

Innovations in Supplier Evaluation: Frameworks and Techniques for Supply Chain Resilience

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ABSTRACT

This study explores the critical dimensions of supplier evaluation in supply chain management, focusing on sustainability, risk assessment, technological advancements, and cross-functional collaboration. The primary objective is to comprehensively analyze supplier evaluation processes and identify strategies for enhancing supplier selection and performance. Using a qualitative research approach, the study draws on secondary data from scholarly articles, industry reports, and case studies. Thematic analysis was employed to identify key themes, allowing for a structured examination of supplier evaluation frameworks. The findings highlight the increasing prominence of sustainability in supplier evaluation, with firms integrating environmental, social, and governance (ESG) criteria into their selection processes. Risk assessment has also become critical, with companies assessing operational, financial, and geopolitical risks to ensure supply chain resilience. Technological advancements, including AI, machine learning, and blockchain, have transformed supplier evaluation by enabling predictive analytics, real-time monitoring, and enhanced transparency. Cross-functional collaboration was essential for achieving a holistic supplier evaluation, as it integrates diverse perspectives from procurement, operations, quality control, and risk management. This study underscores the need for firms to adopt a dynamic, data-driven, and collaborative approach to supplier evaluation. The insights provide practical implications for organizations aiming to enhance supply chain performance, improve supplier accountability, and achieve sustainable business practices. By addressing research gaps and proposing future research directions, this study contributes to the academic discourse on supplier evaluation and offers actionable strategies for practitioners.

Keywords: Supplier Evaluation, Supply Chain Management, Sustainability, Risk Assessment, Technological Advancements, Cross-Functional Collaboration

INTRODUCTION

Effective supply chain management is fundamental to ensuring business competitiveness and operational excellence (El-Garaihy, 2021). Supplier evaluation is a core aspect of this process, which involves systematically assessing suppliers to ensure they meet an organization's quality, cost, delivery, and sustainability requirements. As modern supply chains become more complex and globalized, supplier evaluation has emerged as a critical factor in enhancing supply chain resilience, driving sustainability, and maintaining competitive advantage (Cui, Gao, Dai, & Mou, 2022).

Supplier evaluation is pivotal in achieving supply chain efficiency and overall business performance. In today's highly competitive and globalized market, selecting the right supplier can significantly influence an organization's ability to deliver quality products on time and at competitive costs (Sahoo, Goswami, & Halder, 2024). However, this process has become increasingly complex due to globalization, advancements in digital technologies, and the growing emphasis on sustainability. Organizations are now expected to assess suppliers on cost, quality, and environmental, social, and governance (ESG) criteria. Moreover, introducing Industry 4.0

technologies, such as artificial intelligence (AI) and machine learning (ML), has further complicated supplier evaluation processes, requiring firms to adapt to more dynamic, data-driven decision-making systems (Yu, Wu, Chen, Wang, & Mardani, 2024).

Despite the growing recognition of supplier evaluation's importance, significant challenges remain in practice. Companies often face difficulties in balancing multiple and sometimes conflicting criteria, such as cost, quality, risk, and sustainability (Flechsig, Anslinger, & Lasch, 2022). Additionally, there is a lack of a unified approach for supplier evaluation across industries, and many existing models prioritize financial and operational metrics over qualitative and sustainability-based factors. A fragmented approach leaves organizations vulnerable to supply chain disruptions, reputational risks, and inefficiencies (Manners-Bell, 2023).

While existing studies have explored supplier evaluation's theoretical foundations and practical applications, notable gaps persist. First, many supplier evaluation frameworks emphasize quantitative measures, such as cost, delivery, and quality, while qualitative factors, such as supplier flexibility, environmental impact, and social responsibility, are often underexplored. This oversight limits the ability of organizations to adopt a holistic supplier evaluation approach (Üstündağ & Ungan, 2020). Second, while significant attention has been paid to supplier evaluation in large corporations, research on supplier evaluation in small and medium enterprises (SMEs) remains scarce. SMEs often operate with limited resources, and their ability to adopt complex supplier evaluation models is constrained, making it imperative to develop simpler, more cost-effective evaluation frameworks tailored to their needs (Sahoo et al., 2024).

Third, the impact of technological advancements, particularly the role of Industry 4.0 technologies like big data analytics, Internet of Things (IoT), and artificial intelligence (AI), on supplier evaluation processes remains under-researched. While there is growing interest in data-driven decision-making, empirical studies demonstrating how these technologies influence supplier evaluation practices are still limited. Lastly, limited attention has been given to cross-functional approaches to supplier evaluation. Supplier evaluation decisions are often made within procurement departments, but incorporating cross-functional perspectives from departments such as operations, quality, risk management, and sustainability teams can improve the comprehensiveness and accuracy of supplier assessments (Jagatheesaperumal, Rahouti, Ahmad, Al-Fuqaha, & Guizani, 2021).

