Advances in Consumer Research
https://acr-journal.com/
Volume-3 | Issue-3 | March 2026
Original Researcher Article

Decoding Linkage of Business Intelligence Systems with Organizational Performance of MSMEs in an Uncertain environment

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ABSTRACT
The small and medium enterprises (Micro, Small and Medium Enterprises) is a vital part of the economy of the developed and developing world, as it generates jobs and innovations. Nonetheless, MSMEs tend to be in very uncertain environment with technological disruptors, volatile market, and ever evolving customer tastes. Business Intelligence (BI) systems have become the potent tools that help organizations to convert raw data into actionable information and help them make strategic decisions in such contexts. The purpose of the review paper is to crack the code of the connection between Business Intelligence systems and organizational performance of MSMEs that are working in uncertain environments. The research synthesizes recent publications published in 2021 to 2025 to assess the impact of the BI adoption on strategic decision-making, operational efficiency, competitive advantage, organizational agility, and learning capabilities. The results show that the effectiveness of the BI systems implementation depends on various dimensions, such as strategic alignment, organizational preparedness, technological infrastructure, environmental conditions, and the systematic adoption. All these factors define the extent to which MSMEs can use BI technologies to improve performance and resilience. The research offers a detailed conceptual model that describes the contribution of BI adoption into better performance in organizations in uncertain situations. The results indicate that insights facilitated by BI can help MSMEs to predict risks, streamline activities, and react to changing market environments in advance. The paper will add to the body of existing literature because it offers a combined interpretation of BI adoption and MSME performance as well as provides future research guidelines on digital transformation and data-driven decision-making...
Keywords: Business Intelligence (BI); MSMEs; Organizational Performance; Data-Driven Decision Making; Competitive Advantage; Organizational Agility; Uncertain Business Environment

INTRODUCTION:

Nevertheless, in a time of unprecedented volatility, accelerated technological change, and disruptive economic effects across the globe, Micro, Small and Medium Enterprises (MSMEs) have become a crucial growth engine, source of innovation, and job creation (Cueto et al, 2022). The MSMEs are the pillars of the developed as well as developing economies since they represent more than 90 percent of the total number of businesses in the world and provide up to 60 percent of the total employment globally (Kalaiselvi et al, 2024). They can promote entrepreneurship and encourage inclusive economic development since they are agile, adaptable and close to local markets. Nevertheless, as important as they are, MSMEs are struggling greatly to survive the competitive pressures of the ever-changing unpredictable space that technology and disruption through digital revolutions are contributing to, as well as the changing end consumer demands and geopolitical upheavals. These issues highlight the need to have data-driven decision-making models which are responsive to strategy, operations and resilience. Business Intelligence (BI) systems within this context have become groundbreaking enablers that enable the MSMEs to transform data into actionable insights to invest in evidence-based management and sustainable growth. However, the extent to which BI systems have actual impact on the performance of MSME through uncertainty conditions has not been fully learnt, which is a research gap and is critical and, the proposed study attempts to fill this gap.

1.1 Background of MSMEs and Their Role in National Economies

It is a globally accepted fact that Micro, Small, and Medium Enterprises (MSMEs) form the largest portion of the total number of business setups and number of employments in both the developing and the developed economies (Sinha et al., 2024; Mbandua, 2024; Nor, 2024; Arinzeh, 2022). They play an important role towards innovation, entrepreneurship and inclusive growth as they create jobs, boost local supply chain and enhance industrialization of a region. As the example of the emerging economies such as India, Indonesia, and Nigeria is, MSMEs occupy over 80 percent of the total industrial labor and almost a quarter of the GDP contributions (Fabian and Uchechukwu, 2024). In a comparable vein, the European Union estimates a 99-percent of its businesses to the MSME sector and demonstrates its ubiquitous socio-economic significance. Due to their agility and adaptability, MSMEs can in effect absorb economic shocks and spur sustainable growth, especially during market volatility or policy change (Omowole et al., 2024; Saiful et al., 2025; Susilawati, 2024; Munandar and Witjaksono, 2025). Although they have these benefits, MSMEs tend to work with limited access to finance, skilled workforce, and digital infrastructure, which limits their competitiveness in globalized markets (Hendrawan et al., 2024). Nevertheless, technological democratization and the spread of online platforms have started to change this story, allowing even small companies to compete due to the insight of data and integration of the e-commerce system.The resilience of MSMEs is closely connected with that related to their capabilities to adopt innovation and adjust to disruptive forces. Setiawan et al. (25) note that the development of digital ecosystems has transformed competition parameters, where the focus on physical capital is replaced by the focus on information capital. Smaller businesses that previously could only rely on their intuition and relationships have to make strategic choices using analytics and predictive modelling (Ezeife et al., 2024; Nwoke, 2025; Ridwan, 2025). This shift is in line with the international agenda to inclusive development and sustainable development where MSMEs are essential intermediaries in job creation, poverty alleviation and technological transfer. Nonetheless, these businesses are becoming more vulnerable to uncertainty -whether it be market fluctuations in supply chain and price pressures or regulatory changes. In turn, the tactical implementation of Business Intelligence (BI) has emerged

as one of the crucial means through which MSMEs can improve their efficiency in operations, identify new risks, and maintain a competitive edge. Since MSMEs with dynamic capabilities are more likely to successfully overcome crises because of the digital transformation, as Putritamara et al. (2023) observe, the introduction of business resilience to intelligence-driven management is transformative.

