Enhancing Supply Chain Resilience And Performance: Leveraging Predictive Analytics And Erps In Vendor Selection

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ABSTRACT

Within the manufacturing sector, the supply chain is susceptible to a variety of external and internal risks. In this context, the susceptibility of the affiliated vendor can also lead to disruptions in the supply chain. Hence, the present study places emphasis on the utilisation of predictive analytics and enterprise resource planning (ERP) systems in the process of vendor selection, with the aim of enhancing both supply chain resilience (SCR) and performance within the manufacturing sector of Saudi Arabia. To fulfil this objective, qualitative data was gathered from employees who hold the responsibility of vendor selection within the manufacturing sector. A series of semi-structured interviews were undertaken with a sample of 10 employees who were purposefully selected. Following the interviews, a thematic analysis was conducted. This study identified six key themes: (a) the relationship between supply chain resilience (SCR) and performance challenges; (b) the impact of vendor selection on SCR and performance; (c) the vendor selection process; (d) the role of predictive analytics and enterprise resource planning (ERP) in vendor selection; (e) the integration of technologies; and (f) suggestions for enhancing SCR and performance. The findings indicate that the integration of enterprise resource planning systems (ERPs) and predictive analytics has a positive impact on inventory automation and the identification of vendors with greater resilience. This enables the procurement of necessary materials even in the face of disruptions in the supply chain. These techniques have also been identified as effective measures for mitigating potential supply chain risks in the future. This study also presents various practical and theoretical implications regarding supplier-customer relationships (SCR) and the process of selecting vendors.

KEYWORDS: Supply Chain Resilience; Vendor Selection; Predictive Analytics; ERPs; Saudi Arabia

INTRODUCTION

The rapid advancements in information technology necessitate that companies make necessary adjustments to ensure the continuous relevance and effectiveness of their Enterprise Resource Planning (ERP) systems in light of the latest technological developments in manufacturing processes (Tarigan, Siagian, & Jie, 2021). Conceding that the effective management of supply chains has emerged as a critical factor in determining the success of businesses (Wuni & Shen, 2023), The optimisation and robustness of supply chain operations play a crucial role in a

company's capacity to fulfil customer requirements, navigate unforeseen disruptions, and sustain a competitive edge. Achieving this equilibrium is a complex task due to the dynamic nature of the business landscape, which is marked by evolving consumer inclinations, economic instabilities, and a progressively intricate network of supply chains. The process of vendor selection, which holds significant importance in the realm of supply chain management, necessitates a strategic and data-centric methodology.

However, a considerable number of manufacturing organisations continue to depend on conventional approaches that may not fully harness the possibilities presented by contemporary tools and technologies. The significance of this research lies in its potential to offer valuable insights for Saudi Arabian businesses seeking to enhance the resilience of their supply chains. Through the disclosure of the benefits associated with the utilisation of predictive analytics and enterprise resource planning (ERP) systems in the process of vendor selection, organisations can enhance their decision-making capabilities in relation to their supplier partnerships. Consequently, this can result in enhanced supply chain resilience, increased adaptability to market dynamics, and improved overall performance.

Enterprise Resource Planning (ERP) systems are of utmost importance in the efficient and effective management of the vendor selection process. The projected annual growth rate for revenue in Saudi Arabia's ERP systems is expected to be 2.56% from 2023 to 2028, resulting in a market volume of US$117.80 million by 2028. Furthermore, it is projected that the mean expenditure per employee within the Enterprise Resource Planning (ERP) system will reach a value of US$6.85 by the year 2023 (Statista, 2023). The implementation of Enterprise Resource Planning (ERP) manufacturing systems in Saudi Arabia is having a transformative impact on the industrial sector of the country, facilitating the ability of manufacturers to maintain their competitiveness within the rapidly evolving global market.

By implementing efficient supply chain operations, enhancing productivity, implementing rigorous quality control measures, effectively managing costs, and integrating advanced technologies, the utilisation of ERP manufacturing systems is enabling Saudi businesses to strengthen their operations, stimulate economic growth, and establish the Kingdom as a prominent manufacturing centre. The strategic implementation of Enterprise Resource Planning (ERP) systems will play a crucial role in advancing the manufacturing sector of Saudi Arabia in accordance with the goals outlined in Vision 2030 (The Negocio Solutions, 2023). The ERP systems facilitate the evaluation and comparison of different ERP packages by considering multiple criteria such as the supplier's industry expertise, system dependability, support and assistance, compatibility, functionality, information security, and integration across various modules (Deb et al., 2022).

The successful implementation of an ERP system requires careful and thorough planning, which includes various steps such as the implementation processes, training, supplier selection, change management, and software configuration (Meiryani et al., 2021). Organisations can make informed decisions regarding the selection of an Enterprise Resource Planning (ERP) system by considering various factors, including system proficiency, cost, flexibility, training, and post-sale suppor t (Alatepeli, 2021). Enterprise Resource Planning (ERP) systems provide a comprehensive structure for the selection of vendors, enabling organisations to improve their competitiveness and streamline their decision-making processes.

The utilisation of predictive analytics presents a valuable prospect to augment the procedure of

vendor selection by employing a methodology grounded in data analysis to evaluate and contrast vendors. Through the analysis of historical data and the utilisation of predictive models, organisations have the ability to anticipate and forecast vendor performance, enabling them to make more informed and strategic decisions. When considering the selection of an appropriate vendor within a supply chain, one can employ the Analytic Hierarchy Process (AHP) model. The Analytic Hierarchy Process (AHP) is a decision-making methodology that incorporates both qualitative and quantitative criteria in the evaluation of vendors, with the aim of identifying the most optimal choice (Nafizza, Mukilan, & Krishnan, 2023). In general, the use of predictive analytics enables businesses to enhance their ability to make vendor selection decisions that are more accurate and reliable, as these decisions are based on insights derived from thorough data analysis.