This study seeks to bridge the abovementioned gaps by comprehensively analyzing supplier evaluation processes. The following objectives guide the research:

1. To examine the influence of sustainability criteria on supplier evaluation.
2. To analyze the role of technological advancements
3. To explore the role of cross-functional collaboration in supplier evaluation.
4. To identify strategies for small and medium enterprises (SMEs) to improve supplier evaluation

By addressing these objectives, this research aims to contribute new knowledge to the field of supply chain management, providing practical and theoretical insights for organizations, academics, and policymakers.

LITERATURE REVIEW

Conceptual Framework

Supplier evaluation is a critical component of supply chain management, with various theoretical concepts underpinning its practice. One of the most widely applied frameworks is the Multi-Criteria Decision-Making (MCDM) approach. MCDM provides a systematic method for evaluating suppliers based on multiple, often conflicting, criteria such as cost, quality, delivery performance, and sustainability (Khan, Gupta, Gunasekaran, Mubarik, & Lawal, 2023). Techniques such as the Analytic Hierarchy Process (AHP) and the Technique for

Order Preference by Similarity to Ideal Solution (TOPSIS) are frequently employed within this framework. These methods allow decision-makers to prioritize supplier attributes and make objective, transparent, and justifiable selections (Ismail, Ahmed, Abdel-Gawad, & Mohamed, 2024).

Another significant concept in supplier evaluation is Data-Driven Selection, which leverages large datasets and advanced analytics to inform supplier decisions (Abdulla & Baryannis, 2024). This approach is increasingly relevant in Industry 4.0, where digital tools and technologies generate vast amounts of operational data. Data-driven methods provide real-time insights into supplier performance, enabling firms to make timely, evidence-based decisions. As supply chains become more digitized, the importance of data-driven supplier evaluation is expected to grow (Zekhnini, Chaouni Benabdellah, & Cherrafi, 2024).

Themes and Current Research

Sustainability in Supplier Evaluation

Sustainability has become a central consideration in supplier evaluation, reflecting the growing emphasis on environmental, social, and governance principles in business operations. Companies are integrating sustainability criteria into their supplier evaluation frameworks to balance economic performance with social and environmental impact. This shift requires businesses to assess suppliers' environmental practices, labor conditions, and community engagement. Incorporating sustainability into supplier evaluation can enhance brand reputation, reduce risk exposure, and create long-term value (Lou, You, & Xu, 2024).

Sustainability-driven supplier evaluation frameworks often employ tools like MCDM models to assess environmental and social criteria. Firms prioritize suppliers demonstrating eco-friendly practices, resource efficiency, and compliance with international sustainability standards. This trend aligns with the broader shift towards sustainable supply chains, where firms seek to reduce their environmental footprint while promoting ethical labor practices. As the regulatory environment becomes more stringent and consumers demand greater corporate accountability, sustainability will remain a vital dimension of supplier evaluation (Bajpai, Kannan, Darbari, & Jha, 2022).

Risk Assessment Methodologies

Risk assessment is fundamental to supplier evaluation, especially in an era of increasing supply chain disruptions. Effective risk assessment enables organizations to identify, quantify, and mitigate potential risks associated with supplier relationships. Companies assess various risks, including operational, financial, geopolitical, and reputational risks, to ensure supply chain resilience and business continuity (Hawkins, Gravier, & Muir, 2020).

Several methodologies have been developed to enhance risk assessment within supplier evaluation. For instance, firms use tools like risk matrices, scenario analysis, and sensitivity analysis to evaluate supplier vulnerabilities. Advanced analytics and predictive modeling also play a role in identifying emerging risks, enabling proactive mitigation measures. Given the interconnected nature of global supply chains, organizations emphasize risk-based supplier evaluation to avoid costly disruptions (Mittal, 2023).

Role of Technological Advancements

Technological advancements have significantly transformed supplier evaluation processes, driven by innovations in Industry 4.0, Artificial Intelligence (AI), and Machine Learning (ML). These technologies enable organizations to automate supplier evaluation, process large datasets, and generate predictive insights to improve decision-making (Singh, 2023).

AI and ML algorithms can analyze historical supplier performance data, predict future supplier behavior, and identify optimal suppliers for specific needs. By leveraging big data analytics, firms can gain a holistic view of supplier performance, which enhances transparency and efficiency in the evaluation process. Furthermore, blockchain technology offers an additional layer of trust and accountability by providing immutable records of supplier transactions, enabling companies to trace the origin of materials and ensure supplier compliance with

ethical standards (Javaid, Haleem, Singh, & Suman, 2022).

Industry 4.0 technologies, such as the Internet of Things (IoT), also contribute to real-time supplier monitoring and evaluation. IoT-enabled devices track supplier performance in areas like delivery timeliness and product quality. These innovations have elevated supplier evaluation from a reactive process to a proactive and predictive one, where companies can anticipate and address disruptions before they impact supply chain performance (Sallam, Mohamed, & Mohamed, 2023).