1.2 Significance of Business Intelligence in the Digital Transformation Era

The digital revolution era has significantly altered the competitive logic of a business, shifting the Business Intelligence (BI) to a strategic necessity (Jiménez-Partearroyo and Medina-Lopez, 2024; Ali, 2023; Adewusi et al., 2024; Ridwan, 2025; Dzreke, 2025). BI refers to a collection of analytical methods, technologies, and architectures aimed at transforming raw data into useful insights that can drive the decision-making process within organizations (Adewusi et al., 2024). In the environment of MSMEs BI is an affordable but powerful route to operational efficiency, it assists managers to identify inefficiencies, predict market trends and assess customer behavior. Both the relevance of BI and the importance of real-time monitoring and predictive analysis are both critical to agility and competitiveness in uncertain markets. As Islam, Hossain, and Rahman (2023) discovered, MSMEs that have implemented BI and data analytics report have significantly boosted their performance indicators, which include productivity, innovation, and strategic flexibility. With the help of BI, organizations will be able to utilize both structured and unstructured data in numerous sources that will allow them to make more informed decisions that can be implemented in line with their strategic vision.

Digital transformation has further made BI systems more democratic by lowering cost and technological barriers. Even resource-constrained MSMEs can implement data-driven approaches without the need to invest huge capital in cloud-based BI tools and Software-as-a-Service (SaaS) models. Hoang and Bui (2023) demonstrate that the phases of BI adoption are strongly related to the degree of digital maturity and general transformation direction of a firm. Moreover, the shift between the traditional BI to the adaptive one has changed the business models, especially in the disruptive situation like the COVID-19 epidemic. Akpe et al. (2022) have found that adaptive BI systems have increased the agility of SMEs and their abilities to respond to crises, thus alleviating the impacts of the supply chain disruptions and market declines. BI does not only aid in the decision making but also it serves as a driver of organizational learning as well as innovation. Being able to perceive and react to uncertainty both proactively instead of reactively, which is a change that modern BI systems can facilitate through predictive analytics, machine learning, and artificial intelligence, is a pillar of competitive sustainability in the digital era (Das et al., 2024; Isyaku, 2024; Alhawamdeh et al., 2024).

1.3 Problem Statement: Lack of Clarity on How BI Drives Performance Under Uncertainty

Although the role of BI in improving the performance of firms is increasingly clear, there is still no theoretical and empirical understanding of how BI works under uncertain situations (Chen and Lin, 2021; Yiu et al., 2021; Pancic et al., 2023; Moussas et al., 2024; Seddaoui and Larabi, 2025). The contextual factors facing MSMEs, and especially, their limited digital capacities, the unofficial nature of their decision-making, and the shortage of resources place these enterprises in a distinct position, which tends to blur the channels between the adoption of BI and a tangible increase in performance. Some of these studies report positive changes between BI and financial performance, whereas some display inconsistent or indirect changes, particularly where uncertainty moderates the environment (Singh and Singla, 2024). Uncertainty of the markets, the changing consumer preferences and the changing regulations can reduce predictive capabilities of BI systems unless supported by dynamic capabilities and organizational learning. Hence, there is a research gap on how BI plays the facilitator and mediator role in turbulent business environments.

Furthermore, the limiting effect of the environmental uncertainty and the mediator of digital transformation preparedness are usually disregarded in empirical studies on MSMEs. Mawardi et al. (2025) emphasize that digital transformation and dynamic capabilities enhance the ability to resist uncertainty, and their combination with BI adoption has not been studied. This inconsistency in connecting BI literature and uncertainty theory hinders the creation of a consistent framework of explaining performance difference across MSMEs. Moreover, not all BI implementations fail because of the lack of technology in the way of the success but because of human and cultural factors; insufficient training, illiteracy of data and resistance to change. The accuracy of BI in uncertain situations, as set out by Setiawan et al. (2025) is determined by the match between the analytical capacity with the adjustability and adaptability of the organization and the decision-making agility. This paper is therefore designed to unravel the relationship between BI systems and organizational performance of MSMEs and how the relationship is moderated by uncertainty. The study has gained theoretical as well as practical implications in promoting the success of MSMEs that want to survive in volatile environments by explicating this mechanism.

2. Literature Review Methodology

This study takes a literature review method to review the available literature on the topic of the correlation between Business Intelligence (BI) systems and organizational performance of Micro, Small, and Medium Enterprises (MSMEs) in uncertain market conditions. The aim of this methodology is to combatively find and synthesize pertinent academic research regarding the adoption of BI, digital transformation and performance outcomes. The keywords used to retrieve the relevant literature in the major academic databases that included Scopus, Web of Science, ScienceDirect, and Google Scholar covered Business Intelligence, BI adoption, MSMEs, organizational performance, and digital transformation. The review was restricted to peer-reviewed articles published during 2021-2025 so that the latest trends in BI technologies and their use in SMEs could be captured. The articles were filtered using their relevance to the topic of BI adoption and MSME performance, and irrelevant or non-academic materials were filtered. The chosen articles were further examined and classified into important themes including technological factors, organizational preparedness, environmental influences and performance results. This thematic analysis assisted in pointing out research gaps and formed the conceptual framework included in this research.

3. Literature review

Widhiastuti et al. (2025) investigated the importance of business intelligence to small and medium-sized enterprises (SMEs) in improving financial performance with a focus on the moderating effect of financial ambidexterity. A survey of 233 Central Java SME managers in Indonesia found out that business intelligence has a significant positive influence on financial performance (0.655, $p = 0.044$). The mediating effect of financial ambidexterity (0.531, $p = 0.018$) was also confirmed. Moreover, financial resources, particularly, financial availability (0.243, $p = 0.000$), financial information quality (0.335, $p = 0.016$) and financial access (0.768, $p = 0.025$) had a great impact on business intelligence adoption. The results highlighted the relevancy of business intelligence and finances in enhancing SME financial performance.

Yang et al. (2025) Business Intelligence Adoption (BIA) was being implemented in various organizations across the globe, especially in the developing economies like China that still was to adopt it. The paper examined the implications of BIA in the performance of Chinese commercial banks with references to the functions of Customer Relationship Management (CRM) and Risk Assessment (RA) and the impact of Knowledge Management (KM) on BIA and Organizational Performance (OP). The study followed the Technology-organization-environment (TOE) model and the

Dynamic Capabilities Theory to develop a study based on the analysis of 564 questionnaires with the use of Partial Least Squares Structural Equation Modeling (PLS-SEM). The results showed that BIA had a significant impact on improving the performance of the bank in terms of CRM and RA. Efficient KM systems were used in the implementation of BIA, where KM had both direct and indirect impact on OP. KM played a critical role in the success of BIA despite the institutional issues of knowledge sharing. The research created new knowledge on how digital transformation could be practiced in the Chinese banking industry and it proposed the integration of technology, culture, and governance to find the best use of BIA.

