-ordination of processes between these functions and those of other entities in the pipeline (such as suppliers and customers) through cost effective order fulfillment that maximises current and future profitability [5]. Other than ensuring the provision of goods and services to the customer, a supply chain management objective is to ensure efficiency and cost-effectiveness across the system to the benefit of all parties [5]. However, the failure of an element in a supply chain can cause a ripple effect of disruptions, potentially for all the players in it, putting a supply chain at risk [18]. Supply chain risk is an event that adversely affects supply chain operations and its desired performance measures, such as service levels, responsiveness, and cost. In an endeavor to counter this risk, businesses can adopt supply chain risk management plans, preferably to avoid the risks, or at least to mitigate them [19].

In the management and execution of supply chain risk management plans, ERM has emerged as an important concept since the mid-1990s [3]. A discussion of typical supply chain risks to be managed is presented next, to provide further context to the study.

### *2.2.1 Supply chain risks*

Some supply chain risk sources necessitating the need for management through ERM can be described as follows: there are supply risks associated with supplier reliability in terms of delivery, quality, single versus multiple sourcing, supply disruptions, transit time, variability, and centralised versus decentralised decisions [5]; these are followed by demand risks, such as stock-outs, obsolescence, seasonal demand variations, and surges that can lead to a bull whip effect on the entire supply chain [20].

There are also macro-environmental risks such as economic crises, political instability, natural disasters, and regulatory requirements, which could occur at a single point in the supply chain and ultimately affect the entire supply chain [5, 21]. Faced with the different risks from a multitude of sources, businesses have adopted various risk management approaches, such as a systematic research design process, quantitative supply chain risk modelling [2], or ERM [3]. It is the ERM approach and the challenges that arise from its implementation in the supply chain of a South African petrochemical company that the study was interested in researching.

### *2.2.2 The nature of the value chain of a petrochemical company*

The business that was the focus of this study operates in the petrochemical sector. In laying the basis for an understanding of this company and sector, the nature of their value chain, resulting in supply chain complexity and associated risks, will be discussed. Due to a lack of literature describing the nature of a petrochemical company's value chain, a petroleum one that is similar in its characteristics will be described.

A petroleum company's value chain consists of the following operations: upstream, including exploration and production of crude oil; midstream, consisting of refining and transportation by pipelines and tankers, and maritime and storage; and downstream activities entailing marketing and transportation of final products to service stations and retail outlets [22]. These value chain operations lead to interactions with other players, such as other fully integrated oil and gas companies, independent oil and gas producers, refiners, marketers, pipeline operators, and service companies; the co-ordination of these interactions and activities happens through multiple supply chains [23].

The links and interaction of the value chain with companies in several sectors of the economy lead to multiple supply chains increasing complexity and risks, which are amplified by transportation and storage of hazardous substances [23].

The next section will discuss ERM as a risk management approach based on the nature of the value chain of a petroleum company, its similarity to a petrochemical value chain, and the complexity and subsequent risks associated with it.

## 2.3 Enterprise risk management

Because the business environment is becoming more complex as a result of deregulation, globalisation, downsizing, and technology advancement, businesses are faced with a broad spectrum of risks that have to be managed holistically if they are to be profitable; hence a growing interest in ERM [24]. Contrary to traditional risk management approaches, ERM is a holistic approach to risk management that entails a joint examination of risk that is assessed, quantified, financed, and managed at an enterprise level [25]. ERM is also implemented across all levels of an enterprise and applied in a strategy setting to assure the achievement of corporate objectives [10].

ERM encompasses four key elements:

- risk strategy, which defines goals in support of the overall business strategic objectives;
- risk assessment, which encompasses risk identification, measurement, and monitoring;
- risk governance, which entails the establishment of risk governance processes; and
- structures and risk culture set across the business, actively supported by senior management and strongly communicated [26].

These definitions and elements of ERM are underpinned by the following key characteristics and principles:

- It is a risk management approach that manages risk from a joint and consolidated entity-level portfolio point of view.
- It supports business strategy.
- It spells out risk measurement, monitoring, evaluation, and governance processes.
- It entails active and strong senior managerial support with an inculcated risk culture across the business, supported by strong risk communication initiatives.