Cross-Functional Approaches

Cross-functional approaches to supplier evaluation emphasize the need for collaboration between various departments, including procurement, operations, quality management, and risk management. Traditional supplier evaluation processes often operate in isolation, primarily within the procurement function. However, a cross-functional approach enables a more comprehensive supplier performance assessment, drawing on diverse perspectives and expertise (Li, Wang, Huo, Zhao, & Cui, 2022).

This approach enhances decision-making accuracy, as input from multiple stakeholders ensures that all relevant criteria are considered. For example, quality management teams may emphasize product quality, while operations teams prioritize timely deliveries. Organizations can establish a well-rounded view of supplier performance by involving various departments, minimizing potential blind spots. Cross-functional collaboration is also essential for aligning supplier evaluation with broader business goals, such as sustainability, risk mitigation, and operational efficiency (Patrucco, Frattini, & Di Benedetto, 2022).

Despite significant progress in supplier evaluation research, several gaps remain unaddressed. First, while many frameworks prioritize financial and operational metrics, there is a need for greater emphasis on qualitative factors like supplier flexibility, innovation capacity, and ethical conduct. The existing literature provides limited guidance on how organizations can systematically assess these qualitative dimensions (de Goeij, Gelsomino, Caniato, Moretto, & Steeman, 2021). Second, while SMEs (small and medium enterprises) face unique challenges in supplier evaluation due to resource constraints, much of the current research focuses on large firms. There is a need to develop simpler, cost-effective supplier evaluation frameworks tailored to SMEs' needs (Gamage et al., 2020).

Third, there is an insufficient exploration of cross-functional approaches to supplier evaluation. While some studies have recognized the value of cross-functional collaboration, there is limited guidance on how firms can institutionalize these approaches across different functional areas. Lastly, while the role of Industry 4.0 and emerging technologies in supplier evaluation is acknowledged, further empirical studies are required to demonstrate how firms can effectively integrate these technologies into their supplier evaluation processes. Research should explore best practices for adopting AI, ML, IoT, and blockchain to enhance decision-making and ensure ethical supplier practices (Naradda Gamage et al., 2020).

METHODOLOGY

Research Approach

This study adopts a qualitative research approach to explore the complexities of supplier evaluation. A qualitative approach is appropriate, given the need to understand the underlying themes, perspectives, and contextual factors influencing supplier evaluation processes. The research uses qualitative methods to generate in-depth insights that cannot be easily captured through quantitative data alone. This approach allows for a rich exploration of supplier evaluation frameworks, technological influences, sustainability considerations, and cross-functional collaboration.

Data Collection

The data for this study was collected from secondary sources, specifically scholarly articles, industry reports, and case studies on supplier evaluation. The decision to rely on secondary data was driven by the extensive availability of existing academic literature on the subject and the objective to synthesize findings from multiple perspectives. Secondary data was sourced from peer-reviewed journals, reputable industry publications, and

government and consultancy report relevant to supply chain management, Industry 4.0, sustainability, and supplier evaluation.

The data collection followed a systematic approach, beginning with a comprehensive search for relevant articles and reports published within the last five years. Search engines and academic databases, including Google Scholar, Scopus, and Web of Science, were used to identify pertinent literature. Keywords such as “Supplier Evaluation,” “Supply Chain Management,” “Sustainability,” “Risk Assessment,” and “Industry 4.0” were utilized to locate relevant studies. Articles were then screened for relevance, and only those with substantial contributions to the research objectives were included.

Thematic Analysis

The study employs thematic analysis, a widely used method in qualitative research, to analyze the collected data. Thematic analysis is suitable for identifying, organizing, and interpreting patterns (themes) across qualitative data. This analysis approach enables the researcher to capture and present key insights related to supplier evaluation, sustainability, technological advances, and cross-functional approaches.

The thematic analysis process followed the six-phase approach proposed by Braun and Clarke, which involves the following steps:

1. **Data Familiarization:** The researcher thoroughly reviewed the collected articles, reports, and case studies to become familiar with the content and identify initial patterns.
2. **Initial Coding:** Relevant data from each source was highlighted, and preliminary codes representing key concepts and ideas related to supplier evaluation processes were assigned. For instance, the first coding cycle involves assigning preliminary codes to the data based on its surface meaning, called “semantic” coding (see Table 1). These initial codes encapsulate the essential elements within the data, allowing for the categorization of similar data into clusters.

Table 1: Coding scheme for theme identification.

Code Name	Description	Example
Sustainability	References to sustainability in supplier selection, including environmental, social, and economic considerations.	Alikhani, Nummi, and Ojala (2021) emphasize the importance of considering environmental and social factors and economic criteria.
Risk Assessment	Discussions about assessing potential risks (operational, financial, reputational) associated with suppliers.	Raian et al. (2022) underline risk assessment’s importance in supplier evaluation within the textile industry.
Technological Advancements	Mentions of technological approaches and digital tools (e.g., machine learning, Industry 4.0) in supplier selection.	Ali, Nipu, and Khan (2023) discusses using machine learning in supplier selection.
Cross-Functional Approaches	References to cross-functional or collaborative approaches in supplier evaluation.	Tran, Gorton, and Lemke (2022) highlights the necessity of including diverse organizational perspectives in supplier evaluation.
Industry-Specific Approaches	Mentions of supplier evaluation strategies specific to certain industries.	Gidiagba, Tartibu, and Okwu (2023) discuss sustainable supplier selection in the oil and gas industry.