Molina-Abril et al. (2025) examined the competition surrounding small and medium-sized enterprises (SMEs), and resilience and data-driven decision-making were important in these situations. Even though artificial intelligence (AI), machine learning (ML), and optimization methods could provide significant advantages, SMEs experienced barriers to its adoption in form of expenses, training, and access to hardware. The analysis involved the use of heuristics and metaheuristics as well as ML and hybrid techniques by SMEs in strategic decision-making in times of uncertainty. Bibliometric mapping allowed grouping 82 works of crucial interest into 11 areas of theme, and a useful framework of optimization strategies compelling the parameters of SMEs was obtained. It was found that the key areas of application, obstacles to adoption, and success factors are essential, and heuristics and hybrid methods are effective in multi-objective optimization. The study demonstrated the gaps and proposed the future directions of digital transformation in SMEs.

Champa et al. (2025) evaluated how Artificial Intelligence (AI) and Business Intelligence (BI) can be used to improve operational performance in the manufacturing industry. The paper has emphasized the potential of AI in changing the strategic decision-making process, enhancing the working process, and adding more value. The main issues examined were the role of AI in efficiency of manufacturing, intelligent systems, the integration of a BI, and the use of predictive and prescriptive analytics. In the paper, the intersection of AI with machine learning and advanced analytics was presented especially when optimizing processes and ensuring quality. It accentuated the importance of ethical AI adoption as the strategy of competitiveness and agility and suggested the models of integrating AI with organizational objectives and described the perspectives of the research in the future.

Fabian et al. (2024) discovered that the robust business intelligence strategy provided an improved level of data accuracy and faster reporting to a business operator, which helped them to make decisions faster. The unstructured questionnaires were used to undertake a qualitative study of six participants in Africa who were MSMEs. The data analyzed showed that there were two major categories namely competitive advantage and operational efficiency. The results highlighted that business intelligence played an important role in making timely decisions in the MSME sector of Nigeria to assist owner-managers to survive in a difficult business environment. The paper further indicated that MSMEs and technology needed to be incorporated into government policies in order to stimulate foreign investment.

Tanvir et al. (2024) investigated the way organizations used Data Analytics, Business Intelligence, and Performance Management to enhance the process of strategic marketing decision-making in a data-driven business world. A quantitative study reviewed the data of 300 professionals in the Telecom and Real Estate sectors and found out that there is a significant positive correlation between these factors and the effectiveness of their decisions. Data Analytics was the most powerful factor, as it gives the understanding of market trends, and consumer behavior. Business Intelligence made reporting and campaigns more efficient, and Performance Management made sure that there was a connection between the marketing and the goals of the organization.

Nandez et al. (2024) examined the correlation of entrepreneurial skills, market and sales orientation, business networks and the performance of the micro, small and medium enterprises (MSMEs) in Nigeria. The data were collected and analyzed using regression and mediation techniques using a quantitative research design by using structured questionnaires. The results indicated that the competencies of the entrepreneurship, market, and sales orientation had a direct and indirect positive effect on the performance of the firm with entrepreneurial competence being a key mediating variable. The article has demonstrated how challenging the performance of MSMEs is and how entrepreneurial competencies are crucial to its growth and longevity.

Al-Dosari et al. (2023) highlighted the standards of the information technology (IT) security systems were constantly improved following the changes in the technical sphere. The research found weaknesses in the current use of IT risk-management models in companies that have embraced new technologies, especially among the SMEs. A review of literature carried out between 2016 and 2021 showed that common frameworks, like NIST, were not flexible enough and too abstract to be used by SMEs. The study highlighted the necessity to transform the following frameworks by integrating the most advanced methodologies such as system dynamics, machine learning, and technoeconomic models to improve SME IT security levels.

Al-Matari et al. (2022) examined the business value of dynamic accounting information system (DAIS) to determine the role of business process capabilities in mediating the association between dynamic AIS capability and organizational resilience. Results of the survey on 144 of the matched questionnaires of large Malaysian firms have shown that the dynamic AIS capability determined the resilience by way of business process capabilities. The authors found evidence of Resource-Based Theory and dynamic capabilities perspective, which showed that flexible systems, complementary business intelligence, and human resource competency played a significant role in increasing organizational resilience.

Arabeche et al. (2022) the authors studied the mediating nature of organizational culture between entrepreneurial orientation (EO) and business performance in Algerian manufacturing SMEs. The study used Partial Least Squares Structural Equation Modeling (PLS-SEM), which is based on sample of 180 SME owners and managers. The findings indicated that, EO had a significant impact on organizational culture that moderately impacted on business performance. EO and organizational culture collectively accounted a significant part of the variance in both business performance and organizational culture, which contributes to the development of theoretical knowledge and practical implications of enhancing the performance of SME in North Africa.

Sanil et al. (2021) reported the use of machine learning (ML) emerged as a consistent topic in the business environment, which advances the extent of scalability and functioning due to the adoption of enormous amounts of data created through software integration. The paper observed that the COVID-19 virus increased the pace of ML developments, which are motivated by the emergence of competitive technologies. A report by Accenture Institute predicted that AI could have a potential of doubling the growth rates of the developed economies by 2035. The confluence between AI and big data analytics was found as one of the most important stimuli in the development of ML that will set intelligent systems to surpass human abilities in certain areas.