The integration of predictive analytics and enterprise resource planning (ERPs) offers a promising prospect for improving the robustness and effectiveness of the supply chain through the utilisation of data-driven insights and the optimisation of operational processes. By utilising predictive analytics, organisations have the ability to analyse past data, detect patterns and trends, and thereby anticipate risks and potential disruptions in the supply chain (Cohen, 2022). This approach is beneficial for engaging in proactive decision-making and implementing strategic measures to mitigate the impact of such disruptions. ERPs function as a centralised platform for managing diverse aspects of the supply chain, encompassing production, inventory, and logistics. The integration of predictive analytics capabilities into enterprise resource planning (ERP) systems enables companies to enhance their capacity for real-time monitoring and response to supply chain disruptions (Xia, 2020). This integration facilitates expedited and more effective decision-making processes. The convergence of these factors facilitates increased agility, visibility, and responsiveness, resulting in an optimised supply chain that exhibits enhanced resilience and efficiency.

This research raises fundamental inquiries concerning the strategic integration of predictive analytics and enterprise resource planning (ERP) systems in the process of selecting supply chain vendors. This study investigates the effectiveness of predictive analytics in improving the resilience of supply chains and explores the influence of enterprise resource planning (ERP) systems on data-driven vendor selection. The primary objective of this study is to advance comprehension of the strategic implications of predictive analytics and enterprise resource planning (ERP) integration in the context of supply chain vendor selection. This research endeavours to shed light on the current state of knowledge in this area and provide insights that can guide future supply chain practises.

The research is organised into five primary sections. In Section 2, an in-depth examination of the existing literature is undertaken, with a focus on the identification of areas where further research is needed in the domains of supply chain resilience and vendor selection. Section 3 of the document provides a comprehensive overview of the research methodology employed in this study. It elucidates the specific techniques and procedures employed for data collection and analysis, with a particular emphasis on the utilisation of predictive analytics and event-related potentials (ERPs). In Section 4, the study's findings are presented, with a particular focus on the influence of integrated approaches on the performance and resilience of supply chains. Section 5 provides a contextualization of the aforementioned findings by examining their relationship to the existing body of literature. Also, it explores the practical implications that these findings hold for businesses. Additionally, the paper provides a concise overview of significant discoveries, their significance, and constraints, and proposes potential avenues for

future investigation within the realm of supply chain management and predictive analytics.

LITERATURE REVIEW

Resource based-view theory

The issue of sustainability and resilience in supply chain management has been a subject of intense scholarly discussion in recent years, primarily due to the increased uncertainty in the business environment. According to previous studies (Du, Hu, & Wang, 2017; Nandi et al., 2020; Toptal & Çetinkaya, 2017), the supply chain plays a crucial role in attaining a competitive advantage. Furthermore, the overall competitiveness of a business is intricately connected to the competitiveness of its supply chain system. Achieving sustainability in the supply chain necessitates the establishment of equilibrium among diverse social, economic, and organisational resources, a task that poses considerable challenges. The existing body of literature (Sodero, Jin, & Barratt, 2019; Tarigan et al., 2021) has acknowledged the influence of event-related potentials (ERPs) and predictive analytics on enhancing supply chain and operational performance.

However, there is a dearth of research exploring the impact of organisational and social resources on supply chain competitiveness (Dubey et al., 2019). In addition, a significant portion of existing research (Arda et al., 2023) consists of descriptive studies that lack a solid theoretical foundation. Consequently, this paper aims to address this gap by adopting the resource-based view theory of the firm. By doing so, it seeks to explore the significance of resource and data management in the context of developing a resilient supply chain. The resource-based view theory is a prominent management theory that highlights the significance of valuable and rare resources in achieving a competitive advantage (Kamboj & Rana, 2023). Numerous studies have focused on the theoretical framework of organisational information processing (OIP) to effectively manage resources and capabilities in order to mitigate risks in organisational operations.

Conceding to that, it is important to note that the resource-based view theory is not comprehensively associated with risk management in the context of supply chain resilience. Hence, this paper employs the Resource-Based View (RBV) as a theoretical framework to gain a deeper understanding of the application of the resource-based view theory within the context of supply chain management research.

Supply chain Resilience

In the contemporary economy and industry, the establishment of a robust supply chain is of paramount significance. Throughout history, the economy has experienced numerous noteworthy occurrences, including earthquakes, acts of terrorism, fuel crises, and epidemics, which have had a disruptive impact on business operations. The aforementioned occurrences have prompted scholars and professionals to recognise the urgent necessity of establishing a robust and sustainable supply chain framework in order to mitigate such disruptions (Hosseini, Ivanov, & Dolgui, 2019). This subject has garnered scholarly attention as well, prompting the present paper to conduct a comprehensive review of existing literature pertaining to supply chain resilience. The economy supply chain comprises various stages, including the procurement of raw materials, the processing of raw materials into finished products, inventory management, vendor selection, and distribution.

In the past, scholarly attention has predominantly centred on the concept of supply chain

sustainability. However, there is currently a growing scholarly interest in the subject of supply chain resilience. Supply chain resilience pertains to the capacity of a supply chain to withstand and surmount disruptions arising from unforeseen circumstances, including natural disasters, fluctuations in demand and supply, and political unrest. A resilient supply chain ensures the continuity of operations for firms, even in the presence of disruptive events. The notion of "supply chain resilience" was initially introduced in the literature on supply chain risk management (Hamel & Valikangas, 2004; Sheffi & Rice Jr, 2005).

However, previous literature has also examined the concept of supply chain from a multidimensional perspective. The concept under discussion is primarily being examined within the realms of science, economy, and organisations. Its application to various fields has expanded its scope and comprehension, prompting scholars to highlight the lack of attention given to the issue of consent in the existing literature on Supply chain resilience. The contemporary notion of Supply Chain Resilience (SCR) is characterised by its broad scope and innovative nature, as it signifies a shift in research focus towards the management of risks within supply chains. Supply Chain Resilience has multidimensional definitions drawn by several scholars. Like, Christopher and Lee (2004) demarcated SCR as "Supply Chain system tendency of coming back into its real state or turn into a novel, more desired state after facing the disruption". According to Sheffi and Rice Jr (2005) ''SCR is a unique feature of a firm to resist disturbances or facilitate the Supply chain system to reoccurred to original conditions quicker and have a progressive effect on SC performance''.

