Antecedents of Business Intelligence Systems Adoption in MSMEs: A Quantitative Empirical Examination Utilizing Survey Instrumentation and Multivariate Data Analysis Techniques

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Abstract

In the rapidly evolving digital economy, business intelligence systems (BIS) have become critical tools for enhancing strategic agility, operational efficiency, and data-driven decision-making. Micro, small, and medium-sized businesses (MSMEs) in India still face several obstacles, especially those resulting from strategy and technological uncertainties, even if major organizations have embraced BIS extensively. This study seeks to develop and empirically test a comprehensive framework that identifies the key determinants influencing BIS adoption among Indian MSMEs, with a special focus on these uncertainties. Employing a quantitative research design, primary data were collected through structured questionnaires from 120 professionals across various industry sectors. Analytical methods included descriptive statistics, chi-square tests, and multiple regression analysis to examine the relationship between BIS adoption and five independent variables: adoption process factors, strategic factors, organizational factors, technological factors, and environmental factors. The results reveal that four factors—adoption process complexity, strategic misalignment, lack of organizational readiness, and low technological compatibility negatively and significantly impact BIS adoption. Conversely, environmental factors were not found to have a statistically significant effect. These findings highlight the predominance of internal challenges over external conditions in shaping BIS adoption decisions under uncertainty. This research adds to the academic discussion by combining strategic and technological uncertainty into current BIS adoption models, creating a useful framework for Indian MSMEs. The study also provides actionable insights for policymakers, technology vendors, and MSME leaders to support more resilient and strategically aligned digital transformation initiatives.

Keywords: Business Intelligence Systems, MSME adoption, strategic uncertainty, technological uncertainty, digital transformation, quantitative research, adoption framework

1. Introduction

Business Intelligence Systems (BIS) have become essential tools for companies looking to improve decision-making, operational efficiency, and competitiveness in the quickly changing world of digital transformation [1, 2]. Businesses may gather, combine, evaluate, and display data using BIS to make better operational and strategic choices [3]. Big businesses have long used these technologies, but MSMEs' (micro, small, and medium-sized enterprises') adoption of BIS is still uneven and sometimes delayed, especially in developing nations like India [4]. With over 110 million employees and a 30% GDP contribution, MSMEs are the backbone of

the Indian economy. As such, their digital enablement—particularly via BIS—is essential for competitiveness, innovation, and sustainable growth.

Despite increased knowledge of digital technologies, a number of internal and external obstacles frequently make it difficult for MSMEs to successfully utilize BIS [5]. Strategic and technological uncertainty are among the most important and least studied of them. The quick speed of technical advancement, the absence of standards, and the difficulty of integrating BIS with current systems are all examples of technological uncertainty. On the other side, strategic uncertainty includes low strategic foresight in MSMEs with limited resources, ambiguity around long-term organizational goals, and unpredictable market dynamics [6]. These uncertainties have a big impact on decisions on technology investments, which frequently leads to opposition, hesitancy, or the early termination of BIS projects.

Traditional models of technology adoption—such as the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and Technology-Organization-Environment (TOE) framework—have offered valuable insights into general IT adoption behaviors [7]. However, these models often assume relatively stable organizational environments and overlook how uncertainty impacts the decision-making process, especially in the dynamic and volatile context of MSMEs. Consequently, there exists a gap in the literature and practice concerning how MSMEs can be supported in adopting BIS amid uncertainty. Addressing this gap is crucial, as BIS adoption in MSMEs has the potential to significantly enhance agility, resilience, and competitiveness in uncertain business environments.

This study seeks to explore and empirically validate a framework that incorporates the major factors affecting BIS adoption in Indian MSMEs, with a particular focus on technological and strategic uncertainties [8]. By examining the influence of various factors namely, adoption process factors, strategic alignment, organizational readiness, technological compatibility, and environmental conditions this research aims to offer a holistic and context-sensitive understanding of BIS adoption dynamics. Importantly, the study leverages primary data collected from 120 respondents across a wide range of industries, analyzed through statistical techniques such as factor analysis and regression modeling.

The objectives of this research are fourfold: (1) to identify and evaluate the critical internal and external factors influencing BIS adoption in MSMEs; (2) to investigate the specific roles of technological and strategic uncertainty in shaping adoption decisions; (3) to empirically test the relationships between identified factors and BIS adoption; and (4) to propose a validated, practical framework tailored for MSMEs operating under uncertain conditions [9]. This research is guided by several key questions: What are the most influential factors in the decision to adopt BIS in Indian MSMEs? How do uncertainties related to technology and strategy impact this decision? Which factors show the strongest statistical association with successful BIS adoption?