Comparison Table 1: Business Intelligence and SME Performance Studies (2021–2025)

Author(s) & Year	Focus / Objective	Methodology	Key Findings	Implications
Widhiastuti et al. (2025)	Examines BI's impact on SMEs' financial performance with financial ambidexterity as a mediator and financial resources as enablers.	Quantitative; survey of 233 SME managers in Indonesia; Smart PLS 3 analyses.	BI significantly improves financial performance (β = 0.655, p = 0.044); financial ambidexterity mediates this relationship.	Financial resources and BI adoption are critical for SME competitiveness under uncertainty.
Yang et al. (2025)	Analyzes the mediating role of CRM and risk assessment between BI adoption and organizational performance in Chinese banks, emphasizing knowledge management's impact.	Quantitative; 564 valid surveys from Chinese banks; PLS-SEM under TOE framework.	BI enhances performance via CRM and risk assessment; KM strongly influences BI adoption and organizational learning.	Integrating KM, BI, and CRM enhances digital transformation and operational effectiveness.
Molina-Abril et al. (2025)	Reviews AI, ML, and optimization adoption in SMEs, offering a framework for data-driven decision-making under resource constraints.	Systematic literature review and bibliometric mapping (UMAP, BERTopic) of 82 studies.	AI and hybrid models support SME resilience and strategy; heuristics aid low-cost optimization.	Encourages adoption of accessible AI/ML tools for SME optimization and resilience.
Champa et al. (2025)	Explores AI–BI integration in manufacturing to enhance operational performance and decision-making through predictive analytics.	Comprehensive review and synthesis of AI–BI convergence literature in manufacturing.	AI integrated with BI boosts efficiency and predictive capabilities; ethics crucial for sustainable adoption.	Promotes responsible AI–BI integration for sustainable manufacturing competitiveness.
Fabian et al. (2024)	Investigates BI's role in decision-making within African MSMEs, highlighting competitive advantage and operational efficiency.	Qualitative; unstructured questionnaire and thematic analysis with six MSME participants in Nigeria.	BI enables timely decisions and enhances efficiency; key to MSME competitiveness in Nigeria.	Advocates BI adoption for African MSME policy and technological inclusion.
Tanvir et al. (2024)	Examines the impact of BI, data analytics, and performance management on strategic marketing decision-making.	Quantitative; 300 professionals from multiple sectors using structured questionnaires and statistical analysis.	BI and analytics enhance strategic marketing performance; data analytics most influential factor.	Encourages businesses to align BI and analytics with strategic marketing objectives.
Nandez et al. (2024)	Studies relationships between entrepreneurial skills, market orientation, and MSME performance, mediated by entrepreneurial competence.	Quantitative; structured questionnaires, multiple regression, and mediation analysis (Baron & Kenny method).	Entrepreneurial competence mediates MSME performance, linking market orientation and skills to outcomes.	Stresses importance of developing entrepreneurial skills for MSME success.
AL-Dosari et al. (2023)	Assesses IT risk management frameworks for SMEs and calls for dynamic, adaptive models to address technological changes.	Systematic literature review (2016–2021) on IT risk management frameworks for SMEs.	Static IT frameworks inadequate; proposes dynamic, ML-informed IT risk management models.	Recommends adaptive, technology-driven risk management for SMEs.
Al-Matari et al. (2022)	Explores how dynamic accounting information systems (AIS) and BI enhance organizational	Quantitative; 144 matched surveys from Malaysian firms using PLS-SEM.	Dynamic AIS and BI capabilities improve resilience via process adaptability; supports	Highlights integration of BI and AIS to boost organizational agility and resilience.

	resilience via process capabilities.		RBT and DCV frameworks.	
Arabeche et al. (2022)	Examines entrepreneurial orientation, organizational culture, and SME performance, showing culture's mediating role in Algeria.	Quantitative; 180 Algerian SME owners; PLS-SEM to test mediation of culture between EO and performance.	Entrepreneurial orientation affects performance through organizational culture; EO explains 38.9% of variance in culture.	Emphasizes fostering organizational culture to enhance EO's effect on SME performance.
Sanil et al. (2021)	Reviews ML and AI use in business operations and analytics for scalability, automation, and competitive advantage.	Literature review of global ML/AI applications.	ML enhances decision-making, efficiency, and business scalability; AI drives economic growth and innovation.	Calls for broader AI/ML adoption to maintain global competitiveness and innovation.

3.1 Research Gap

Although Business Intelligence (BI) and digital transformation have built a lot of literature, there are still research gaps on the relationship between the BI systems and organizational performance of MSMEs especially in uncertain business environments. First, most of the existing literature mainly deals with large organisations or even within a particular sector like banking and manufacturing and little has been done to deal with MSMEs. The fact that MSMEs work with limited resources and not formal decision-making processes means that the ways in which BI has an effect on their performance will not necessarily be the same as those of large businesses. Second, most of the previous research has been focused on BI adoption using a perspective, e.g. the technological readiness or organizational capability, without bringing the factors of strategic, technological, environmental and adoption process into a holistic framework. Such a disjointed strategy restricts the realization of the overall impacts of various variables on BI adoption and its results. Third, the moderation of environmental uncertainty has not been appropriately studied. The new dynamism in technology, market shocks and disruptions in the global market necessitate agile and data-driven decision making by the MSMEs but the literature lacks insight on how the BI systems can aid in resilience and adaptability in such circumstances. Moreover, most empirical research pays its attention to direct correlation between BI adoption and performance without considering mediating or enabling factors e.g. organization culture, leadership support, and knowledge management. Consequently, a thorough conceptual frame needs to be developed that unites these dimensions and how BI adoption can result in improved organizational performance in MSMEs that operate in uncertain environments.

4. Identification of Factors, Questionnaire Development, and Model Construction

The business intelligence (BI) adoption determinants and the resulting effect on the performance of micro, small and medium enterprises (MSMEs) were initially determined by conducting an extensive literature review. Based on these listed determinants, a questionnaire design was drawn up that would draw empirical data among managers and owners of MSMEs. The items in the questionnaire were developed using a Likert -type of scale in order to measure important constructs, such as strategic alignment, organizational readiness, technological capability, environmental pressure, and BI adoption practices. The gathered answers were subject to statistical methods that were used to investigate the relationship to exist between the variables. The measurement constructs were tested by undertaking factor analysis and to gain further statistical tests to isolate the important determinants of BI adoption. As a result, it was proposed that creates a conceptual model that outlines the relationship between the specified dimensions, the adoption of BI systems, and the performance outcomes of MSMEs that work in the context of uncertain environmental conditions.