However, successful implementation of ERM is dependent on various factors. For instance there is a correlation between a participative leadership style that allows employees to speak up, and the success of ERM [27]. Various additional prerequisites exist for ERM to be successful. The first order of business should be the development of a business strategy, after which risk events to be managed through ERM and that could pose a threat to its success should be identified. An ERM function should be established that is headed by a senior person, such as a Chief Risk Officer. This person should be responsible for establishing and communicating ERM policies, training current employees on ERM, and staffing the ERM function with professional personnel with ERM expertise [11]. Due to its integration of risk management practices and a holistic and simultaneous management of different types of risk, ERM has been viewed as presenting benefits [3]. The next section discusses some of these benefits.

### *2.3.1 Benefits of enterprise risk management*

Several reasons have been put forward regarding the benefits of ERM as an appropriate approach for managing the various risks facing business. ERM enables a consistent treatment and addressing of risk, encourages a longer-term risk view enabling accurate resource allocation, and enhances a quicker reaction to identified and emerging risk, which may lead to an increase in profitability [28]. Through the integration of decision-making on different risks across the business, the duplication of risk management expenditure is avoided, and a better understanding of the aggregate risk in different business activities is gained. This improves capital efficiency and information about the business's risk profile, further enabling a reduced risk of expected regulatory scrutiny costs [29]. Through its approach of identifying, estimating, treating, monitoring, and communicating risks, ERM may have a positive impact on boosting competitive business advantage [16].

Although ERM has been viewed as presenting benefits, obstacles and challenges to its successful implementation have also been identified. Some of these challenges are reviewed in the next section.

### *2.3.2 Enterprise risk management implementation challenges*

Owing to its key characteristics and principles, a critical analysis of ERM has identified some challenges that a business can experience in its implementation. Due to its proactive decision-making nature, ERM requires strong leadership, a considerable commitment of resources and time,

timeous reporting, and insightful real-time data [28]. The absence, or lack, of these requirements could lead to implementation challenges that impact on the success of ERM. Arnaboldi and Lapsley [30] have also raised as another challenge the collaborative tension between ERM champions and managers. whose roles within the organisation already entail being in charge of controlling risks at managerial level, caused by unclear roles and responsibilities in ERM implementation. They further state that, when other risk management and control systems are perceived to be satisfactory by managers, ERM and its owners struggle to find a space and to sell its value-add.

Because one of ERM's characteristics is an enterprise-wide portfolio view and management of risk, an implementation challenge could arise because organisations have different objectives — they have different levels of risk tolerance and diversified risk appetites [11]. A prescriptive ERM requirement to adopt a formal enterprise-wide risk view and its management could give rise to implementation challenges. This is because different industries and sectors have different environments, opportunities, and limitations that create a need for a flexible, or a specific, risk management approach [7]. This is corroborated by a study on the implementation of various major formal risk management frameworks by non-franchised fast food small enterprises in Cape Town, including ERM, which, if they adopt a flexible or a customised risk management framework, could drastically improve their current sustainability [8].

It has also been identified that inadequate training of relevant staff poses a difficulty for ERM implementation in various organisations andindustries [12]. From a technology point of view, one of the implementation challenges facing ERM is to find a proper framework for its implementation, supported by a suitable IT system [11].

From the study of the main ERM implementation challenges experienced by Chinese construction firms operating in Singapore, Zhao *et al*. [10] found the following:

- Insufficient resources such as time, and financial and human resources.
- Unsupportive organisational culture.
- Lack of perceived value or benefits of ERM.
- Inadequate training on ERM.
- Inadequate change management and resistance to change.
- Lack of qualified personnel to implement ERM.
- Lack of internal knowledge, skills, and expertise.
- Lack of a risk management information system.
- Unclear ownership and responsibility for ERM implementation.