To answer these questions, the study is structured as follows: Section 2 reviews existing literature on BIS, MSMEs, and technology adoption models while identifying gaps. Section 3 outlines the research methodology, including sample selection, instrument design, and analytical techniques. Section 4 presents the data analysis results, focusing on demographic profiles, factor structures, and regression outcomes. Section 5 discusses the implications of the findings in light of existing research and practical applications. Section 6 proposes a conceptual

framework based on the results, and Section 7 concludes with insights, limitations, and future research directions. By providing a data-driven, empirically tested framework, this research aims to support MSMEs in navigating uncertainty and making more informed decisions regarding BIS adoption, ultimately contributing to their digital transformation and long-term sustainability.

1.1 Background and Significance of Business Intelligence Systems (BIS) in MSMEs

Business Intelligence Systems (BIS) are a class of advanced technologies and tools that facilitate the collection, integration, analysis, and presentation of business data to support informed decision-making across organizational levels [10, 11]. At their core, BIS encompass a wide range of applications including data warehousing, online analytical processing (OLAP), reporting tools, dashboards, and increasingly, artificial intelligence (AI)-driven predictive analytics [12]. Historically, BIS evolved from rudimentary decision support systems (DSS) in the 1960s and 70s, which focused on structured reporting and analysis based on limited internal data. Over the decades, BIS matured into robust platforms capable of integrating vast amounts of structured and unstructured data from both internal and external sources, thereby enabling deeper insights, real-time monitoring, forecasting, and scenario planning.

This evolution from descriptive to predictive and even prescriptive analytics has significantly enhanced the strategic value of BIS, making them indispensable in today's data-driven economy [13]. In this context, the adoption of BIS has become vital for organizations striving to remain competitive, agile, and innovative. For Micro, Small, and Medium Enterprises (MSMEs) in India, the relevance of BIS is particularly profound. Indian MSMEs, which form the backbone of the national economy by contributing approximately 30% to the GDP and employing over 110 million people, operate in highly diverse and volatile market environments [14]. Unlike large corporations, MSMEs often lack the infrastructure, technical manpower, and financial resources required to invest in and implement complex information systems. These limitations hinder their ability to effectively harness the power of data, which is increasingly becoming a crucial asset for survival and growth. Moreover, MSMEs face unique operational challenges such as limited market visibility, inefficiencies in supply chains, low productivity, and difficulty in accessing credit and global markets [15, 16]. In this scenario, BIS can play a transformative role by offering these enterprises the ability to extract actionable insights from their business data, streamline operations, enhance customer understanding, optimize inventory, detect fraud, and make evidence-based strategic decisions. Through dashboards and visual analytics, business owners and managers in MSMEs can monitor key performance indicators (KPIs), identify trends, and quickly respond to market changes or internal inefficiencies [17]. Specifically, BIS can democratize data access and analysis, enabling non-technical stakeholders in MSMEs to eliminate the need for guessing or intuition and make quicker, more accurate choices. Furthermore, the significance and urgency of MSMEs adopting BIS have increased due to the Indian government's recent drive for digital transformation [18]. The goal of programs like Startup India, Digital India, and the MSME 4.0 vision is to empower small enterprises digitally and promote technology-led innovation and competitiveness. The adoption of BIS is made possible by these initiatives, which encourage the incorporation of cloud computing, the Internet of Things (IoT), artificial intelligence, and data analytics into corporate operations.

Additionally, several policy interventions and financial schemes have been introduced to subsidize IT infrastructure costs, support digital literacy, and incentivize technology adoption in the MSME sector [19]. Despite these efforts, however, the actual uptake of BIS among Indian MSMEs remains sporadic and uneven due to factors such as limited awareness, uncertainty over return on investment (ROI), lack of skilled personnel, and perceived complexity of the systems. Many MSMEs are still at the early stages of digital maturity and remain hesitant to commit to full-fledged BIS implementation without a clear understanding of its benefits and associated risks. Thus, while the potential benefits of BIS for MSMEs are immense—ranging from improved efficiency and customer engagement to better resource planning and strategic agility—the path to adoption is fraught with challenges. It becomes essential, therefore, to explore the factors influencing BIS adoption in this segment and to develop a tailored framework that takes into account the specific constraints and opportunities that Indian MSMEs face. Understanding how these businesses can leverage BIS to navigate operational complexity and strategic uncertainty is crucial for their long-term resilience and contribution to India's digital economy.