The developed conceptual model was tested on the empirical level based on the data collected with the help of the above-mentioned questionnaire that was provided to respondents who represented a wide spectrum of companies and operational settings. The measurement instrument was used to measure the core constructs that affected adoption of Business Information Systems (BIS): strategic, organizational, technological, adoption-process, and environmental. The dataset was examined using descriptive statistics and regression analysis in order to test the relationships between the independent variables and the BIS adoption. The results showed that there were statistically significant relationships between adoption- process factors, strategic factors, organizational factors and technological factors and BIS adoption, but they had low explanatory power. On the other hand, the environmental factors did not statistically show a positive connection with BIS adoption. These findings suggest that the influence of internal organizational and technological preparedness has a stronger impact on the adoption of BIS and is stronger than the impact of external conditions of the environment. In line with this, the statistical data supports the suggested concept framework, explicating the relationships between the identified variables and BIS adoption and, thus, providing empirical information on the influence of determinants of Business Intelligence system adoption in the organizational context.

Table 2: Summary of Regression Results for BIS Adoption Model

Hypothesis	Independent Variable	β (Beta)	t-value	p-value	Result
H_1	Adoption Process Factors → BIS Adoption	-0.248	-2.779	0.006	Supported
H_2	Strategic Factors → BIS Adoption	-0.205	-2.279	0.024	Supported
H_3	Organizational Factors → BIS Adoption	-0.186	-2.058	0.042	Supported
H_4	Technological Factors → BIS Adoption	-0.221	-2.459	0.015	Supported

H_5	Environmental Factors → BIS Adoption	-0.176	-1.947	0.054	Not Supported

The outcomes of the regression analysis give empirical data on the variables that affect Business Information System (BIS) adoption. According to the model findings, the factors of adoption process (-0.248, p = 0.006) have a statistically significant relationship with BIS adoption, which implies that the processes of BIS adoption implementation and administration are significant in predetermining the success of the system adoption. Likewise, strategic factors (= -0.205, p = 0.024) also indicate a strong relationship between BIS adoption and strategic factors, which implies that harmonization of BIS initiatives with organizational strategy has an effect on the process of adoption. Organizational factors (0.042 = -0.186, p = 0.042) also show that the effect is significant and tend to pay attention to the availability of resources, management support, and internal readiness of the organization. In addition, technological variables (= -0.221, p = 0.015) are also important in affecting BIS adoption, which also points to the importance of technological infrastructure, system compatibility, and data management capabilities. Nevertheless, environmental factors (β = -0.176, p = 0.054) do not have a statistically significant relationship with BIS adoption at 5% level of significance. In general, the findings can be interpreted to imply that the role of internal organizational and technological influences on the BIS adoption is more critical than the role of external environmental influences. These results can be utilized to support the conceptual model that was proposed and supplement the explanation of the determinants of BIS adoption in organizations.

In general, most of the hypothesized associations are substantiated by the statistical analysis, which suggests that the proposed conceptual model can be used to provide sufficient explanations of factors that contribute to the adoption of BIS. Thus, the paper uses the model as an analytical tool in explaining the factors that determine the adoption of Business Information System.

5. Proposed Conceptual Model

This study presents a conceptual framework that describes the connection between Business Intelligence System (BIS) adoption and organizational performance of MSMEs in an uncertain environment based on the knowledge gained on the literature review (Alsibhawi **et al.**, 2023). It has been proposed in the model that good implementation of BI systems depends on five major dimensions namely strategic, organizational, technological, environmental, and adoption process dimensions (Ahmad **et al.**, 2020). All these dimensions identify the effectiveness with which the MSMEs can adopt the BI systems and use them to enhance performance outcomes and decision-making processes (Zheng & Khalid, 2022).