Furthermore, Ivanov et al. (2017) acknowledge the concept of "Supply Chain Resilience" as the ability to maintain and restore planned performance while also striving to achieve the intended (or modified, yet still satisfactory) performance. While there may be variations in the previously stated definitions of SCR, a few shared elements can be observed. The definitions encompass several essential elements, including the anticipation of unforeseen disruptive events, the ability to endure and overcome disruptions, prompt responsiveness to disruptions, and the restoration of stable, original, or improved conditions. In spite of this, several other significant components of supply chain resilience are derived through an analysis of the supply chain literature (Nunes, Causer, & Ciolkosz, 2020).

One aspect is the practise of risk management, which involves the ability to anticipate potential disruptions and develop proactive strategies to mitigate the adverse consequences. By taking these risks into consideration, supply chain networks can proactively prepare and implement contingency plans to ensure continuity in the face of disruptions. The second aspect is agility or adaptability, which pertains to the promptness with which a firm reacts to uncertain circumstances and adjusts its strategies accordingly. This necessitates the firm to possess flexibility in areas such as production, distribution, and inventory management, without compromising on overall efficiency. Redundancy is a crucial component in ensuring the resilience of a supply chain system, as it provides backup options for production and distribution. This redundancy serves to mitigate potential disruptions and enhance the overall robustness of the system.

Supply chain in Saudi Arabia

Saudi Arabia is a developing economy that exhibits a significant reliance on global trade and the logistics of supply chain operations. Consequently, the concept of supply chain resilience assumes a crucial role within this context (Alshahrani & Salam, 2022). Saudi Arabia is actively

pursuing the goal of attaining a position among the top 15 global economies. To achieve this, the country is placing significant emphasis on enhancing its logistics and supply chain systems. The objective is to establish a resilient supply chain that can effectively mitigate risks and maintain stability in the face of unforeseen circumstances (Azmi et al., 2022). The government of Saudi Arabia has initiated a global supply chain initiative with the aim of capturing $10.64 billion. This initiative seeks to leverage the country's resources and infrastructure in order to enhance the resilience of logistics operations. This initiative entails significant investments in infrastructure upgrades to align with international standards.

The government is allocating funds towards the development of a resilient global transportation network, encompassing ports, airports, and roads, with the aim of enhancing connectivity across various regions worldwide (Chen & Han, 2019). This will provide an opportunity to access and utilise previously unexplored market segments and resources. The infrastructure in Saudi Arabia has undergone significant advancements, including the construction of modern and advanced warehouses and logistics parks. One notable example is the King Abdullah logistic zone. The government is implementing digitalization in logistics systems, exemplified by the utilisation of the digital customs clearance platform "FASAH" and artificial intelligence. Consequently, digitalization and green initiatives have become integral components of the global supply chain initiative. Additionally, the enhancement of legal and compliance regulations is a necessary component of this initiative.

Enterprises resource Planning Impact on Supply Chain Resilience

The intensification of globalisation has led to a significant enhancement in market competition. In order to effectively navigate the ever-changing market trends, meet the demands of customers, and keep up with technological advancements, enterprises must adopt an inclusive business model and employ appropriate methodologies. Due to the extensive nature of supply chain systems, which encompass various units and entities, the task of effectively transmitting information across different sections can present challenges. However, the implementation of Enterprise Resource Planning (ERP) can assist organisations in achieving the seamless transfer of diverse information throughout different segments and functions. This, in turn, facilitates accurate and timely delivery, enhances customer satisfaction, and reduces costs (Oghazi et al., 2018). "Enterprise recourse planning is a tool that helps firms to keep business operation integrated and execute business routine tasks in an automatic way''. The Enterprise Resource Planning (ERP) system comprises multiple components that establish connections between information originating from different departments within an organisation (Bhatt et al., 2021). Each unit, such as finance, manufacturing, order tracking, and logistics, is regarded as having a distinct structural function.

Therefore, by establishing connections between these units and other units, information originating from different components becomes interconnected, providing managers with crucial data to gain a more comprehensive understanding of the business's operations and make more informed real-time decisions (Pettit, Croxton, & Fiksel, 2019). Enterprise resource planning (ERP) systems in supply chain management facilitate the automation of demand and supply forecasting by leveraging historical and real-time data. This enables organisations to promptly respond to unexpected disruptions in the supply chain. Enterprise Resource Planning (ERP) systems are also beneficial in facilitating the procurement process, including the acquisition of resources, raw materials, and the selection of vendors. Enterprise Resource Planning (ERP) systems facilitate the integration of production processes by effectively

managing the procurement of necessary raw materials and maintaining a comprehensive database of vendor information. This enables convenient access to relevant data for subsequent operations (Mahmood, Khan, & Bokhari, 2020).

Vendors play a crucial role in the supply chain as they can significantly impact business growth. Acting as intermediaries between buyers and sellers, vendors have the potential to either drive or hinder the growth of a business. The selection of vendors is a critical decision for businesses, as it can greatly impact their success. However, existing literature has not fully grasped the significance of vendors within the supply chain. Hence, it is imperative to recognise the significance of proficient vendor management and acknowledge that a sole emphasis on procurement is insufficient in the present era. Moreover, it is crucial to prioritise the cultivation of strong relationships with these vendors. A vendor is a key participant within the supply chain, tasked with the procurement of raw materials for companies and the subsequent distribution of goods and services to customers (Czekster et al., 2019). Managing a large number of vendors with varying pay rates, terms, and conditions poses a significant challenge for a firm. However, this challenge can be effectively addressed by utilising Enterprise Resource Planning (ERP) systems. ERPs facilitate the comprehensive documentation of vendor information, allowing for the meticulous maintenance of records. This, in turn, enables the firm to efficiently select the most appropriate vendor when the need arises.