1.2 The Role of Technological and Strategic Uncertainty in Adoption Decisions

Technology and strategic ambiguity are major factors in how businesses, especially MSMEs with limited resources, approach digital transformation when it comes to the use of Business Intelligence Systems (BIS) [20]. The term technological uncertainty describes the complexity and unpredictability of quickly changing technologies' creation, integration, and operation. For MSMEs, which often lack dedicated IT departments or expert technical staff, this uncertainty presents a substantial barrier to adopting sophisticated systems like BIS. The fast-paced innovation in analytics platforms, data storage solutions, cloud-based services, and artificial intelligence makes it difficult for smaller firms to assess which technologies are mature, stable, and compatible with their existing infrastructure. Furthermore, constant upgrades, vendor variations, lack of standardization, and cybersecurity concerns increase the perceived risk of making the wrong technological investment. MSMEs fear obsolescence, integration failures, and high switching costs, all of which compound hesitation and delay in adoption decisions. Even when these businesses recognize the strategic value of BIS, they often struggle with uncertainty about implementation complexity, data quality requirements, and long-term technical support [21]. This apprehension results in a conservative approach to technology investments, despite the growing pressure to compete in increasingly data-driven markets.

The problem of strategic uncertainty is just as important as technological uncertainty. The capacity of a company to match long-term strategic goals with IT adoption programs is impacted by the uncertainty and unpredictability of the business environment. Strategic uncertainty in MSMEs often stems from volatile market conditions, frequent policy shifts, changing customer behavior, and heightened global competition. Unlike large organizations that can absorb strategic shocks through diversification and scale, MSMEs operate with limited financial buffers and are more vulnerable to strategic misalignments. When it comes to BIS adoption, strategic uncertainty manifests in doubts over return on investment (ROI), unclear performance metrics, and difficulty in forecasting long-term business value. MSME decision-makers may question whether investing in BIS will provide tangible outcomes such as improved sales, customer retention, or operational efficiency [22]. This is especially pertinent in uncertain or unstable economic contexts, where business priorities may shift rapidly, leaving

little room for long-term digital commitments. Additionally, MSMEs typically lack formalized strategic planning processes, which further weakens the linkage between technology adoption and strategic direction [23].

The interplay between technological and strategic uncertainty creates a complex environment that shapes how MSMEs assess BIS adoption. These forms of uncertainty are not isolated; rather, they reinforce each other. For instance, strategic ambiguity around future market positioning can amplify technological hesitation, while technological confusion can impede strategic clarity about innovation or competitive advantage. This interdependence necessitates a nuanced understanding of how MSMEs make decisions under uncertainty [24]. Traditional technology adoption models often fall short in capturing this complexity, as they focus on static constructs such as perceived ease of use or perceived usefulness, without adequately addressing the dynamic and uncertain nature of the MSME context. As such, there is a pressing need to incorporate uncertainty as a central dimension in BIS adoption frameworks tailored for MSMEs [25, 26]. Recognizing uncertainty not as a barrier but as a condition under which adoption decisions are made can offer more practical and accurate models for research and implementation. The role of uncertainty becomes even more crucial in an environment where government-led programs are pushing MSMEs to digitize. Despite favorable policies, subsidies, and awareness programs, many MSMEs remain cautious due to their exposure to both technological and strategic risks. Addressing these uncertainties through structured frameworks, policy support, and contextualized research is essential to drive adoption rates and improve outcomes. Therefore, understanding the role of technological and strategic uncertainty is not just an academic exercise it is fundamental to enabling meaningful digital transformation among MSMEs. The present study is grounded in this realization and seeks to empirically explore how these uncertainties influence BIS adoption, ultimately contributing to a framework that aligns more closely with the realities faced by Indian MSMEs.

1.3 Importance of data-driven decision-making in contemporary organizations.

In the modern digital age, organizations are increasingly realizing the value of data as a strategic asset. Data-driven decision-making (DDDM) has emerged as a critical process that allows businesses to make informed, objective, and evidence-based decisions rather than relying on intuition or past experience [27]. The importance of DDDM is rooted in the ability to derive actionable insights from vast and complex datasets to enhance operational efficiency, improve customer satisfaction, reduce costs, and maintain competitive advantage. One of the primary advantages of data-driven decision-making is its ability to enhance accuracy and reduce uncertainty. In highly dynamic markets, decisions based on intuition or limited information may no longer suffice. DDDM, by contrast, relies on concrete metrics and historical data, which helps organizations predict outcomes more reliably and align strategies accordingly [28]. Whether it involves identifying emerging market trends, forecasting demand, or optimizing supply chains, data provides the foundation for high-impact decisions. Moreover, DDDM supports a culture of transparency and accountability. When decisions are based on data, they can be tracked, measured, and audited. This allows managers and stakeholders to justify actions, allocate resources efficiently, and hold departments accountable for performance outcomes. It shifts organizational culture toward objective assessment and continuous improvement. For instance, employee performance can be assessed based on data

from key performance indicators (KPIs) rather than subjective evaluations, leading to fairer and more motivating appraisal systems [29].