Theme Identification: Codes with similar meanings were grouped to create broader categories. For instance, concepts like “Supplier Risk,” “Operational Risk,” and “Geopolitical Risk” were clustered under the broader

theme of “Risk Assessment in Supplier Evaluation.” Each code was reviewed in depth, examining how it interacted with other codes and the broader context of the data. Codes sharing similar ideas or concepts were clustered, forming preliminary themes (see Figure 1).

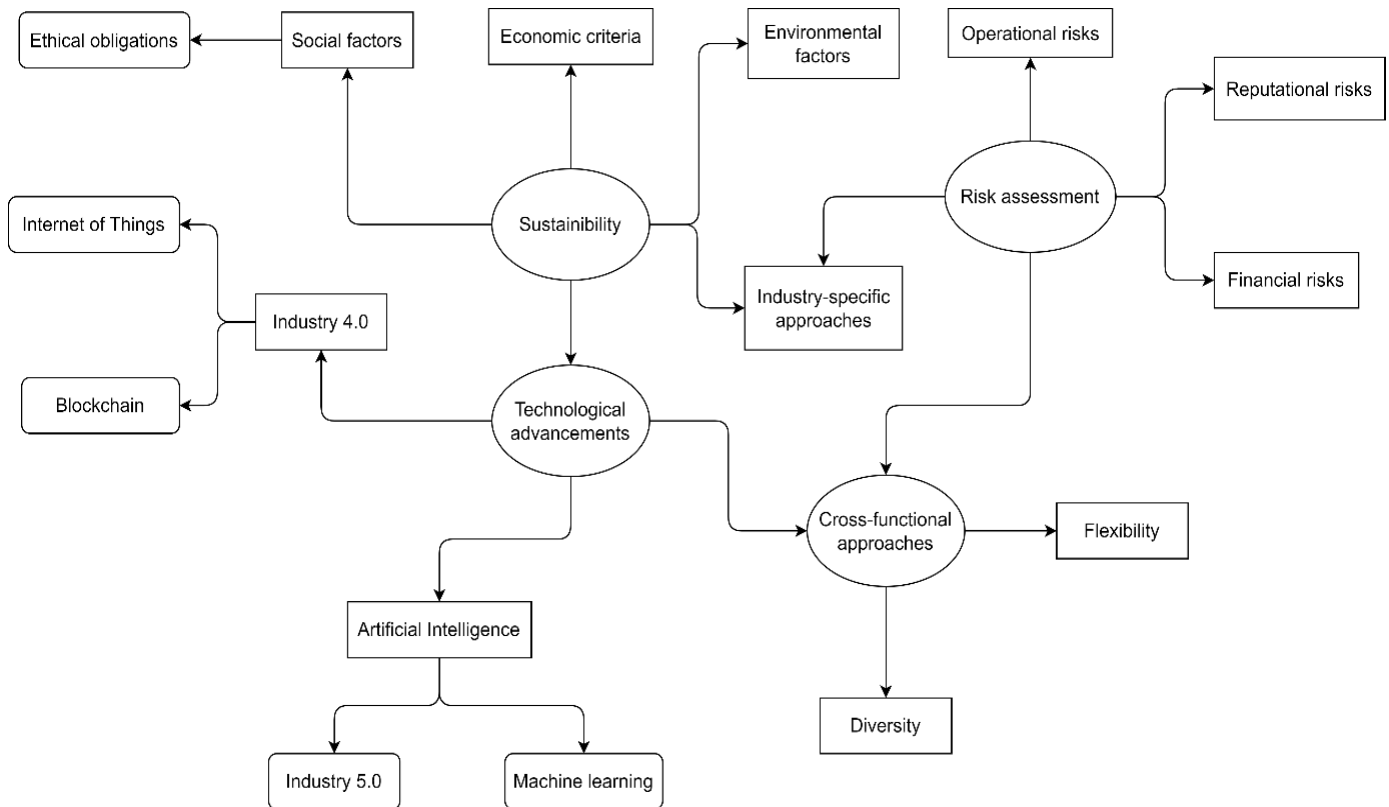


Figure 1: Initial thematic map showing the four main themes.

Theme Review: The initial themes were refined to ensure coherence, clarity, and relevance. Some themes were merged or restructured, while others were subdivided to capture more nuanced insights (see Figure 2).