The utilisation of Enterprise Resource Planning (ERP) systems facilitates the vendor selection process by enhancing efficiency in identifying and tracking the most appropriate vendor, achieving predetermined targets, engaging in negotiations regarding contract terms and payment rates, and evaluating vendor performance. This results in significant time and cost savings for organisations (Mondal, Nandy, & Baidya, 2020). If a company possesses comprehensive information about a vendor, it can effectively mitigate the risks associated with vendor selection, such as the procurement of substandard materials and additional expenses. This can be achieved by evaluating the vendor's past performance and any relevant certifications, which contribute to bolstering the resilience of the supply chain. Furthermore, the utilisation of Enterprise Resource Planning (ERP) facilitates the assessment of vendor performance in accordance with contractual obligations, thereby streamlining the process of verifying whether the vendor is effectively meeting the specified requirements. This, in turn, enhances the overall performance of the supply chain. Although ERPs have the potential to enhance supply chain performance by facilitating vendor selection, there appears to be a dearth of comprehensive studies in the existing literature on this topic. There is a limited body of research (Mahmood et al., 2020) that has examined the influence of enterprise resource planning (ERP) systems on supply chain performance.

However, there is a lack of investigation into the specific factors that contribute to the effective selection of vendors and how these factors enhance overall performance. This paper aims to examine the potential impact of effectively managing Enterprise Resource Planning (ERP) systems and vendor selection on enhancing supply chain resilience.

Predictive Analytics and supply chain resilience

In contemporary business environments characterised by intricate complexity and extensive organisational structures, firms are compelled to move beyond relying solely on instinctive decision-making processes. Hence, organisations are increasingly depending on the analytical capabilities of their companies to enhance their decision-making processes in order to adapt to

unpredictable and evolving circumstances (Fan et al., 2017). Analytics competence is defined as the integration of various tools, methodologies, and processes that enable organisations to process, organise, visualise, and analyse data in order to generate meaningful insights. These insights empower managers to make informed and impactful decisions pertaining to business operations and related activities. According to Yeboah-Ofori et al. (2021), predictive analytics in the literature is referred to as the set of administrative skills that enable organisations to collect, organise, and analyse data in order to generate valuable insights that can provide a competitive edge (Gunasekaran et al., 2017).

Furthermore, Jeble et al. (2018) assert that predictive analysis enhances data processing from diverse sources within an organisation, enabling the anticipation of future trends and potential risks through statistical analysis of current or historical data. However, the factors that require consideration when managing predictive analytics for the supply chain have not been adequately defined in prior research. Predictive analytics has emerged as a crucial tool within the realm of supply chain management, facilitating the process of making optimal decisions. This tool effectively enhances the examination and correlation of data derived from various sources, including customer feedback, inventory records, transportation data, and vendor information (Maheshwari, Gautam, & Jaggi, 2021). Nevertheless, a comprehensive examination of blockchain's influence on supply chain performance and resilience remains incomplete, resulting in a limited understanding among organisations regarding the various factors that may affect its implications.

As past data is a determination of future demand and market trends, analysing past data helps to determine the expectations of consumers so those products and services are produced (Dubey et al., 2021). But the level to which it influences vendor or supplier selection decisions is understudied, regardless of the fact that vendors are crucial in the supply chain as they manage the sources of firms from procurement to consumption and delivery of final products. Predictive analytics in SC have a major impact on overall business performance. Any firm can optimise its decision-making while selecting vendors by reviewing past data, vendor history, vendor's contracts, quality assurance, time management, pay rates, and negotiations. Through this, a firm gets in a better position to select the most suitable vendor, negotiate the terms of the contract, and ask for better rates that make the supply chain resilient and effective. The analysis of past data is crucial in determining future demand and market trends. By examining past data, one can gain insights into consumer expectations, which in turn inform the production of products and services (Dubey et al., 2021).

However, there is a lack of research on the extent to which it impacts the decision-making process for selecting vendors or suppliers. This is despite the critical role that vendors play in the supply chain, as they are responsible for managing the procurement, consumption, and delivery of final products for firms. The utilisation of predictive analytics in supply chain management has a significant influence on the overall performance of businesses. The optimisation of decision-making in vendor selection can be achieved by any organisation through the examination of various factors such as past data, vendor history, contractual agreements, quality assurance, time management, pay rates, and negotiation strategies. This process enables a company to enhance its ability to choose the most appropriate vendor, engage in contract negotiations, and secure more favourable rates, thereby improving the resilience and effectiveness of the supply chain (Deretarla, Erdebilli, & Gündoğan, 2023; Fan et al., 2016; Hazen et al., 2018; Srinivasan & Swink, 2018). It is evident that academics and experts often employ the terms data analytics, big data analytics, predictive analytics, and big data

interchangeably.

The term "predictive analytics" is a relatively recent concept, and existing literature is insufficient for a comprehensive understanding of its implications in the context of supply chain resilience. Therefore, this paper aims to examine this topic in greater detail. This paper comprehensively explores various factors that impact supply chain resilience, including enterprise resource planning systems (ERPs), predictive analytical capability, and vendor selection.

METHOD

The current investigation utilises a qualitative research design, which is congruent with the intricate nature of the study's research aims. Qualitative research is well-suited for examining the complex dimensions of supply chain management and the intricate dynamics of vendor selection, which encompass subjective factors and decision-making processes. The primary objective of this study is to examine the various methodologies and optimal strategies associated with the utilisation of predictive analytics in the process of vendor selection. Therefore, the use of a qualitative research design is deemed suitable for this study, as it facilitates the exploration of individuals' experiences, insights, and contextual factors that exert influence on decision-making processes (Hennink, Hutter, & Bailey, 2020).