Organizations across industries finance, healthcare, retail, manufacturing, and education—are embracing DDDM to gain operational insights. In retail, companies like Amazon and Walmart use customer data to optimize inventory, personalize marketing campaigns, and predict purchasing behavior. In healthcare, patient data helps medical professionals develop targeted treatment plans and identify public health trends. In finance, data analytics is used to detect fraud, assess risk, and create personalized investment strategies. In addition, data-driven decision-making fosters innovation. By analyzing customer feedback, market responses, and operational outcomes, organizations can identify areas of improvement or entirely new business opportunities. For example, Netflix's success in content creation is largely attributed to its ability to analyze viewer preferences and trends, allowing it to produce shows that are more likely to succeed. This evidence-based innovation minimizes risks while improving the odds of market acceptance.

Big data and real-time analytics are transforming the role of data-driven decision-making (DDDM) in organizations. With the rise of real-time dashboards and AI, organizations can make swift, adaptive decisions based on demand, competition, and external factors. However, DDDM faces challenges such as data quality, integration of disparate sources, privacy concerns, and lack of analytical capabilities. Data silos, insufficient investment in analytics tools, and resistance to change can also hinder effective data use. Leadership plays a crucial role in overcoming these obstacles, with senior management promoting data literacy, investing in analytics tools, and fostering a culture where data is valued in everyday decision-making. Training programs, workshops, and collaboration between IT and business units can help integrate DDDM into organizational DNA.

1.4 Emergence and significance of Business Intelligence Systems (BIS) in modern enterprises.

The rise of Business Intelligence Systems (BIS) has significantly transformed the way organizations operate, compete, and deliver value [30]. BIS is a tool that gathers, integrates, analyzes, and presents business information to support effective decision-making. It was developed due to the exponential growth in data generation across various touchpoints, such as customer interactions, supply chains, financial transactions, and social media. Traditional methods of reporting and manual data analysis proved inadequate in terms of speed, scalability, and insight generation. BIS offers functionalities such as data warehousing, online analytical processing (OLAP), dashboards, data mining, and predictive analytics [31]. These features allow users to identify patterns, uncover hidden relationships, and derive insights that inform strategy. BIS also contributes to strategic agility by enabling real-time monitoring of key performance indicators (KPIs) and trends, allowing organizations to adapt strategies promptly.

Operational efficiency is another area where BIS adds value. By automating data collection and analysis, BIS reduces the time and effort required to generate reports, freeing up human resources for higher-level tasks [32]. BIS also plays a significant role in enhancing customer relationship management (CRM). Companies like Salesforce and SAP offer BIS-integrated CRM solutions that help businesses gain a competitive edge by leveraging customer insights. The strategic significance of BIS extends beyond large enterprises, as cloud-based and scalable

solutions now widely available enable even small and medium-sized enterprises (SMEs) and MSMEs to adopt BIS to improve decision-making processes. However, successful implementation depends on organizational readiness, data quality, employee training, and top management support. BIS is crucial for modern enterprises, serving as the backbone of data-driven decision-making, strategic agility, and operational excellence. The integration of BIS with AI, machine learning, and real-time analytics will further enhance its capabilities, making it an indispensable element of enterprise success in the digital era.

Literature Review

2.1 Understanding Business Intelligence Systems (BIS)

Alnawafleh et.al (2024) "discussed the business intelligence systems (BIS) have become increasingly popular throughout the world with the goal of helping enterprises navigate the cutthroat corporate world. Nevertheless, because of implementation issues, many businesses find it difficult to reap the full benefits of BIS. The absence of efficient measuring techniques is one of the main causes of these difficulties. The objective of this study is to present a concise synopsis of business intelligence and the critical elements that affect its effective application in enterprises. The research determines the most important elements required for the efficient usage of a business intelligence system by reviewing the body of available literature. It suggests a theoretical framework based on the Information System Performance Model for assessing BIS performance at the organizational level. According to this approach, improving perceived usefulness and user satisfaction which in turn leads to organizational benefits requires the strong performance of system, information, service, relationship, and process quality. Through the integration of concepts from pertinent literature, this study provides a comprehensive knowledge of how to evaluate BIS performance in an organization. The results show how business intelligence systems improve organizational performance and decision-making, enabling firms to make well-informed choices. This study is distinctive because it offers a theoretical framework for assessing BIS effectiveness in businesses that is founded on a thorough literature evaluation. Furthermore, it expands the use of the Information System Success Model to the field of BIS in order to analyze management-level performance".