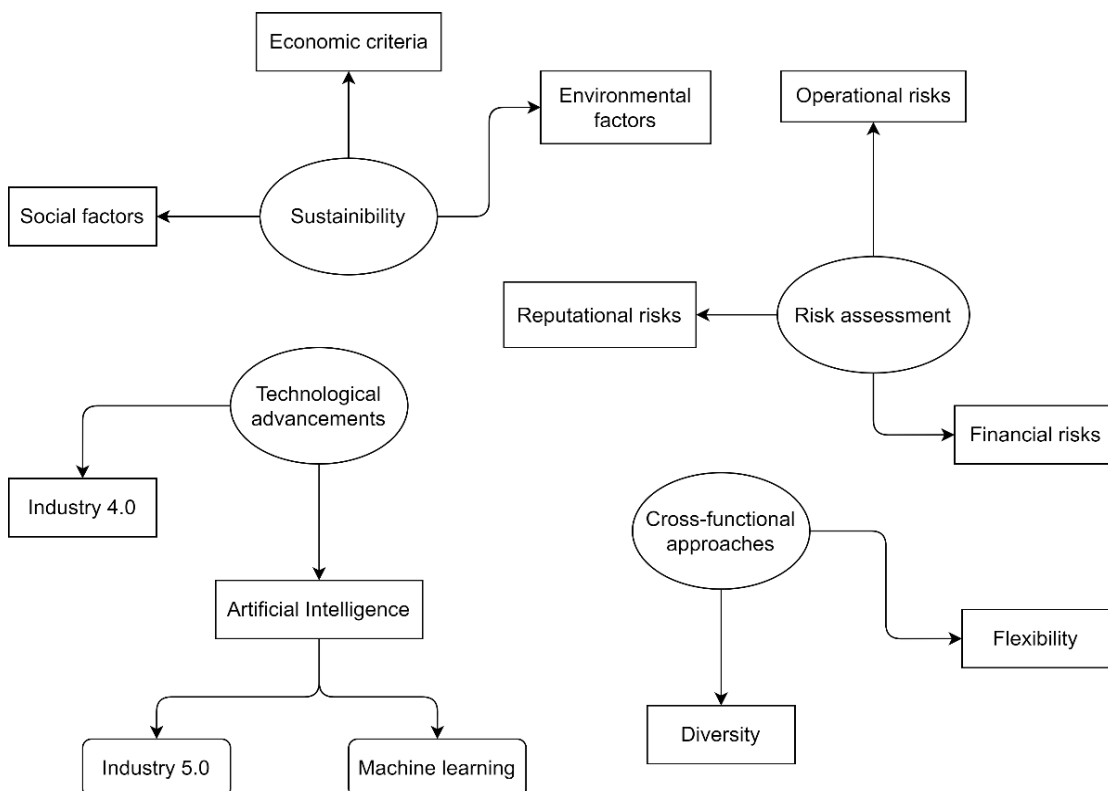


Figure 2: Developed thematic map showing the four main themes.

Theme Definition and Naming: Each theme was defined, and a descriptive label was assigned to capture the essence of the content. Themes such as “Sustainability in Supplier Evaluation,” “Technological Advancements in Supplier Selection,” and “Cross-Functional Collaboration” emerged as the core themes (see Table 2).

Table 2: The four main themes identified in the literature.

Theme	Key Findings	Key Studies
Sustainability in Supplier Evaluation	Emphasizing environmental and social factors and traditional economic criteria, using multi-criteria decision-making methodologies like AHP and TOPSIS.	Alikhani et al. (2021); Gidiagba et al. (2023)
Risk Assessment in Supplier Evaluation	Evaluating suppliers based on potential operational, financial, and reputational risks. Importance in diverse industry sectors, including textile dyeing and oil and gas.	Alikhani et al. (2021)
Technological Advancements in Supplier Selection	Leveraging machine learning techniques and Industry 4.0 to refine the supplier evaluation process. Signifies the increasing digitization and efficiency of supplier selection.	Ali et al. (2023)
Cross-Functional Approaches to Supplier Selection	Incorporating diverse organizational perspectives into supplier evaluation for more comprehensive assessments. Emphasizing the need for flexibility evaluation in multi-echelon supply chains.	Tran et al. (2022)

Report Production: The final step involved synthesizing the key findings from the themes into a coherent narrative, ensuring that each theme was supported with evidence from the reviewed data.

This thematic analysis approach allowed for a structured and systematic identification of the key dimensions of supplier evaluation. By following this method, the research achieves a clear and comprehensive understanding of how organizations assess and select suppliers in modern supply chains.

Validity and Reliability

Ensuring the validity and reliability of the research findings is critical in qualitative studies. Several strategies were employed to enhance the trustworthiness of the thematic analysis. The study utilized multiple secondary data sources, including academic articles, industry reports, and case studies. This triangulation approach strengthens the credibility of the findings by ensuring that insights are corroborated across various sources.

A detailed audit trail was maintained, documenting the decision-making process at each stage of the thematic analysis. This included records of how codes and themes were developed, refined, and defined, allowing for transparency and replicability of the analysis process. The researcher’s thematic analysis was reviewed by an independent expert in supply chain management to ensure that the coding and theme development were consistent and free from researcher bias. Feedback was incorporated into the final analysis.