Dafikpaku [31] has also consolidated the challenges of ERM implementation as follows:

- Human weakness can affect ERM decisions subject to conditions at the time of implementation; these could be time constraints, available information, or business pressure.
- A well-designed ERM framework could break down during implementation due to a misunderstanding of implementation instructions by key personnel, or judgement errors due to carelessness and fatigue.
- Cost considerations could be put above ERM benefits, impacting on its successful implementation.
- Managers could deliberately deviate from prescribed ERM procedures and policies for personal gain, while employees could collude in altering financial and management information critical to ERM's implementation success.

Another study, based on a comprehensive literature search and review of various empirical studies from January 2000 to December 2015 on the implementation challenges of ERM, found that the top challenges experienced were a lack of support from top management, different management priorities from those of ERM, reluctance to discuss sensitive information, difficulties in quantifying the risks, lack of a common risk language, lack of quality data, and limited access to data [6].

The above insights indicate that risk has negative consequences, so it needs to be managed to eliminate, control, or minimise its adverse impact. Given that the function being study is supply chain, the nature of supply chain, the reasons that supply chain risks need to be managed, and the

different supply chain risks and their sources were presented. The business being studied operates in the petrochemical sector; so the nature of the value chain of a petroleum company, which is equivalent to a petrochemical one, including its supply chain, was presented. The discussion on the nature and structure of this value chain has also shared the insight that it exposes a petrochemical company to operational risks that have to be managed through risk management approaches such as ERM. Key ERM characteristics, principles, elements influencing its implementation, and its successful implementation prerequisites were presented. Further insight was provided into the benefits of ERM implementation, together with some of its identified implementation challenges, based on empirical studies and the comprehensive literature search and review undertaken.

The next section will discuss the study methodology and how it was carried out.

## 3 METHODOLOGY

### 3.1 Research design

A single holistic case study research approach was adopted as suitable for empirical exploration of a current real-life case within its real-world context [32]. It supported the study's aim of investigating a case of a petrochemical supply chain with unusual characteristics, such as multiple supply chains, and extracting real-life experiences from participants. Due to risk dynamism, a cross-sectional study was undertaken in which participants were interviewed once to capture their experiences at that particular point in time [33].

### 3.2 Sampling

One of the researchers is employed by the business selected for the case study. The business had recently introduced ERM, and implementation challenges were being experienced; hence the motivation for the study, drawing lessons from experience. The unit of analysis in this study was an entire supply chain of the case under review. Individual practitioners responsible for ERM implementation and relevant senior management were interviewed. The case under review has a national presence in South Africa, with refining operations and a head office in Gauteng; and, as stated, it has economic significance for South Africa.

The sampling method used to select participants was purposeful sampling, enabling access to the key and most knowledgeable participants who could help in identifying information-rich cases [34]. Consequently only participants who had been involved in the implementation of ERM in the business' supply chain for more than two years were selected for the study, as it was felt that they would have adequate experience. This also informed the sampling inclusion and exclusion criteria. Maximal variation sampling was used. This purposeful sampling strategy enables participants to be selected based on differing characteristics, such as age and experience [33]. The study investigated the experiences of senior and middle managers and of operational specialists with varying experiences and age, providing multiple perspectives.

The study consisted of nine relevant participants falling within the discussed sampling method. After the seventh interview, no exceptionally different experiences were reported in the next interviews, thus requiring no further interviews to confirm whether the experiences were shared by more participants. The participants included one female and eight males from different ethnic backgrounds and hierarchical levels, as shown in Table 1

### 3.3 Data collection

The main data source was nine semi-structured interviews conducted during September and October 2016, six of which were conducted face-to-face in the meeting rooms of the participants' respective offices in Gauteng. Three interviews were conducted via video conferencing because the participants were located outside Gauteng Province. The face-to-face semi-structured interviews enabled the researcher to ask predetermined questions with flexibility, excluding or including certain questions based on the experiences of the participant, and avoiding misinterpretation ny using probes and seeking clarity [35]. A discussion guide with open-ended questions was developed, enabling participants to create their own options for responses to questions [33].