Alsibhawi et.al (2023) "proposed the Small and medium-sized firms, in particular, have several challenges as they attempt to thrive using conventional technologies. To solve the problems, businesses must use information technology system management to implement business intelligence. This study offers a conceptual framework that pinpoints the possible determinants of business intelligence system adoption in Libya's SME sector. Thus, the unified theory of adopting and utilizing technology (UTAUT) and the technology acceptance model (TAM) served as the foundation for this investigation. Consistent with earlier research that examined this kind of influence, this study suggested a conceptual framework that included a number of elements, including IT project management, change management, knowledge sharing, information quality, perceived utility of a BIS, and perceived ease of adoption of a BIS. The impact of environmental variables on the adoption of a business intelligence system (BIS) was not taken into account in this study since small and medium-sized businesses differ in terms of their industry type and sector".

Al-Okaily et.al (2023) "explored the growing significance of Business Intelligence Systems (BIS) adoption in the digital economy, where data-related challenges are increasingly complex and ambiguous. Focusing on the Jordanian banking sector, the research investigates critical success factors influencing BIS efficiency, using the DeLone and McLean model as a theoretical foundation. A quantitative approach was employed, utilizing a structured questionnaire distributed to actual BIS users who rely on these tools for both strategic and operational decision-making. The collected data were analyzed through partial least squares–structural equation modeling. The findings reveal that system quality, information quality, user quality, user satisfaction, and user performance significantly enhance BIS efficiency in this sector. These insights provide valuable guidance for policymakers in Jordanian banks seeking to optimize BIS implementation and improve organizational performance. Notably, this study is the first to present a theoretical model specifically tailored to evaluating BIS efficiency within Jordan's banking industry".

Fu et.al (2022) "explained the advent of intelligent technology has spurred most large companies to introduce business intelligence systems (BIS), but those with low information maturity still have a wait-and-see attitude towards BIS. In order to accelerate the introduction of BIS, this study found and analyzed the critical factors (CFs) considered by companies when introducing BIS. First, the literature on factors considered by companies to introduce BIS was reviewed. The three stages before, during, and after introduction in marketing that organizations undergo during the procurement process were developed into a three-layer hierarchy factor table. An expert questionnaire with pairwise factors was then designed and sent to senior executives in companies that had introduced BIS, and the weights of all factors were calculated by the fuzzy analytic hierarchy process (FAHP) based on the collected questionnaire data".

Aws et.al (2021) "determined the implementation of Business Intelligence System (BIS) has grown rapidly world-wide in recent years to enable organizations to compete in the rigorous business environment. To date, several organizations are still struggling to derive BIS benefits as its implementation was not a successful as expected. The lack of measurement is believed to be a main reason for the BIS failure. Towards this issue, a theoretical model was proposed in this article grounded on the Information System Success Model (ISSM) to BIS success measurement at the organizational level. The authors argued that system quality, information quality, service quality, collaboration quality and process quality will individually and jointly influence both perceived usefulness and user satisfaction, influence perceived usefulness on user satisfaction and thereby these factors are antecedences of organizational benefits. This conceptual paper has synthesized knowledge from relevant literature and has offered a holistic understanding of the BIS success assessment in an organization. To the best of our knowledge based on a comprehensive literature review, our present paper is the first of its kind to propose a theoretical model to BIS success measurement in an organization. It also extends the ISSM to use in BIS filed at the organizational level of analysis".

Salisu et.al (2021) "proposed the Healthcare firms are forced to use new technologies for their daily decision-making in this age of industrial revolution (IR 4.0) and the fatal worldwide COVID-19 epidemic. Industry experts and policymakers are interested in the Business Intelligence System (BIS), one of the highlighted developments, because of its ability to offer more sophisticated information for decision-making processes. Moreover, the adoption of BIS

in SMEs generally and healthcare specifically is rather insignificant. This is due to numerous factors. It is therefore necessary to discover and analyze the essential determinants affecting the adoption of BIS in healthcare SMEs. Therefore, this study tries to tackle this gap by exploring the relevant factors for BIS adoption using a systematic literature review (SLR) and an expert-ranking survey of 63 studies that were published in Scopus and WoS databases from 2011 to 2020. A total of 22 determinants are identified and sent to 15 experts. The data that were gathered from these experts were analyzed using SPSS. The results of the analysis indicated 15 determinants were significant, and one determinant was added by an expert. Consequently, a theoretical structure has been developed based on technology, organization, environment, and CEOs determinants and theories".