Clear definitions for key concepts such as “Sustainability,” “Risk Assessment,” and “Technological Advancements” were established to ensure consistency in coding and theme development. Finally, the researcher engaged in reflexive practices by recognizing and mitigating potential biases that could influence the analysis. Reflexive journaling was used to track thoughts and decisions throughout the research process.

By employing these strategies, the study ensures that its findings are both valid and reliable. The use of multiple data sources, clear operational definitions, and transparent documentation contribute to the robustness and credibility of the thematic analysis. This methodological rigor enhances the trustworthiness of the study’s conclusions, providing a solid foundation for future research and practical application in supplier evaluation.

RESULTS

Sustainability in Supplier Evaluation

Sustainability has emerged as a fundamental theme in supplier evaluation, reflecting the growing emphasis on environmental, social, and governance principles. Companies increasingly incorporate sustainability criteria into their supplier evaluation frameworks to align with global sustainability standards and respond to regulatory pressures.

The thematic analysis revealed that organizations prioritize environmental sustainability by assessing suppliers' environmental impact, energy efficiency, waste management practices, and use of eco-friendly materials. Suppliers demonstrating strong environmental responsibility are more likely to secure long-term contracts with firms aiming to achieve sustainable supply chains.

Social sustainability also plays a vital role in supplier evaluation. When assessing suppliers, companies emphasize labor rights, health and safety, and fair wages. These criteria often align with global standards such as the United Nations' Sustainable Development Goals. Companies that adopt socially responsible supplier evaluation practices are better positioned to mitigate reputational risks and avoid negative publicity related to unethical supply chain practices. While often linked to cost considerations, economic sustainability is increasingly viewed from a broader perspective. Companies now evaluate suppliers' financial stability, long-term growth potential, and capacity to maintain consistent supply during periods of economic uncertainty. Suppliers with a robust economic position are considered reliable partners capable of supporting business continuity.

Risk Assessment in Supplier Evaluation

Risk assessment is a critical factor in supplier evaluation, especially given the increase in global supply chain disruptions. The thematic analysis highlighted that firms assess supplier risks in multiple dimensions, including operational, financial, and geopolitical risks. Operational risk is assessed by evaluating the supplier's capacity to deliver goods and services on time, maintain quality, and respond to disruptions. Companies monitor suppliers' production capacity, lead times, and logistical capabilities to minimize the risk of supply delays or disruptions.

Financial risk is analyzed to ensure the financial stability of suppliers. Companies assess suppliers' credit ratings, financial health, and liquidity. Suppliers with weak financial positions are viewed as high-risk partners, especially during periods of economic downturn or financial crisis.

Geopolitical risk has become a prominent consideration due to the impact of global events, such as trade wars, pandemics, and natural disasters. Companies now evaluate the geopolitical stability of regions where suppliers operate. Suppliers in politically unstable regions may face higher scrutiny, with firms seeking alternative sources to mitigate potential supply chain disruptions (Rasshyvalov, Portnov, Sigaieva, Alboshchii, & Rozumnyi, 2024).

Risk assessment also extends to suppliers' compliance with ethical, legal, and regulatory standards. Companies monitor suppliers' adherence to anti-corruption policies, labor laws, and health and safety regulations. Non-compliance with these standards can result in legal penalties and reputational damage for the buying firm (da Silva, Ramos, Alexander, & Jabbour, 2020).

Technological Advancements in Supplier Selection

Technological advancements are reshaping supplier evaluation processes, driven by the rise of Industry 4.0, digital transformation, and data-driven decision-making. The thematic analysis identified three major technological advancements influencing supplier selection: Artificial Intelligence, Machine Learning, and Blockchain Technology.

AI and ML have revolutionized supplier evaluation by enabling predictive analytics and automation of decision-making. Companies can forecast supplier performance, identify potential risks, and predict supplier failures through machine learning models. AI-powered platforms provide data-driven recommendations, allowing procurement teams to make faster, more informed supplier selection decisions (Khedr, 2024).

Blockchain technology enhances transparency, traceability, and trust in supplier evaluation. Using blockchain, companies create immutable records of supplier transactions and performance metrics. This technology allows firms to verify suppliers' certifications, track material origins, and ensure suppliers adhere to ethical and sustainable standards (Vazquez Melendez, Bergey, & Smith, 2024).

Big Data Analytics also plays a crucial role in supplier evaluation. Firms use big data to analyze historical supplier performance, quality issues, and customer feedback. Real-time monitoring of supplier performance, enabled by IoT devices and advanced analytics, allows companies to respond quickly to potential disruptions or quality issues. Technology-driven supplier evaluation transforms traditional processes, making them more agile, accurate, and efficient. As supply chains continue to digitize, companies are expected to increase their reliance on AI, ML, and blockchain to maintain a competitive edge in supplier management.