**Table 1: Summary of participants and organisation details**

| Participant | Job title | Gender | Firm code | Duration of interview |
|---|---|---|---|---|
| **P1** | Specialist: Supply chain risk | Male | S1 | 23:14 |
| **P2** | Lead specialist: Supply chain risk | Male | S1 | 18:46 |
| **P3** | Risk business partner | Male | S1 | 24:04 |
| **P4** | Risk manager: Functions | Female | S1 | 23:52 |
| **P5** | Risk expert: Upstream | Male | S1 | 30:12 |
| **P6** | Risk business partner | Male | S1 | 24:30 |
| **P7** | Risk business partner | Male | S1 | 15:38 |
| **P8** | Manager: SA Energy supply chain management outbound operations, DRP and facilities | Male | S1 | 23:16 |
| **P9** | Vice president: Supply chain management, outbound operations | Male | S1 | 20:58 |
| | | | Average interview duration | 22.52 |

Before finalisation, the guide was piloted with three individuals (two in supply chain and one in the ERM function). This ensured that all technical aspects in these respective functions were covered. Changes were made, based on the feedback from the interviewees, to the final discussion guide. No further changes were made to the discussion guide during the interviews.

Participants were requested to sign consent forms in which they agreed to their voluntary participation. A request was then made to audio-record the interview. The interviews lasted from 15 to 30 minutes, with an average duration of 23 minutes excluding introductions and ethical discussions. All of the interviews were transcribed by a researcher one or two days after being conducted to enable data familiarity. Further transcription and proofreading was conducted by a professional transcriber, and thereafter transcripts were again compared with the audio-recordings for consistency and accuracy.

### 3.4 Data analysis

The study used a thematic analysis method, which identifies and organises meaningful patterns across data [36]. The audio recordings were listened to, together with reading the transcripts for data familiarisation. An iterative process of coding data and splitting codes led to final codes that were closest to the study topic. Codes sharing common features were clustered into sub-themes, which were later collapsed into main themes [36]. The themes were defined to ensure an understanding of the context in which they were used in the study. To link the findings to the topic, the main themes and the sub-themes were linked together with raw data extracts from the interviews.

### 3.5 Trustworthiness

To ensure trustworthiness, person triangulation — involving collecting and validating data from different sources, such as from participants of differing experiences and hierarchical levels — was conducted [37]. Credibility and confirmability were ensured by a member-checking exercise of sending participants their interview transcripts and initial findings to provide confirmation that the results were a true reflection of their input [38]. Transferability was ensured by providing a detailed description of the participants, the methodology, the study site, and the context [37]. Validity and dependability were ensured because only one researcher undertook the study, with a detailed and accurate recording of data collection, preparation, and analysis [39].

### 3.6 Ethical considerations

The study was approved by the relevant research ethics committee at a South African university. All participants read and signed an informed consent form. This ensured their voluntary participation, having been informed in advance of the research's purpose, its expected duration, and procedures, and their right to decline to participate or to withdraw from the study once it had started [40]. Assurance of privacy and anonymity was granted to ensure open and honest responses. Codes were used to protect the identity of the participants and the organisation.

## 4 FINDINGS

Table 2 below lists nine ERM implementation challenges identified in the study. Eight challenges were grouped into three main themes, while the ninth emerged as an overall theme. The table indicates which of the implementation challenges were mentioned by participants.

**Table 2: Main themes and sub-themes emerging from the study (Source: Author's own work.)**

| Participant | Organisational misalignment | | | Human resource development | | Organisational design | | | Information technology support for ERM |
|---|---|---|---|---|---|---|---|---|---|
| | Lack of management buy-in for | Change management | Goal misalignment | Inadequate ERM training | Lack of ERM understanding | Supply chain complexity | Organisational complexity | ERM rigidity | |
| P1 | X | x | x | x | | x | | x | x |
| P2 | x | x | x | x | | | x | | x |
| P3 | x | x | x | x | x | | | x | x |
| P4 | x | x | x | x | x | x | x | | x |
| P5 | x | x | x | x | x | x | x | | x |
| P6 | x | x | x | x | x | x | x | x | |
| P7 | x | x | x | x | x | x | x | x | |
| P8 | x | x | x | x | x | x | | x | x |
| P9 | x | x | x | x | | x | x | x | x |

The main themes and sub-themes that were identified will be defined in the discussion below.