In addition, the utilisation of qualitative research methods can contribute to the examination and evaluation of the incorporation of ERP systems within decision-making procedures. In addition, the utilisation of qualitative research design facilitates the comprehensive examination of the benefits and obstacles related to the incorporation of predictive analytics and enterprise resource planning (ERP) systems in the process of vendor selection. The utilisation of qualitative research design facilitates the investigation of the impacts associated with the integration of predictive analytics and enterprise resource planning (ERP) systems on both supply chain resilience and performance metrics. Additionally, this study is grounded in the research philosophy of interpretivism and employs an inductive approach, thereby facilitating a nuanced analysis that is tailored to the specific context.

Data Collection

The current study utilised primary data collected through structured interviews with industry experts who have experience in vendor selection within the field of supply chain management. The utilisation of structured interviews in the current study is consistent with its research objectives and facilitates the acquisition of precise and standardised data (Roulston & Choi, 2018). Structured interviews are characterised by the utilisation of a predetermined set of questions and response options, which serves to maintain a high level of consistency in the process of data collection (Marta, 2021). The utilisation of structured interviews proved to be advantageous in the investigation of the particular facets pertaining to vendor selection practices and the adoption of enterprise resource planning (ERP) systems. The interview encompassed a series of eight inquiries pertaining to the process of vendor selection.

 Furthermore, the utilisation of structured interviews facilitated the researcher's evaluation of the significance of enterprise resource planning (ERP) systems and predictive analytics in the process of vendor selection, as well as discerning patterns and trends within the interviewees' responses. The participants for the study were chosen using convenience and purposive

sampling methods. Purposive sampling enables the researcher to deliberately choose experts who possess the necessary expertise and knowledge within the specific field of study (Bhardwaj, 2019). This enabled the researcher to specifically focus on supply chain professionals who possess expertise and experience in the areas of vendor selection and technology integration. In addition, the utilisation of convenience sampling facilitated the researcher's ability to choose participants who were conveniently accessible or readily available, thereby mitigating the logistical obstacles related to recruitment. The study's target population was comprised of individuals employed in the manufacturing sector of Saudi Arabia who were involved in the process of vendor selection. The study's sample consisted of 10 participants who possessed specialised knowledge in the area of vendor selection and the decision-making processes related to this phenomenon.

Data Analysis

The data that has been gathered will undergo a thematic analysis in order to extract meaningful insights from the research. The process of data analysis entails becoming acquainted with the interview transcript and constructing a coding framework. The use of NVivo software is planned for the purpose of coding the interview transcript. This software was selected due to its ability to effectively manage and organise qualitative data, thereby minimising the likelihood of errors (Dhakal, 2022).

RESULTS

Upon the completion of gathering the necessary qualitative data, a thorough thematic analysis was conducted. This analysis resulted in the identification and formulation of several themes that were specifically designed to address the following objectives of the study:

1. Theme I: Supply Chain Resilience (SCR) and Performance Challenges
2. Theme II: Impact of Vender Selection on SCR and Performance
3. Theme III: Vendor Selection Process
a. *Theme IIIa: Conventional Methods vs Modern Techniques*
b. *Theme IIIb: KPIs*
4. Theme IV: Predictive Analytics and ERPs in Vendor Selection
a. *Theme IVa: Predictive Analytics and ERPs Challenges*
5. Theme V: Integration of Technologies
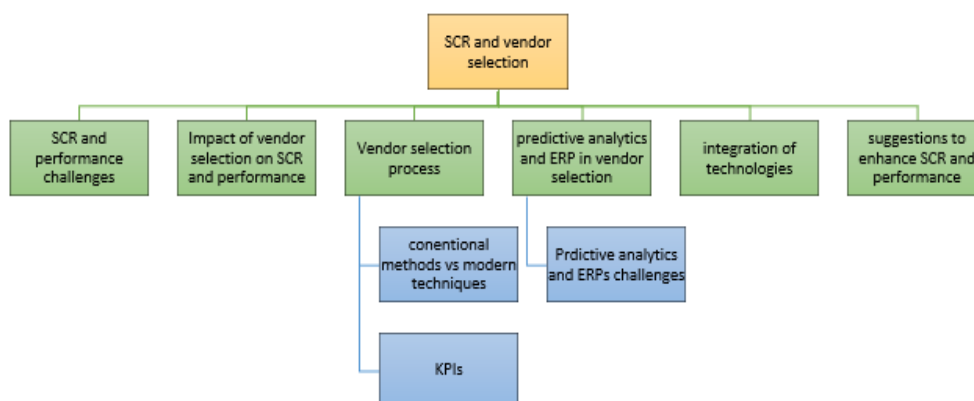6. Theme VI: Suggestions to Enhance SCR and Performance

Figure 4.1. Mind map- Thematic analysis

Theme I: Supply Chain Resilience (SCR) and Performance Challenges

The manufacturing sector in Saudi Arabia has encountered various challenges in its efforts to improve the Saudi Capitalization Rate (SCR). Based on the responses of seven participants, it was observed that the manufacturing industry encountered a shortage of materials in the aftermath of the COVID-19 pandemic. This persistent issue continues to pose a significant challenge, exerting a detrimental influence on the Supply Chain Resilience (SCR). Additional challenges that have been observed in this context encompass the escalation of commodity prices, shortages of raw materials, transportation difficulties, and extended lead times. Nevertheless, it is worth noting that three participants in the study also expressed the view that the challenges associated with demand forecasting have been exacerbated by the complexities of the non-linear global market. In support of this argument, one of the respondents said:

"Pandemic and other global financial issues have largely impacted demand forecasting. In order to avoid these issues, we have incorporated data-driven research to select the associated vendors or suppliers."

Theme II: Impact of Vender Selection on SCR and Performance

According to eight participants in the study, various external and internal factors, such as transportation challenges and inadequate stakeholder management, contribute to the occurrence of supply chain disruptions. In this context, an inadequate choice of vendor can contribute to external risks. Hence, it was observed that six participants placed emphasis on the importance of selecting vendors effectively in order to mitigate risks and vulnerabilities within the supply chain framework. The utilisation of this approach is also regarded as imperative in the mitigation of risks. Within this context, one of the respondents quoted:

"In my opinion, vendors are the crucial sources of vulnerability, therefore, better vendor selection is beneficial to build resilience, decreasing the supply chain risks as a whole."