Cross-Functional Approaches to Supplier Selection

Cross-functional collaboration is a central theme in supplier evaluation, reflecting the need for diverse perspectives in supplier-related decision-making. Traditional supplier evaluation processes are often siloed within procurement departments, but cross-functional approaches involve input from multiple departments, including operations, finance, quality control, and sustainability teams.

Collaborative decision-making ensures that supplier selection is comprehensive, as each department brings unique priorities and expertise. For example, while the procurement team may prioritize cost and delivery, the quality control team may focus on product specifications and defect rates. Operations teams emphasize production continuity, while risk management teams focus on supplier resilience.

Cross-functional approaches also enhance the accuracy and objectivity of supplier evaluation. When various departments assess suppliers together, they can identify potential issues that may not have been apparent in a single-department review. This approach reduces the likelihood of supplier-related risks and improves overall supply chain performance.

Integrated technology platforms are facilitating cross-functional collaboration. Digital platforms and supplier relationship management (SRM) tools provide a shared space for stakeholders from different departments to view supplier data, assess supplier performance, and provide feedback. This transparency supports better alignment of supplier evaluation criteria and streamlines decision-making. Cross-functional collaboration is essential for aligning with broader organizational goals, such as sustainability and risk management. By involving multiple departments in supplier evaluation, firms ensure that supplier selection is comprehensive and aligned with the company's long-term strategy (Fröhlich & Steinbiß, 2020).

In summary, the four themes identified in the thematic analysis highlight the evolving nature of supplier evaluation in supply chain management. As firms integrate ESG criteria into their supplier selection processes, sustainability is becoming a key driver. Risk assessment has become more comprehensive, with companies analyzing operational, financial, and geopolitical risks. Technological advancements, such as AI, ML, and blockchain, are revolutionizing supplier evaluation, making it more data-driven, transparent, and predictive. Finally, cross-functional approaches are enabling companies to make well-rounded supplier selection decisions, as multiple departments collaborate to ensure comprehensive assessments.

These findings underscore the need for organizations to adopt holistic, technology-enabled, and collaborative approaches to supplier evaluation. As global supply chains face uncertainties and disruptions, firms that leverage these four themes are better positioned to achieve supply chain resilience, sustainability, and competitive advantage.

DISCUSSION

Alignment with Previous Studies

The emphasis on sustainability in supplier evaluation is consistent with prior research highlighting the growing importance of environmental, social, and governance (ESG) considerations. Companies are now prioritizing suppliers that adhere to sustainable practices, such as responsible sourcing, waste reduction, and labor rights. This finding echoes earlier studies that emphasize the role of sustainability as a strategic imperative for firms seeking to enhance supply chain resilience and corporate reputation.

Similarly, the role of risk assessment in supplier evaluation aligns with existing literature on supply chain risk management. Prior studies have shown that companies increasingly assess operational, financial, and geopolitical risks when selecting suppliers. This study reaffirms the necessity of proactive risk assessment to prevent disruptions and maintain supply chain continuity, especially in the face of global challenges like geopolitical conflicts and pandemics.

The adoption of technological advancements such as AI, ML, and blockchain builds on recent studies that emphasize the transformative impact of digital tools on supplier evaluation. Prior research has highlighted how AI-driven predictive analytics and blockchain's transparency-enhancing features enable more accurate and efficient supplier assessments. This study's findings provide further evidence of the role of these technologies in driving data-driven, real-time, and transparent supplier evaluations.

The findings on cross-functional approaches provide new insights that go beyond existing literature. While prior studies have discussed the benefits of cross-functional collaboration in supplier selection, this study underscores the specific mechanisms by which cross-functional teams enhance supplier evaluation. By integrating perspectives from procurement, quality control, operations, and risk management, firms can ensure a more holistic and well-rounded evaluation process.

Intersection of Key Themes

One of the most compelling insights from this study is the intersection of sustainability, risk assessment, technological change, and cross-functional approaches. These themes are not independent but interact to holistically shape supplier evaluation.

1. **Sustainability and Risk Assessment:** Sustainable supplier evaluation inherently incorporates risk assessment, as firms evaluate suppliers' exposure to social, environmental, and ethical risks. The alignment of sustainability with risk assessment allows organizations to build more resilient supply chains that are less susceptible to reputational damage and regulatory penalties.
2. **Technology and Risk Management:** Technological advancements, such as AI and blockchain, strengthen risk management processes by enabling predictive analytics, real-time monitoring, and traceability. Blockchain's ability to provide an immutable record of supplier transactions enhances supplier accountability and reduces risks related to fraud, non-compliance, and unethical practices.
3. **Cross-Functional Collaboration and Sustainability:** Cross-functional teams are pivotal in integrating sustainability considerations into supplier evaluation. Quality control teams assess suppliers' compliance with environmental standards, while procurement teams focus on cost and efficiency. By involving multiple departments, organizations ensure that sustainability is not an isolated objective but a shared goal across the supply chain.
4. **Technology and Cross-Functional Collaboration:** Technology facilitates collaboration by providing shared data platforms and supplier relationship management (SRM) tools. These platforms enable departments to view supplier performance in real-time, share feedback, and coordinate decisions. As a result, supplier evaluation becomes a more cohesive and collaborative process.