### 4.1 Organisational misalignment

Under the main theme of organisational misalignment, a lack of ERM management buy-in, change management, and goal misalignment were identified by all participants as posing ERM implementation challenges. Organisational misalignment exists when there is incongruence in the organisation on strategy direction, values, and beliefs, causing potential tension, lack of co-operation, and instability [41]. The three sub-themes mentioned identify existing misalignment as some of the role players in ERM's successful implementation, such as managers, not fully supporting its objectives. Others continued to work in isolation, despite a key ERM requirement of joint risk management across the business. This is supported by the following statement:

*"So firstly it was people to get behind change, and secondly, they worked in silos and everybody thinks they know everything. So that was a problem for us and we still struggle with that." (P1, male, specialist, supply chain risk)*

The above is supported by Arnaboldi and Lapsley [30], who raised, as an implementation challenge, collaborative tension between ERM champions and managers who fail to align with the broader organisation on ERM implementation by continuing with other risk management and control systems that they perceive to be satisfactory, and thus they do not buy into ERM's value-add. The sub-themes of lack of management buy-in for ERM, change management, and goal misalignment are presented in the next discussion.

#### *4.1.1 Lack of management buy-in for ERM*

A lack of ERM buy-in by management, including senior managers, was cited by all participants as an implementation challenge. A lack of management buy-in is experienced when there is minimal or no management participation in, or blessing of, a proposed change [42]. This is supported by the following statement:

*"I would say trained facilitators, senior management buy in and availability of the correct people for the workshops [are ERM implementation challenges]." (P4, female, risk manager, functions)*

To corroborate this finding, and based on a comprehensive literature search and review from January 2000 to December 2015, the lack of management support, including top management, was among

the top challenges in ERM implementation. Top management often do not fully understand the concepts behind ERM [6].

#### *4.1.2 Change management*

All participants mentioned change management as one of the main challenges. Change management is the use of processes such as common vision creation, establishing leadership sponsorship, communication, and people involvement in developing a broad-based action plan to control an organisational change effort [43]. This is corroborated by the following statement:

*"So I think that's one of the challenges, but you can summarise it and just add the words 'change management' there as well. I think it's a matter of ensuring that not only initially, but also follow up that the actual application thereof afterwards is still aligned with the intention of the ERM framework, if you understand what I mean". (P2, male, lead specialist, supply chain risk)*

The change management challenge in ERM implementation can be linked to a finding by Zhao *et al.* [10], in their analysis of Chinese construction firms operating in Singapore, that change management and resistance to embrace a change to ERM as a risk management tool was found to be among the top challenges.

#### *4.1.3 Goal misalignment*

The study found that all participants cited misalignment between ERM objectives and the supply chain business strategy. For instance, they felt that some of the supply chain strategic objectives, such as dealing with risk emanating from sole source suppliers, industrial action in supplier companies, possible supplier bankruptcy, and oil price fluctuations, are not adequately addressed by ERM objectives. Misalignment is a lack of complementarity between top-down and bottom-up approaches that results in systematic deficiencies, inefficiency, and ineffectiveness [44]. In the context of this definition, a supply chain business strategy could be viewed as a top-down approach, informing the objectives of a bottom-up ERM process. Views on misalignment are expressed as follows:

*"I'm not all that convinced that it (ERM) is fully aligned with the supply chain strategy. I'm not sure that the risks that we've identified are such that if you effectively manage those risks it will enable you to achieve your strategy [i.e., a supply chain strategy]". (P5, male, risk expert, upstream)*

*"To be honest with you, there's something that we've missed, to me, is the oil price [i.e., its fluctuation, in the ERM objectives]". (P1, male, specialist, supply chain risk)*

Successful ERM implementation is reliant on the initial definition of the business strategy, followed by an ERM process of identifying and managing events that may impact the achievement of this strategy [11]. It is evident from the study findings that there are gaps in how the ERM process and objectives are viewed to support the supply chain business strategy, resulting in ERM implementation challenges, as ERM is then not entirely supported in the supply chain function.