Theme III: Vendor Selection Process

Manufacturing firms employ various processes and techniques to effectively choose vendors for the timely acquisition of necessary raw materials. Seven participants in the study engaged in a discussion pertaining to the process of vendor selection within their respective organisations. It was posited that consideration of the company's objectives is necessary when selecting vendors. One of the respondents also highlighted the importance of establishing effective evaluation criteria in order to ensure the selection of a vendor with resilience. However, it is worth noting that three participants in the study mentioned that their respective organisations engage in vendor briefings as part of the vendor selection process. Vendors that possess strong and efficient resilience attributes are more inclined to provide uninterrupted services and other associated products, even in the face of disruptions. This also helps in improving SCR. Therefore, while explaining the vendor selection process at his firm, one of the respondents stated:

"We at ABC company utilizes a seven step procedure for vendor selection, starting from analysing and defining the requirements of the company to signing the contract with vendor."

Theme IIIa: Conventional Methods vs Modern Techniques

A total of seven participants expressed the belief that the integration of contemporary

technologies holds significant importance when considering the process of vendor selection. The individuals held the belief that the traditional approaches to selecting vendors were time-consuming and arduous. Hence, as a result of ongoing advancements in the manufacturing sector, there has been a notable rise in the adoption of e-procurement systems, thereby contributing to the enhancement of resilient vendor selection. Manufacturing firms in Saudi Arabia are utilising various contemporary technologies, including big data and the internet of things (IoT), to facilitate vendor selection processes. These technologies are employed with the aim of enhancing supply chain resilience (SCR) and overall performance. In this regard, one of the respondents was of the view:

"In order to enhance the SCR, we mainly focus on selecting the resilient vendor. In past, the selection process was long and tiring, requiring incorporation of different company policies. Therefore, in order to save time and resources, we incorporated modern technologies such as ERPs for vendor selection."

Theme IIIb: KPIs

Seven participants indicated that the evaluation of vendors' on-time delivery is conducted through the utilisation of Enterprise Resource Planning (ERP) systems. The return on investments (ROIs) were additionally examined through the application of predictive analytics in order to ascertain the cost savings and revenue generated as a result of the materials supplied by a specific vendor. Additionally, it was reported by four participants that their respective organisations employ predictive analytics to assess the performance of specific vendors by analysing inventory turnover. Additional key performance indicators (KPIs) utilised for the assessment of vendors encompass vendor risk assessment, lead time, quality, cost variance, and other pertinent factors. Within this context, one of the respondents stated:

"Selection of appropriate vendor is vital to ensure the shorter lead time, which can improve the agility of the associated supply chain."

Theme IV: Predictive Analytics and ERPs in Vendor Selection

Seven participants indicated that their respective organisations implemented an Enterprise Resource Planning (ERP) system, which facilitated enhanced automation and management of the manufacturing process. This implementation subsequently led to the achievement of optimal performance. In the contemporary manufacturing industry, supply chains have experienced heightened complexity and dynamism as a result of the expanding forces of globalisation. The application of predictive analytics is observed to be on the rise within the manufacturing industry, specifically for the purpose of predicting supply chain risks. This utilisation of predictive analytics has the potential to enhance the promotion of sustainable supply chain resilience. This particular technique has also been observed to be efficacious in the optimisation of inventory. In support of this argument, one of the respondents quoted:

"We utilized predictive analytics to identify different patterns and trends in the supply chain of manufacturing sector which helped us in mitigating the associated risks before they occur. This also helped us in reducing the risks associated with the supply shortage by selecting appropriate vendors."

Theme IVa: Predictive Analytics and ERPs Challenges

Manufacturing firms encounter various challenges when it comes to the implementation of Enterprise Resource Planning (ERPs) and predictive analytics in order to enhance Supply Chain Resilience (SCR) and improve vendor selection. The manufacturing sector frequently integrates various systems, including Enterprise Resource Planning (ERP) and Transportation Management Systems (TMS), within its supply chain, resulting in adverse effects on data sharing. Three participants expressed apprehensions regarding the dependability and precision of the data employed in predictive analytics. However, an additional concern that has been observed with regards to the implementation of Enterprise Resource Planning (ERP) and predictive analytics is the presence of resistance towards change. One of the respondents said:

"Our 60% of the workforce incorporates people from the age group of 50 to 65 years. They are resistant towards the incorporation of ERPs and predictive analytics in vendor selection which led to various data management issues and supply chain disruptions within the company."

Theme V: Integration of Technologies

A notable portion of the participants placed significant emphasis on the adoption of sophisticated technologies and strategic approaches as means to enhance the SCR metric. The proponents held the belief that the integration of various technologies, including machine learning, artificial intelligence (AI), big data, and others, contributes to the enhancement of the vendor selection process. These technologies have demonstrated efficacy in expediting data analysis. This methodology has the potential to assist manufacturing enterprises in effectively identifying suitable vendors by employing specific selection criteria, thereby mitigating potential external risks. In support of this argument, one of the respondents said:

"I believe the integration of technologies such as AI, IoT, predictive analytics and ERPs is crucial to conduct data-driven research which can help in reducing the supply chain risks related to vendor selection in manufacturing sector."

In this regard, another respondent said:

"In my opinion, different machine learning algorithms, including neural networks can be effective in improving the vendor selection process within the supply chain management."