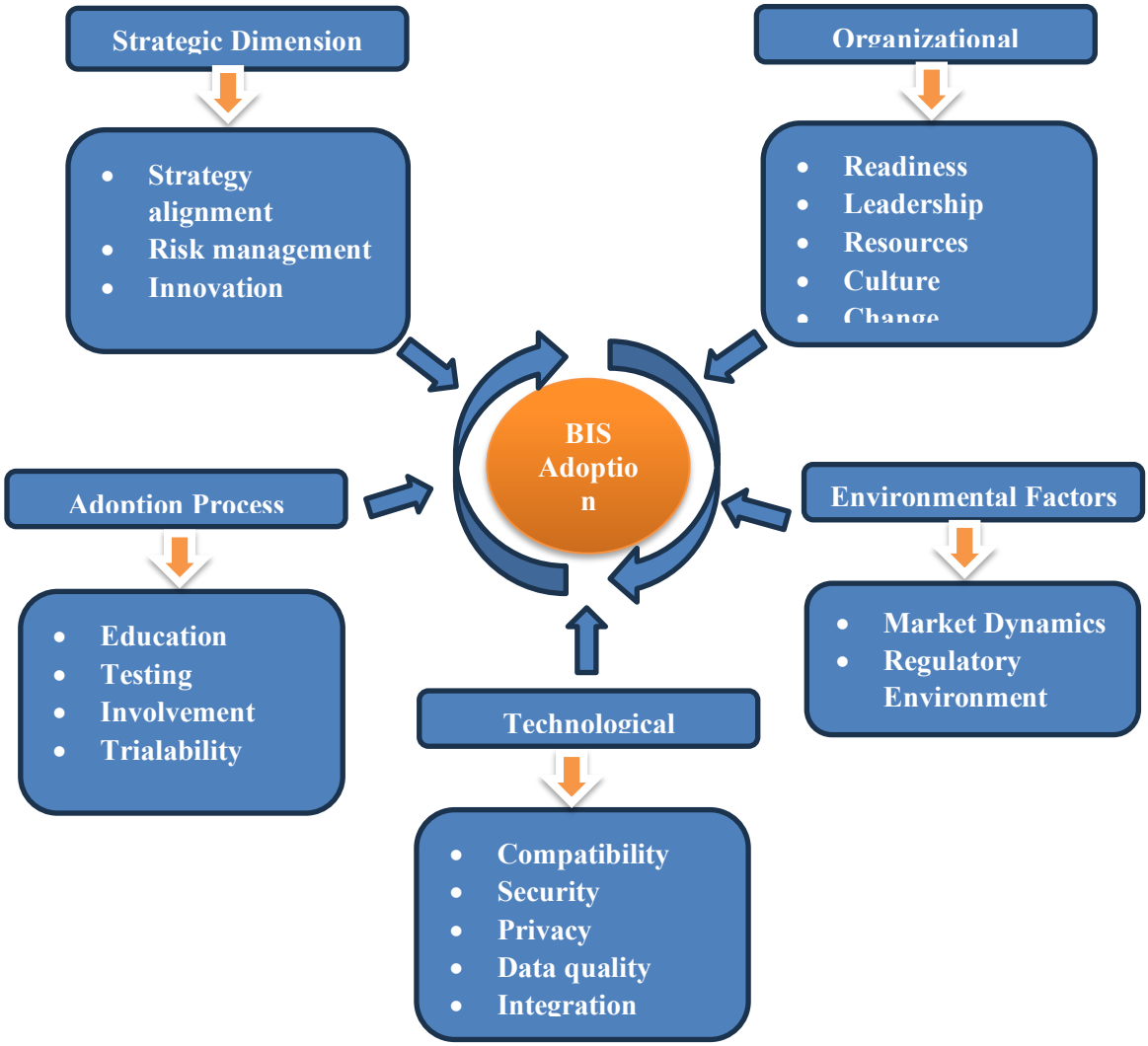

Figure 1: Conceptual Model

5.1 Strategic Dimension

The strategic aspect is the correspondence between the BI initiatives and the long-term objectives and the competitive strategies of an organization (Jiménez-Partearroyo & Medina-López, 2024). Strategic alignment is so that BI systems will serve business goals like expansion of the market, efficiency of operations, and innovation. In MSMEs, strategic orientation is especially significant since due to the scarce resources, technological investments have to be prioritized carefully (Ilmudeen et al., 2019). Once the BI programs are synchronized with the business strategies, organizations are able to make effective use of analyticals findings to be used in decision-making and the development of competitive advantage.The strategic dimension is also an important element of risk management (Al Shawabkeh, 2024). BI systems allow organizations to track the trends on the market, identify the possible risk and predict the uncertainty by analytics. Early risk identification helps MSMEs to create proactive measures aimed at reducing financial, operational, and related market risks. Also, the strategic aspect has innovation capability as a significant part (Fuertes et al., 2020). Companies, which promote innovation, would find it easier to experiment with best-advanced data analytics tools and introduce BI systems into their business processes, which will enhance their strategic agility.

5.2 Organizational Dimension

Organizational dimension looks at the internal competencies and resources that define the willingness of MSMEs to adopt and use BI systems (Hoang & Bui, 2023). One of the most significant forces affecting the BI adoption is leadership commitment. Leaders, who promote the use of digital transformation, may formulate an idea of data-driven decision-making and inspire their staff to adopt new technologies (Salisu et al., 2021). Leadership support also guarantees that there is proper allocation of resources to the implementation of BI both financially and in terms of human resource (Ahmad et al., 2020).Another critical issue in the organizational dimension is the availability of resources. MSMEs usually have some limitations with respect to financial capital, expertise, and infrastructure (Zheng & Khalid, 2022). The presence of qualified workers and technology have a big impact on the success of implementing BI systems. In addition, the organizational culture is important in promoting the application of data analytics in managerial decisions. It may be possible to embrace and utilize BI tools with the help of a culture that supports learning, innovation, and collaboration. BI adoption is also not possible without readiness to change. The introduction of new technologies frequently necessitates organizational changes in terms of the organization processes and the functions of employees (Triandini et al., 2023). Companies that succeed in managing change processes successfully with the help of training, communication, and involvement of employees are better placed to have successful BI implementation.

5.3 Technological Dimension

Technological dimension entails technical attributes and functionality of BI systems that determine their efficiency. Fit with the current information systems is another consideration, since BI tools should be able to fit well with organization databases, enterprise resource planning systems and other digital platforms (Trieu, 2023). Great compatibility minimizes difficulties in implementation and increases the efficiency of the system. Another important technological aspect is data quality. There needs to be dependable and precise data to create valuable insights with the help of BI systems (Al-Okaily et al., 2023). Low quality data may result in wrong analysis, and wrong decision-making. Consequently, companies should institute viable data management habits in order to achieve quality and reliability of data. Security and the privacy are also of main concern in the adoption of BI technologies. Given that BI systems handle a lot of sensitive organisational data, security systems need strong security measures in order to guard against access by unauthorized persons or even cyber-attacks (Gonzales & Wareham, 2019). Also, the ability to integrate systems allows BI platforms to communicate with various sources of data and give an in-depth understanding of it, which enhances organizational performance and effectiveness to make decisions (Solano & Cruz, 2024).