### 4.2 Human resource development

Two main challenges linked to this main theme are identified as a lack of training provided by those responsible for implementing ERM, such as risk specialists, and a lack of understanding of ERM by most of the important stakeholders in the business. Human resource development is a set of systematic and planned activities designed by an organisation to provide its members with the opportunities to learn the necessary skills to meet current and future job demands [45].

The identified sub-themes will be defined and expanded on in the discussion that follows.

#### *4.2.1 Inadequate ERM training*

Inadequate training of personnel and other key facilitators responsible for ERM advocacy and implementation was identified by all participants as presenting implementation challenges. Training is a learning process by which management or training staff provide employees with intentional learning opportunities in a structured way to develop the skills, knowledge, and attitudes that are necessary to achieve organisational objectives [46].

The following statements support this finding:

*"Then also you have the challenge that not all risk specialists are competent [in ERM]". (P8, male, manager, SA energy supply chain outbound operations, DRP & facilities)*

*I think that is one of the limitations of it [ERM implementation] is that people that are implementing it, they need to have an overall view of the framework". (P7, male, risk business partner)*

In corroborating this challenge from past studies in various industries, inadequate training of the relevant staff responsible for ERM implementation, including risk personnel, posed implementation difficulties [12].

#### *4.2.2 Lack of ERM understanding*

Most participants identified a lack of understanding of the nature and benefits of ERM as an important implementation challenge. Understanding is a general level of cognitive competence realised in the learning process [47].

The following statement corroborates the finding:

*"People don't understand ERM and again, like I said, the value. If you can't prove value, why would you take your time and do it?" (P4, female, risk manager, functions)*

For ERM's successful implementation, it has been found that one of the key prerequisites is the education of staff to understand its value and thus to support it [11]. A lack of this education and of subsequent ERM understanding has given rise to an implementation challenge.

### 4.3 Organisational design

The complexity of the supply chain, the case under study, and the rigid nature of ERM design and processes were identified by most participants as presenting further ERM implementation challenges. These were consolidated under the main theme of organisational design. Organisational design is a deliberate configuration of an organisation's structures and processes to achieve its objectives [48].

The mentioned sub-themes under organisational design are presented in the discussion below.

#### *4.3.1 Supply chain complexity*

Supply chain complexity is defined as variations in operations, structure, and behaviour caused by uncertainties or variations that occur, whether or not they are expected, along a supply chain system [49]. The complex nature of the supply chain of a petrochemical business was viewed as one of the main challenges:

*"The complexity of the supply chain process, especially in a company like ours, is immense; it makes ERM very difficult". (P4, female, risk manager functions)*

The above sentiment is confirmed by a view on the complex nature of the value chain of a petrochemical business, which includes multiple supply chains, compounded by the transportation of hazardous substances [23].

#### *4.3.2 Organisational complexity*

Most participants also pointed to the challenge of the complex nature of the business under study. Organisational complexity is regarded as the presence of variability, uncertainty, and unpredictability in describing organisational behaviour [50]. This finding is supported by the following statement:

*"I think the complexity of a big organisation is one of the factors [i.e., ERM implementation challenge factors] to ensure that role players are informed, on board and so forth".* (P2, *male, lead specialist, supply chain risk)*

Linked to the above-mentioned challenge, most participants felt that, even though ERM dictates a standard approach to managing risk, the uniqueness and the complex nature of a petrochemical business necessitated the adaptation of ERM to suit these characteristics.

This is corroborated by Singhal *et al*. [7], that different industries and sectors have different environments, opportunities, and limitations, creating a need for a specific risk management approach.