Theme VI: Suggestions to Enhance SCR and Performance

Nine participants in the study placed significant emphasis on the importance of establishing explicit objectives for the organisation when considering the process of vendor selection. However, it was found that six of the participants held the belief that the ongoing trend of globalisation and diversification in the manufacturing industry necessitates the integration of predictive analytics in order to accurately forecast demand. The authors also placed significant emphasis on the integration of this technique as a means of mitigating potential supply chain disruptions arising from vulnerabilities in vendors. In this context, it has been observed that enterprise resource planning (ERP) systems are effective in resource and budget management, a critical factor in enhancing supply chain resilience (SCR). Within this context, one of the respondents stated:

"Support from upper management is vital for incorporating effective ERP and predictive analytics for enhancing SCR."
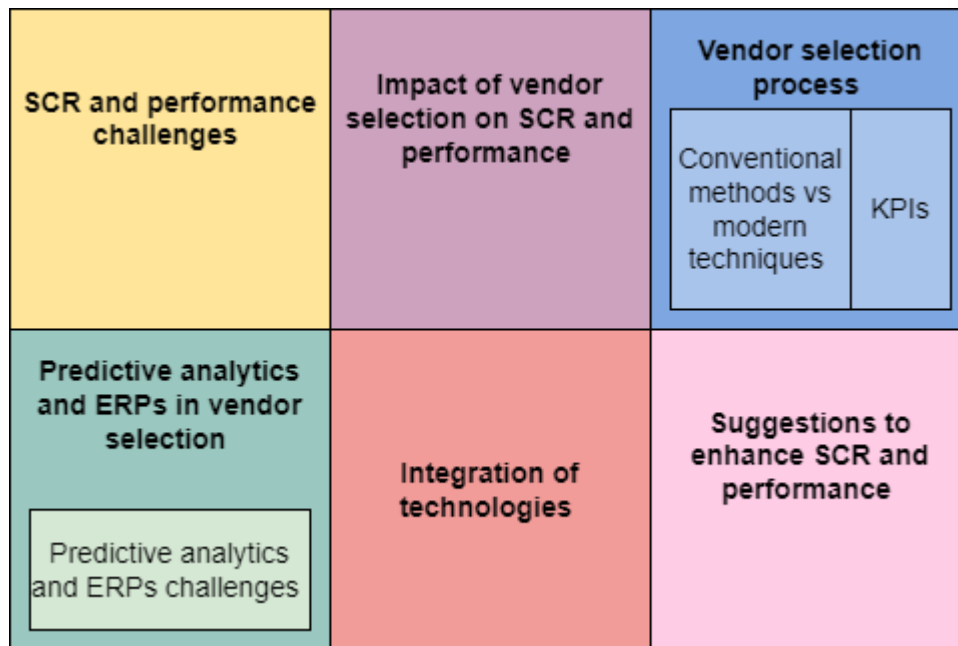

Figure 4.2. Treemap- Thematic analysis

DISCUSSION

The primary objective of this study is to examine the strategic implications of predictive analytics and enterprise resource planning (ERP) integration in the context of supply chain vendor selection. This research aims to shed light on the potential benefits and challenges associated with these technologies, ultimately paving the way for supply chain resilience (SCR). This study has identified six significant themes to address the formulated objectives of the present research.

The findings derived from this study demonstrate that supply chain management (SCM) within the manufacturing sector of Saudi Arabia encounters various external and internal risks as a result of uncertain and unforeseen circumstances. The respondents of the present study have identified various factors, including the COVID-19 pandemic, the non-linear nature of the global market, and a high inflation rate, as having a detrimental effect on the effectiveness of supply chain management (SCM). These factors additionally impact the demand forecasting process by influencing the accessibility of the necessary services or products. The vulnerability and ineffectiveness of vendors can have a detrimental impact on the availability of necessary raw materials and resources. This underscores the importance of employing various techniques to assess and choose suitable vendors.

Pramanik, Mondal, and Haldar (2020) posit that the act of choosing sustainable vendors contributes to the enhancement of enduring relationships between vendors and customers. The respondents of the present study also expressed support for this argument, emphasising the importance of integrating resilient vendors in order to establish a resilient supply chain management system that can effectively mitigate the impact of uncertain conditions. Despite the importance of selecting resilient vendors to enhance supply chain resilience (SCR), numerous manufacturing firms in Saudi Arabia continue to rely on traditional vendor selection

methods, which are typically characterised by lengthy and time-consuming processes. Hence, a majority of the participants placed significant emphasis on the utilisation of Enterprise Resource Planning (ERPs) and predictive analytics as effective tools for the identification and selection of resilient vendors. This strategic approach aims to mitigate the potential risks that arise from external factors impacting the supply chain. It was posited that the utilisation of enterprise resource planning (ERP) systems and predictive analytics holds potential for effectively assessing vendors by considering key performance indicators (KPIs) such as lead time, return on investment (ROI), inventory turnover, quality, and cost variance.

Furthermore, it has been noted that the careful selection of a suitable vendor plays a crucial role in enhancing the overall agility of supply chain management. Siva Kumar and Anbanandam (2020) have highlighted the significance of adopting enterprise resource planning (ERP) systems for the purpose of integrating vendors. The Enterprise Resource Planning (ERP) system facilitates the dissemination of crucial information among the Supply Chain (SC) members, thereby aiding in the formulation of efficient criteria for the selection of vendors. The respondents also put forth this argument, asserting that ERPs are effective in enhancing inventory and supply chain management, resulting in noteworthy outcomes. Event-related potentials (ERPs) and predictive analysis are valuable tools for identifying and analysing dynamic market trends. This information is crucial for effectively identifying and selecting resilient vendors that can enhance supply chain resilience (SCR).

This study also emphasises the various challenges encountered by manufacturing firms in Saudi Arabia when implementing enterprise resource planning (ERP) systems and predictive analytics, specifically in the context of vendor selection. The challenges encompassed in this context pertain to the inadequate quality of data, reluctance towards change, and the integration of multiple systems within the supply chain. Based on the feedback provided by the participants, it has been observed that the inadequate precision and dependability of the supply chain data can have adverse effects on the assessment of vendors, which is conducted through the utilisation of enterprise resource planning systems (ERPs) and predictive analytics. The consequence of this can be the choice of unsuitable vendors, thereby affecting the overall Supply Chain Resilience (SCR).