2.2 The Landscape of MSMEs in India

Manida et.al (2024) "explained the critical facets influencing the expansion of MSMEs in the Indian context. The study explores various dimensions, including technological advancements, government initiatives, market dynamics, and global trends, that shape the growth trajectory of these enterprises. The first facet delves into the technological landscape, highlighting how MSMEs increasingly leverage innovations to enhance productivity, streamline operations, and gain a competitive edge. Adopting digital tools, automation, and Industry 4.0 principles plays a pivotal role in shaping the expansion strategies of MSMEs. Government initiatives form the second facet, focusing on policies to support and rejuvenate the MSME sector. Collateral-free loans, credit guarantee schemes, and incentives for technology upgradation are examined, shedding light on the role of policy frameworks in fostering a conducive environment for MSME growth. Market dynamics constitute the third facet, exploring how MSMEs navigate domestic and international markets. Consumer preferences, market trends, and supply chain dynamics are analyzed to understand how MSMEs position themselves for expansion amidst evolving market conditions. The fourth facet investigates the global perspective, emphasizing how India's MSMEs align with international standards and explore export opportunities. Initiatives to enhance global competitiveness, along with trade agreements and collaborations, are discussed as critical drivers of expansion. In termination, the abstract underscores the interconnected nature of these facets, emphasizing the need for MSMEs to strategically align technological adoption, government support, market insights, and global strategies for sustainable and resilient expansion. The findings contribute to a holistic understanding of the factors influencing the growth of MSMEs in India, providing insights for policymakers, researchers, and entrepreneurs seeking to navigate the dynamic landscape of small and medium enterprises".

Lishmah Dominic et.al (2024) "discussed the Micro, Small, and Medium Enterprise (MSME) sector stands as a pivotal pillar within the Indian economy, contributing to 48% of the nation's production output and providing employment to a staggering 110 million individuals. The pervasive impact of the pandemic has inevitably reverberated across the economic landscape, although its full extent remains shrouded in uncertainty. Particularly, the small-scale enterprises that play a crucial role in India's manufacturing and service domains have borne the brunt of this impact. The year 2020 witnessed an unprecedented deceleration in revenue, with the MSME sector grappling with severe challenges in maintaining operational continuity. In response to this crisis, the government took affirmative action aimed at rejuvenating the beleaguered sector, offering targeted support to MSMEs. This concerted intervention proved

to be a significant impetus, infusing hope and vitality into these enterprises. Consequently, a comprehensive evaluation of the barriers encountered, a candid exposition of these hurdles, and the formulation of a robust strategy to surmount the pandemic-induced turmoil have become imperative. In light of this exigency, the researcher undertakes a rigorous analytical investigation into the government's policies crafted to ensure the sustainable growth of MSMEs in India. By distilling insights from diverse sources, a holistic understanding of the challenges faced by MSMEs and the efficacy of governmental interventions is pursued".

Banerjee et.al (2023) "proposed the Micro, small, and medium enterprises (MSMEs) play a crucial role in driving economic growth, employment generation, and innovation. However, these enterprises face numerous challenges in the dynamic business landscape, along with various opportunities to thrive and expand. This article examines the challenges and opportunities for MSMEs and explores strategies to navigate these complexities. The study employed a mixed-methods approach, including surveys, interviews, and case studies, to gather data from a diverse sample of MSMEs. The results highlight key challenges such as limited access to finance, market competition, regulatory compliance burdens, and skill shortages. On the other hand, opportunities such as digital transformation, access to new markets, and supportive government policies emerged as potential avenues for MSME growth. The discussion section critically analyzes the findings and offers recommendations to enhance MSME competitiveness, including tailored business strategies, technological adoption, skill development initiatives, and policy reforms. The existing literature by shedding light on the challenges and opportunities faced by MSMEs, providing insights for policymakers, researchers, and practitioners involved in fostering the growth and sustainability of these enterprises".