#### *4.3.3 ERM rigidity*

The rigidity of ERM and its processes was also viewed by most participants as posing challenges to its implementation. Rigidity is the organisation of components so that they are typically handled in a routine manner and persistently applied in the same schema [51].
The following statement supports this challenge:

*"So the limitations are a very simple way of doing things, but it [ERM] is still quite a rigid framework. If you apply it without thought, you can get caught up in the process and actually not add value. You go to the mechanics of it without actually understanding when to actually add value to the companies". (P7, male, risk business partner)*

ERM ensures consistent treatment and responses to risk [28], but this consistency can lead to inflexibility and rigidity in responding to the risk management requirements of the studied supply chain and business.

### 4.4 Information technology support for ERM

Most participants identified the lack of an appropriate information technology tool, which has not yet been found to support ERM implementation, as presenting a challenge. Information technology is a tool that enables decision-making by gathering, storing, manipulating, and communicating information [52]. This finding is supported by the following assertion:

*"Well, I think one of our limitations, and I say that outright, is a lack of software or application to support it. Our process is predominantly very manually driven". (P3, male, risk business partner)*

The above is corroborated by the view that, from a technology point of view, ERM has been found to be a difficult framework to be supported by an information technology tool [11].

## 5 CONCLUSION

### 5.1 Summary of findings and theoretical implications

This study has explored the challenges experienced in the supply chain function of a single South African petrochemical business in implementing ERM.

The findings indicate that misalignment exists in the organisation between the respective key stakeholders responsible for, or influential in, ERM implementation. This is manifested by the identified lack of buy-in of ERM and its value-add as a chosen standard business-wide risk management approach by management, including senior management. This is corroborated by a comprehensive literature search and review, which has found that a lack of ERM support from top management, such as senior managers, was found to be among the top ERM implementation challenges [6]. However, this finding contradicts an ERM element that views senior management's active support of ERM as a given [26]. Furthermore, goal misalignment exists between some supply chain business strategic objectives on how to manage risk emanating from industrial action in supplier companies, possible supplier bankruptcy, and oil price fluctuations on the one hand, and ERM objectives or strategy on the other, thus creating an ERM implementation challenge.

The study's findings present a scenario in which it is evident that the ERM process was not initiated as a collective effort, but rather was initiated at head office with little or no involvement by the supply chain business function. The need for an aligned business strategy and ERM objectives in managing events that may impact the achievement of that strategy, or where implementation challenges are experienced in the absence of such alignment, is corroborated by Dornberger *et al*. [11]. Change management difficulties are also prevalent as the business fails to embrace and buy into ERM as a new selected business-wide risk management approach. This is corroborated by the study findings of Chinese construction firms operating in Singapore, that change management and resistance to embracing a change to ERM as a risk management tool were found to be among the top challenges [10].

The findings on organisational misalignment and the sub-themes discussed add to the existing academic knowledge base of ERM implementation challenges by reinforcing a lack of senior management ERM buy-in, change management difficulties, and misaligned organisational goals between a business strategy and ERM objectives, as ERM implementation challenges.

Further findings indicate gaps in human resource development pertaining to the identified lack of ERM knowledge and training by personnel (such as risk specialists) who are key in ERM value proposition selling and implementation. This is corroborated by a study in various organisations and industries that the lack of training in ERM implementation for the relevant staff poses implementation challenges [12]. This finding strengthens the literature in this regard. Linked with this is the identified challenge of the business' lack of understanding of ERM's processes and value. This is corroborated by a prerequisite for the education of staff in understanding ERM and its value, as a failure to do so leads to an implementation challenge [11]. These findings also strengthen existing academic knowledge on the importance of ERM training and awareness by personnel and other important ERM implementation stakeholders in the organisation for its successful implementation. Supply chain risk management could be enhanced by ensuring a broader understanding of the value-add of ERM in the supply chain, enabled by technically capable and skilled risk management personnel, such as risk specialists.