5.4 Environmental Dimension

The environmental dimension is the external factors defining the adoption and use of Business Intelligence (BI) systems by Micro, Small, and Medium Enterprises (MSMEs) (Hoang & Bui, 2023). The current markets are highly competitive and the organizations operating in these competitive markets experience mounting pressure due to the changing customer preferences, technological changes, and increased competition (Salisu et al., 2021). These extrinsic influences stimulate the use of data-driven tools that can help MSMEs to keep track of the market trends and address the challenges of the market competition in a strategic manner. BI systems are critical in the analysis of huge amounts of market data, customer behavioral patterns, and future trends (Zheng & Khalid, 2022). Real-time analytics and performance monitoring allow firms to gain a better insight into the dynamics in the industry and change their strategies accordingly. The implementation of BI technologies, in turn, increases the responsiveness of MSMEs to the strategy and helps them to stay in the competitive environment of changing markets (Alsibhawi et al., 2023).Besides market forces, regulation structures and government policies also play a significant role in BI adoption (Ahmad et al., 2020). Various governments across the developing economies have presented digital transformation efforts, monetary incentives and technology assistance packages to inspire the digitalization of MSMEs. Such initiatives usually cover cloud computing, digital infrastructure, and data analytics tools, which are used to implement BI systems (Stjepić et al., 2019). Meanwhile, such regulatory provisions as data protection laws and cybersecurity standards also influence the ways organizations handle and use business data. Economic volatility, global supply chain disruption, and geopolitical instability are also considered as a source of environmental uncertainty that would augment the significance of timely and accurate information (Anoke, 2024). It is in these contexts that BI systems enable the MSMEs to minimize uncertainty through proactive decision-making, better risk management, and enhancing organizational resilience in fast paced changing business environments.

5.5 Adoption Process Dimension

The dimension of adoption process is devoted to the systematic phases of the implementation and integration of Business Intelligence (BI) systems in the companies (Salisu et al., 2021). To implement BI successfully, knowledge of technology is not enough but the organizational learning and involvement of the employees. Training and education are essential in this process, since they assist the employees to be familiar with the functionality, advantages, and strategic importance of BI technologies (Al-Daraba et al., 2025). Organizations can improve the analytical abilities of the employees and develop a culture of using data to make sound decisions through systematic training programs and workshops (Fu et al., 2022). These efforts can decrease the level of technological resistance and enhance the confidence of the users in the efficient application of the BI tools. Furthermore, informed workers are more apt to incorporate in their day-to-day operation and strategy activities using BI knowledge, which enhances efficiency of the organization at large (Jaradat et al., 2024).The other important aspects of the process of adoption are testing and pilot implementation. Through pilot projects or trial implementations, organisations can test the performance and compatibility of BI systems and then implement it on a full-scale basis (Ul-Ain et al., 2019). Such a strategy will help companies to recognize technical issues, optimize environment changes and make sure that the BI system meets the requirements of an organization. Moreover, the process of engaging employees to work on the implementation process helps to develop a sense of ownership and promotes the active engagement in the technology

adoption. Trialability, which means a chance to test the usage of BI tools on a small scale, also boosts trust in the system by eliminating doubts and perceived risks (Hoang & Bui, 2023). Therefore, properly planned adoption process will make the BI implementation less problematic and will maximize the chances of attaining sustainable benefits to the organization (Ranjbarfard, 2020).

5.6 Business Intelligence System Adoption and Organizational Performance

Business Intelligence System (BIS) adoption is put at the core of the proposed conceptual framework, as it signifies the successful combination and application of BI technologies in the decision-making of organizational functions (Alsibhawi et al., 2023). In the case of MSMEs, adopting BI systems will offer the company a chance to change vast amounts of unstructured and disorganized data into valuable and usable insights. The insights will help the managers make strategic and operational decisions that are informed to improve efficiency and competitiveness in the organization (Ahmad et al., 2020). Through data analytics, reporting and predictive models, BI systems enable organizations to discover trends, measure performance parameters, and track significant business operations in real time. This feature helps greatly in the quality of decision-making as it minimizes the use of intuition to make decisions and allows evidence-based management (Alnawafleh et al., 2024). Besides, BI adoption enables MSMEs to make optimal use of resources, rationalize operations, and define inefficiencies in processes. Consequently, organizations can be in a position to increase their productivity levels, better service delivery and come up with innovative solutions that can reinforce their competitive stand in the fast-changing markets.Moreover, the implementation of BI systems has a vital part to play in increasing the performance of the organization especially in environments that are uncertain and volatile. The dynamic nature of markets which MSMEs in many cases operate within presents a major challenge towards sustainable growth due to the presence of economic changes and technological upheavals as well as evolving customer needs

(Zheng & Khalid, 2022). At these levels, BI technologies will offer the ability of analysis that will help firms predict possible risks, study the market trends, and react promptly to the emerging opportunities. BI systems foster the agility of decisions and the dynamism of strategies through high-quality data visualizations, prediction mechanisms, and real-time analytics (Jaradat et al., 2024). Along with that, BI integration with digital technologies including cloud computing, artificial intelligence, and machine learning also boost the level of analytical power that is offered to organizations. With this kind of integration, MSMEs can be able to understand more about customer behavior, market dynamics and performance (Popovič et al., 2019). As a result, successful BI implementation does not only make organizational resilient but also leads to long-term sustainability as MSMEs are able to adjust to unpredictable conditions and remain operational and strategically competitive.

6. Discussion

The literature review results suggest that Business Intelligence (BI) systems are now a mandatory part of the current organizational strategy, especially in case of MSMEs working in unstable environments. BI technologies allow companies to convert raw data into insights that facilitate the creation of information helping to make crucial decisions and operate efficiently. With the combination of BI tools and the business processes, MSMEs will be able to be more strategic and better adjusted to the new market conditions. The discussion brings into focus the effects of BI adoption on a number of the crucial dimensions of organizational performance.

6.1 BI and Strategic Decision-Making

Business Intelligence (BI) systems are known to enhance strategic decision making in MSMEs as it allows managers to view past and current information. Data visualization tools, dashboards, and predictive analytics will help organizations to identify trends in the market, assess their business activities, and foresee any risks. Such a data-driven methodology will decrease the use of intuition and evidence-based strategic planning. BI systems enable MSMEs to adjust their strategic goals to the market dynamics and competitive forces. Consequently, companies are able to make better decisions on products development, market penetration and resource allocation and eventually enhance their long term strategic competitiveness and enhance their responsiveness to unpredictable business environments.