Balkrishna et.al (2023) "discussed the Micro, Small, and Medium Enterprises (MSMEs) play a pivotal role in India, efficiently utilizing limited resources. They excel in resource optimization, operational flexibility, innovation, and low investment needs. Globally, the MSME sector contributes significantly to economic growth, comprising over 99% of enterprises in the European Union and around 80% in the United States, representing 44% of economic activity. In India, the MSME sector shows immense promise, with approximately 63.5 million units significantly contributing to manufacturing GDP, services, and overall output. It stands as the second-largest employment provider, generating 11.10 crore jobs, particularly in rural areas. Nurturing this sector is critical for achieving inclusive growth and self-sufficiency goals set by the Atmanirbhar Bharat initiative. The government supports MSMEs through market assistance, export promotion, and various programs like MSE-CDP, PMEGP, SFURTI, and IT ecosystems. Initiatives like NIMZs, make in India, Start-Up India, Stand Up India, and Digital India further prioritize MSME growth. However, nonuniform growth rates and labor migration have posed challenges. To unlock the sector's full potential, adopting advanced technology is recommended".

3. Research Methodology

This study employed a quantitative research design to examine the factors influencing the adoption of Business Information Systems (BIS) across various organizational settings. The research was conducted through a structured survey questionnaire, which was distributed to a sample of 120 respondents working in diverse industries, job roles, and organization sizes. The

aim was to analyze the relationship between BIS adoption and five key independent variables: adoption process factors, strategic factors, organizational factors, technological factors, and environmental factors.

3.1 Research Design

This study employed a descriptive and inferential research design to systematically collect, summarize, and analyze data related to Business Information System (BIS) adoption. The descriptive aspect was used to profile respondents based on demographic and organizational characteristics, including age, gender, education, job position, and industry. The inferential component involved statistical techniques such as Chi-square tests, correlation, and regression analysis to examine relationships between independent variables (adoption process, strategic, organizational, technological, and environmental factors) and the dependent variable (BIS adoption). A cross-sectional research design was adopted, where data were collected at a single point in time. This approach was suitable for understanding current trends and associations within the target population without the need for long-term observation. The design enabled the researcher to test hypotheses and identify statistically significant patterns, making it an effective framework for studying factors that influence BIS adoption in varied organizational contexts.

3.2 Population and Sampling

The target population for this study comprised professionals employed across diverse sectors, including education, healthcare, finance, retail, manufacturing, government/non-profit, and technology. These individuals were selected based on their involvement in or awareness of Business Information System (BIS) usage and related organizational decision-making processes. To ensure the collection of meaningful and relevant data, a purposive sampling technique was employed. This non-probability sampling method allowed the researcher to intentionally select participants who possessed the specific knowledge and experience required for the study. The sampling strategy prioritized diversity in professional roles and organizational backgrounds to capture a wide range of perspectives on BIS adoption. A total of 120 valid responses were obtained, providing a robust dataset for both descriptive and inferential statistical analysis. This sample size was considered adequate to explore patterns, relationships, and potential influencing factors affecting BIS adoption across different industries and organizational structures.

3.3 Data Collection Instrument

The study's data were gathered using a self-administered structured questionnaire designed to gather data on demographic factors and factors influencing the adoption of business information systems (BIS). The survey was broken up into pieces. The first component collected demographic information about the respondents, including age, gender, education, occupation, years of experience, industry, and size of the company. The second section measured the dependent variable, BIS adoption, and the five independent variables: organizational, technological, strategic, adoption process, and environmental factors. To ensure consistency and ease of analysis, Likert-scale items were used, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), allowing respondents to express varying degrees of agreement

with each statement. The instrument was pre-tested for clarity and reliability, and feedback was incorporated to refine the final version. This structured format facilitated the collection of quantifiable and analyzable data suitable for statistical evaluation.

3.4 Variables

- **Dependent Variable:** BIS Adoption

- **Independent Variables:**

  - Adoption Process Factors
  - Strategic Factors
  - Organizational Factors
  - Technological Factors
  - Environmental Factors

3.5 Data Analysis Techniques

The collected data were analyzed using SPSS software v27. Descriptive statistics (mean, standard deviation, skewness) were used to understand data distribution. Chi-square tests were conducted for categorical variable relationships. Multiple linear regression analysis was applied to test the significance and direction of relationships between the independent variables and BIS adoption. The significance level was set at $p < 0.05$.

4. Result & Discussion

The results reveal a balanced and diverse sample of 120 respondents in terms of age, gender, education, job position, experience, industry, and organization size. Most participants are well-educated and come from various professional backgrounds, enhancing the reliability of the findings. Descriptive statistics show a generally symmetrical distribution across key variables, with minor skewness in technological and adoption process factors. Hypothesis testing indicates that adoption process, strategic, organizational, and technological factors significantly affect BIS adoption, all showing a negative relationship. However, environmental factors were not statistically significant ($p = 0.054$). These results suggest that internal organizational factors play a more crucial role in BIS adoption than external environmental influences.