Hence, the participants of this research study also underscored the significance of incorporating additional technologies such as artificial intelligence (AI), the Internet of Things (IoT), blockchain, and machine learning to enhance the vendor selection process and augment supply chain resilience (SCR). It was believed that the incorporation of cutting-edge technology is imperative in the process of vendor selection in order to remain in step with contemporary society. The support of top management is crucial in this context, as they bear the responsibility of making critical decisions for the manufacturing firms involved.

CONCLUSION

The manufacturing sector in Saudi Arabia has experienced a significant impact on its SCR as a result of heightened uncertainty in the global manufacturing industry. In relation to this matter, the susceptibility of vendors during disruptions in the supply chain also leads to inconsequential consequences, underscoring the importance of integrating resilient vendors. So, this qualitative study shows that using data-driven methods together with predictive analytics and event-related potentials (ERPs) can make it easier to find and choose the right vendors to improve supply chain resilience (SCR). These techniques have also been observed

to be effective in the realms of data automation, inventory optimisation, and efficient supply chain management. The implementation of such techniques presents various challenges, encompassing the integration of multiple systems in supply chain management, resistance to change, and the presence of inaccurate data.

Additionally, the utilisation of predictive analytics is effective in the prediction of potential risks, enabling manufacturing firms to proactively implement necessary measures to mitigate these risks, thereby improving the overall supply chain resilience (SCR) and performance. This study also highlights the incorporation of cutting-edge technologies, such as machine learning, the Internet of Things (IoT), blockchain, and others, in order to augment Supply Chain Resilience (SCR).

THEORETICAL IMPLICATIONS

The present study aims to elucidate the application of event-related potentials (ERPs) and predictive analytics in the process of vendor selection, with the ultimate goal of improving supply chain resilience (SCR). This study enhances the understanding of various conventional methods and contemporary techniques employed in the vendor selection process within the manufacturing sector in Saudi Arabia, thereby contributing valuable insights to the field. Simultaneously, this study underscores the incorporation of additional cutting-edge technologies, such as artificial intelligence (AI), the Internet of Things (IoT), and others, in order to augment the effectiveness of secure code review (SCR). These techniques are expected to yield positive outcomes in the realm of data management as well.

Furthermore, this study has also demonstrated its efficacy in motivating future researchers to prioritise various challenges within the realm of SCR. This approach has the potential to offer significant resolutions to the identified challenges.

PRACTICAL IMPLICATIONS

The findings derived from this study indicate that the manufacturing sector in Saudi Arabia employs various advanced technologies and strategies for the purposes of data management and vendor selection. The utilisation of enterprise resource planning (ERPs) and predictive analytics has been emphasised in this context. This can serve as an incentive for various manufacturing firms and other sectors in the construction industry to implement significant strategies in the process of selecting resilient vendors, thereby enhancing the overall management of the supply chain. In this context, the implementation of enterprise resource planning (ERP) systems and the application of predictive analytics can be enhanced by senior management within these organisations.

Furthermore, in light of the inherent difficulties pertaining to enterprise resource planning (ERPs) and predictive analytics, manufacturing companies can implement various strategies to safeguard data privacy. Furthermore, this study also provides a presentation of efficient criteria and key performance indicators (KPIs) for the selection of vendors. This can also serve as a catalyst for the advancement of crucial supply chain risk (SCR) policies, with a specific emphasis on the vendor selection process.

LIMITATIONS

Every research study possesses inherent limitations that must be acknowledged and identified in order to guide future investigations. Likewise, the present study also encompasses various

constraints that are outlined in this section. The primary focus of this study was limited to the implementation of predictive analytics and enterprise resource planning (ERP) systems in the context of vendor selection, thereby delimiting the scope of the research. However, the lack of attention given to other technologies in this area can be attributed to constraints such as limited time and available literature. Furthermore, the present study employed a limited sample size in order to gather data, as a result of the qualitative approach adopted. The availability of constrained resources prevented the collection of data from a larger audience. Furthermore, it is important to note that this particular study exclusively examined the concept of supply chain resilience within the manufacturing sector of Saudi Arabia. Due to the availability of readily accessible data and research bias, this narrow focus was possible.

FUTURE RESEARCH DIRECTIONS

To address the limitations of this study, future research may consider exploring the integration of additional technologies, such as blockchain, big data, and the Internet of Things (IoT), in the context of vendor selection and supply chain resilience. Furthermore, it is recommended that future studies prioritise the gathering of quantitative data from a more extensive sample size in order to enhance the validity and efficacy of the research subject. Furthermore, it is recommended that future research endeavours prioritise the incorporation of Event-Related Potentials (ERPs) and predictive analysis in the assessment of vendor selection and supply chain resilience. This should be explored within various sectors, including but not limited to the construction industry and IT industry, in order to optimise the application of these methodologies.

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APPENDIX A

Interview Questions

1. Supply chain management is crucial for a manufacturing company. In your opinion, what challenges are faced in improving the supply chain resilience and performance within the manufacturing sector?
2. In your opinion, how does vender selection influence the supply chain resilience and performance in the manufacturing sector?
3. Can you explain different steps which are incorporated by your company in vender selection? In your opinion, how are the modern strategies different from conventional methods regarding vender selection?
4. Does your company incorporate modern techniques such as predictive analytics and ERPs in vendor selection? What key performance indicators (KPIs) are taken into account for evaluation of vendors, using ERPs and predictive analytics?
5. In your opinion how do predictive analytics and ERPs influence supply chain resilience and performance? How is the data managed, using these techniques?
6. What challenges are faced by the manufacturing companies in implementing predictive analytics and ERPs for vender selection?
7. In your opinion, does the integration of other technologies (such as blockchain technology, IoT or others), with the predictive analytics and ERPs, is effective in vendor selection for enhancing supply chain resilience in manufacturing sector?
8. Can you provide any suggestions concerning the incorporation of different technologies or techniques in vendor selection to improve supply chain resilience and performance in the manufacturing sector?