6.2 BI and Operational Efficiency

BI systems are significant in enhancing the efficiency of the operations through offering information on business processes and performance indicators. By constantly tracking and using analytics in real time, the organizations will be able to determine what is working inefficiently, where waste is occurring, and how to better spend the resources. BI tools can assist MSMEs to monitor the production activity, supply chain activity and customer service performance. These understandings help managers to identify bottlenecks at a very fast rate and take corrective actions. Therefore, BI implementation results in better workflow management, cost-saving and the increase in the level of productivity. BI systems help in increasing the level of transparency in operations and optimization of processes thus increasing the overall efficiency and effectiveness of operations of the MSME.

6.3 BI and Competitive Advantage

The implementation of BI systems can help MSMEs gain competitive edge as it can give better understanding of customer tastes, trend in the market and activities of competitors. BI tools enable organizations to process customer larger data and pinpoint new opportunities, as well as develop specific marketing strategies. This is made possible through the ability of MSMEs to be innovative in coming up with products and services that respond to the evolving customer demands. Also, insights provided by BI are able to enable quicker and more knowledgeable decision-making, allowing companies to react fast to market shifts. Consequently, companies that successfully deploy BI technologies will be able to stand out among the others and improve their market competitiveness, which will eventually contribute to their competitive advantage.

6.4 BI and Organizational Agility

Organizational agility is the capacity of the firms to respond to changes occurring in the business environment promptly. BI systems contribute to agility by enabling an organization to have real-time information and analytical insights that are used in responding quickly to market fluctuations, technological changes and changing customer demands. BI tools will enable MSMEs to track external trends and internal performance indicators at the same time. This is enabled where the managers will be able to alter strategies, operations, and resource allocation in a more efficient manner. BI adoption helps an organization to become more flexible and resilient by accelerating and ensuring the quality of a decision and allows MSMEs to survive and expand even when business conditions are unpredictable and extremely dynamic.

6.5 BI and Organizational Learning

BI systems help in organizational learning as they foster the culture of knowledge sharing through data and constant improvement. Employees deal with BI tools and analytical reports regularly thus they are better analytical and have a more in-depth perception of the business operations. BI systems are also useful in collecting and examining knowledge within the organization and in the process, the firm is able to spot patterns, compare previous decisions, and enhance future planning. This is an ongoing learning process that strengthens innovation, knowledge of solving problems, and adaptation to the organization. Consequently, MSMEs which effectively incorporate the use of BI systems in decision-making processes are capable of enhancing their learning capabilities and

ensure long-term organizational growth and performance.

7. Future Research Directions

Even though this paper offers a rich conceptual insight into the impact of Business Intelligence (BI) system on the organizational performance of MSMEs operating in uncertain environments, there are several areas where future studies can be conducted. To begin with, empirical research is needed, which would help to support the suggested conceptual framework and study the connection between the strategic, organizational, technological, environmental, and adoption process variables affecting the BI adoption. To test relationships hypothesized on the use of advanced quantitative methods like Structural Equation Modeling (SEM) or Partial Least Squares Structural Equation Modeling (PLS-SEM) to be used by different researchers to verify the relation across various industries and geographical settings. This empirical validation would make the theoretical basis of the BI adoption models more robust and create more solid evidence of how BI systems affect the performance of MSMEs.Second, it is necessary to conduct the research in the future that investigates how the emerging digital technologies can be integrated with the traditional Business Intelligence systems. The artificial intelligence, the machine learning, the big data analytics, and the cloud computing technologies could provide a substantial improvement in predictive and analytical characteristics of BI systems. Exploring the interaction between these technologies and BI systems can be used to gain more information about how MSMEs may use advanced analytics to make strategic decisions and achieve competitive advantage. Furthermore, the comparison of studies conducted in developed and developing economies would aid in determining the role that institutional contexts, digital infrastructure, and governmental policies play in BI adoption among MSMEs.Lastly, the study ought to be extended to behavioral and organizational issues that influence effective execution of BI systems in future studies. Leadership style, organizational culture, employee engagement, and digital literacy are variables that might have a substantial impact on the effectiveness of BI adoption. It would also be interesting to conduct longitudinal studies to trace the way in which BI capabilities change over time and lead to organizational resilience in case of economic crisis. The proposed research would shed more light on how MSMEs can work towards sustainable and data-driven strategies to overcome uncertainty and deliver long-term organizational performance.

Conclusion

With the growing unstable and technologically oriented global economy, Micro, Small and Medium Enterprises (MSME) need to be creative and data-driven to stay viable and competitive. This review paper discussed the relationship between Business Intelligence (BI) systems and organizational performance of the MSMEs that are in the uncertain environment. The research was an integration of recent literature to gain insights into the rate at which BI technologies can be used to assist in strategic decision-making and operational efficiency and organizational adaptability. The results reveal that BI systems can help MSMEs to turn high amounts of unstructured data into valuable information, which can be used by management to make decisions and help businesses to perform better. The BI tools enable organizations to determine market opportunities, foresee threats, and adapt properly to the changing market environment through the use of advanced analytics and predictive modeling combined with real-time monitoring capabilities. Moreover, several dimensions are interrelated, such as strategic alignment, organizational readiness, technological infrastructures, environmental pressures, and organized adoption processes in the adoption of BI systems. All these factors result in effectiveness of BI implementation and its influence on the organizational outcomes. The review further notes that the adoption of BI enhances the agility of organizations, encourages an organization to engage in continuous learning, and allows MSMEs to build competitive advantages in fast evolving markets. On a more negative note, there are a number of challenges that may impede the successful implementation of BI among MSMEs, which are financial scarcity, absence of technical skills, and aversion towards change in technology. As such, organizations need to invest in both digital capabilities as well as trainings of their employees and supportive leadership in order to maximize the potential of BI systems. In general, this paper is the addition to the existing literature because it helps to gain an in-depth insight into the impact of BI adoption on the performance of MSME in conditions of uncertainty. The new study can be conducted in the future with the aim of empirical confirmation of the suggested framework and investigation of the place of new technologies, including artificial intelligence and big data analytics, in improving the ability of BI and resilience of organisations

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