The findings also point to organisational design and process challenges to ERM implementation in the case firm. Identified here is the complex nature of the supply chain and the organisation of a petrochemical business, and the rigidity of the ERM framework and its processes. It was further indicated that the prescriptive and rigid nature of ERM processes and implementation does not take into account this complexity, and could compromise the effective management of unique risks emanating from external value chain partners; hence a more flexible ERM framework, or a customised one, is required. This is corroborated by Singhal *et al*. [7], that different industries and sectors have different environments, opportunities, and limitations, creating a need for a flexible or specific risk management approach. Bruwer [8] provides further corroboration through the study of non-franchised fast food small enterprises in Cape Town, that their current sustainability could drastically improve if they were to depart from the rigidly prescribed implementation of formal risk management frameworks such as ERM, and adopt more flexible or customised risk management frameworks that suit their environment.

This finding corroborates the current academic knowledge base on the need for a flexible ERM or a customised risk management framework that is conducive to the limitations and needs of the environment in which it is being applied. Simultaneously, the findings contradict the prescriptive nature of the ERM process and implementation for its success, as found in the ERM literature. Consequently, the effectiveness of ERM in supply chain risk management could be vastly improved if it were to be adapted to suit the unique needs of the organisation and its supply chain.

Lastly, the findings indicate that there is a lack of a suitable information technology tool or software to support ERM implementation. This presents a challenge, as risk capturing, analysis, manipulation, interpretation, and management are currently undertaken manually using Excel spread sheets and a number of templates. This corroborates the literature, which notes that ERM has been found to be a difficult framework to support with an information technology tool [11]. Practitioners could focus time and resources on finding a suitable information technology support system for the benefit of effectively managing supply chain risk.

While the findings indicate that ERM has been able to assist the case firm in managing its supply chain risks, as no major risk management failures have been experienced, its effectiveness continues to be threatened by the challenges identified above, necessitating urgent attention to them. Addressing these challenges will also enable the uninterrupted agility and fast responsiveness of the supply chain that is required in the new era of competition [5].

### 5.2 Managerial implications

The study's findings have specific implications for the management of the case firm. The findings can enable managers to use them for possible reference as lessons they could consider. The findings indicate that, before the roll-out of ERM, management and general employee buy-in through ERM business case workshops or other relevant educational engagements, and incorporating ERM

principles in supply chain strategy crafting activities, should be set as prerequisites. This will ensure that other possible challenges, such as resistance to ERM and a lack of alignment between different functional strategies and ERM objectives are eliminated. Thus time and effort should be invested in this first critical stage.

The training of the broader personnel responsible for ERM implementation, such as risk specialists/officers, should also be prioritised. This will ensure that they have the technical knowledge and expertise to sell the value of ERM and to train other business stakeholders. The implementation of ERM in complex petrochemical businesses and their supply chains should have an element of flexibility to cater for their unique needs. Demonstration of this flexibility will enable buy-in and support, as it will be seen as 'fit for purpose'. ERM implementation should be supported by a fit-for-purpose information technology system or tool. Adequate time should be spent on researching the most appropriate information technology system, and the necessary investment should be made in such a system. A return on this investment would be a successfully implemented ERM, enabling business competitiveness over others [16]. This competitiveness would enable the business to continue playing its critical role in the economy, uninterrupted by negative risk consequences.

### 5.3 Limitations and directions for future research

The findings of the study are based on a single petrochemical company, with potentially different results if other petrochemical businesses were studied. Therefore a future research study could include multiple petrochemical businesses to validate the findings of this study. The study was confined to a supply chain of a petrochemical business, and the findings might be different in other sectors and functions; therefore a future research area could be an analysis of ERM implementation challenges in a business operating in another sector and in a function other than supply chain. The study also analysed ERM implementation challenges in a broad supply chain. Future studies could entail an in-depth and focused study of the ERM implementation challenges in either the outbound or the inbound part of the supply chain. The study did not look at the correlation between the business's characteristics, e.g. type of business, its structure and complexity, and their influence on ERM planning and implementation decisions. Future research could be a quantitative study on the correlation of these variables. The findings are further limited by the study of a large business. There could be different results for smaller businesses, creating space for future research into smaller businesses with fewer organisational and functional complexities than the one studied. The sample was mainly representative of participants who are directly working in the risk function, with a limited number of senior managers included in the study. A future study could research the views of participants at senior management level to validate the findings of this study.

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