In conclusion, the findings of this study demonstrate that supplier evaluation is no longer a linear, isolated

process. Instead, it is a dynamic, multi-dimensional approach incorporating sustainability, risk management, technological innovation, and cross-functional collaboration. By aligning these themes, firms can enhance supplier performance, reduce risk, and achieve competitive advantage. The integration of sustainability and risk assessment with advanced technologies and cross-functional approaches represents a paradigm shift in how organizations manage their supply chains. These insights provide a foundation for future research and offer practical implications for firms seeking to strengthen supplier evaluation processes.

CONCLUSION AND FUTURE RESEARCH

Summary

This study highlights the key themes that shape supplier evaluation processes, offering critical insights for supply chain management. The thematic analysis identified four major themes: sustainability, risk assessment, technological advancements, and cross-functional approaches. Each of these themes contributes to a holistic understanding of supplier evaluation, emphasizing the need for organizations to adopt comprehensive, technology-driven, and collaborative approaches.

The study's findings indicate that sustainability is no longer optional but a strategic imperative for organizations seeking to build resilient and ethical supply chains. By incorporating environmental, social, and governance (ESG) criteria into supplier evaluation, companies can mitigate risks, enhance their corporate reputation, and contribute to sustainable development goals.

Risk assessment has become a critical component of supplier evaluation, especially as global supply chains face increasing disruptions. Companies are now required to assess operational, financial, and geopolitical risks associated with their suppliers. Effective risk assessment allows firms to anticipate potential disruptions and develop strategies to maintain supply chain continuity.

The study also underscores the role of technological advancements in transforming supplier evaluation. Technologies such as Artificial Intelligence (AI), Machine Learning (ML), blockchain, and big data analytics have enabled firms to automate decision-making, enhance transparency, and monitor supplier performance. The integration of these technologies supports predictive analytics, real-time supplier tracking, and traceability, thereby improving supplier accountability and responsiveness. Finally, the study highlights the importance of cross-functional collaboration in supplier evaluation. Unlike traditional siloed approaches, cross-functional collaboration integrates procurement, operations, quality control, and risk management perspectives. This approach enables more comprehensive and accurate supplier assessments, reducing blind spots and fostering alignment with organizational goals.

Future Research

Future research can build on the findings of this study to address the identified limitations and explore new frontiers in supplier evaluation. One promising area for future inquiry is empirically validating the identified themes. Primary data collection through case studies, interviews, and surveys with procurement managers, operations teams, and supply chain executives can provide empirical evidence to support and refine the themes. Another critical avenue for research is the development of industry-specific supplier evaluation models. Since industries such as healthcare, construction, and food production have unique supply chain needs and challenges, tailored frameworks would enhance supplier evaluation criteria' specificity and relevance. Emerging technologies like quantum computing, augmented reality (AR), and digital twins also present new possibilities for transforming supplier evaluation processes. Research into how these technologies can further enhance evaluation precision and decision-making capabilities would offer valuable insights for both academics and practitioners.

Another essential direction for future research is the impact of geopolitical risks on supplier evaluation. Global events like pandemics and trade conflicts have underscored the need for firms to integrate geopolitical risk considerations into supplier evaluation models. Further research could explore strategies for incorporating these risks to enhance supply chain resilience. Cross-functional collaboration frameworks also warrant deeper

exploration, which is pivotal in ensuring holistic and inclusive supplier evaluations. Future studies could examine how organizational culture, leadership, and technology facilitate effective cross-functional collaboration. Finally, as blockchain technology continues to shape supply chain transparency, the research could investigate how firms can leverage blockchain to ensure supplier compliance with ethical labor practices, fair trade standards, and environmental regulations. Such research would allow firms to build more ethical and transparent supply chains, contributing to sustainable development goals.

Call to Action for Researchers and Practitioners

The findings of this study highlight the importance of adopting a holistic approach to supplier evaluation, one that integrates sustainability, risk assessment, technological innovation, and cross-functional collaboration. Researchers are encouraged to build on the themes identified in this study and conduct empirical research that addresses the limitations and advances theoretical frameworks for supplier evaluation.

The call to action is clear for practitioners: embrace comprehensive and data-driven supplier evaluation methods. Companies should leverage AI, blockchain, and big data analytics to enhance supplier transparency, automate evaluations, and achieve predictive insights. Cross-functional collaboration should be prioritized, ensuring procurement, quality control, risk management, and operations teams are actively involved in supplier evaluation. Finally, organizations should view supplier evaluation as not a one-time event but a continuous, dynamic process. Supplier evaluation frameworks must be adaptable and forward-looking as supply chains evolve in response to global disruptions, sustainability demands, and technological change. By adopting these practices, organizations can create more resilient, sustainable, and competitive supply chains that meet the demands of a rapidly changing global landscape.

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