Table 1: Age Distribution of the Sample Population

Age	Frequency	Percent
Under 25 years	19	15.8
25-34 years	28	23.3
35-44 years	24	20
45-54 years	26	21.7
55 years and above	23	19.2

Total	120	100

The given table represents the age distribution of a sample population of 120 individuals. It categorizes respondents into five age groups and provides both the frequency and percentage of each group. The majority of participants (23.3%) fall within the 25-34 years age bracket, followed closely by those in the 45-54 years group (21.7%) and the 35-44 years group (20%). Individuals aged 55 years and above account for 19.2% of the sample, while the youngest category, under 25 years, comprises the smallest proportion at 15.8%. This distribution indicates a fairly balanced representation across different age groups, with a slight predominance of younger and middle-aged respondents.
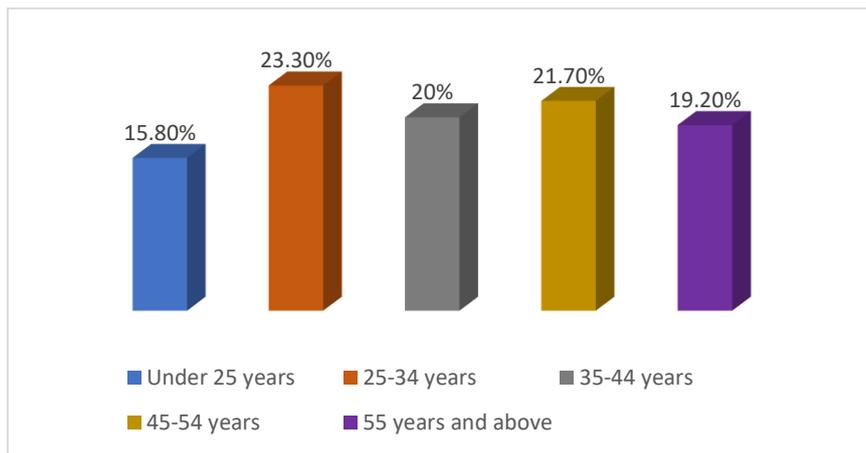

Figure 2: Age Distribution of Respondents (Graphical Representation)

Table 2: Gender Distribution of the Sample Population

Gender	Frequency	Percent
Male	56	46.7
Female	64	53.3
Total	120	100

The given table presents the gender distribution of a sample population of 120 individuals. It shows that 64 respondents (53.3%) are female, while 56 respondents (46.7%) are male. This indicates a slightly higher representation of females in the sample compared to males. However, the difference is not significant, suggesting a fairly balanced gender distribution within the surveyed population.
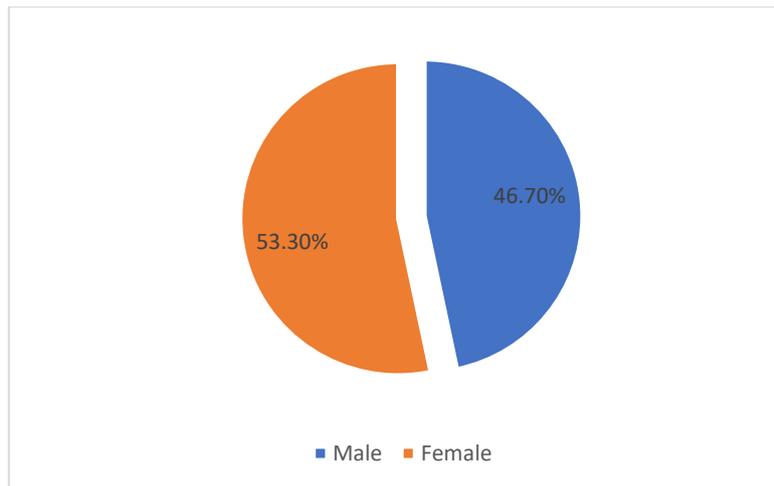
Figure 3: Gender Distribution of the Sample Population

Table 3: Education Level Distribution Among Respondents

Education Level	Frequency	Percent
Some college or associate degree	25	20.8
Bachelor's degree	30	25
Master's degree or higher	30	25
P.hd	35	29.2
Total	120	100

The given table illustrates the education level distribution among a sample of 120 individuals. The highest proportion of respondents, 29.2% (35 individuals), hold a Ph.D. degree, indicating a significant representation of highly educated individuals. Both the Bachelor's degree and Master's degree or higher categories have an equal share of 25% (30 individuals each), showing a balanced representation of undergraduate and postgraduate qualifications. Meanwhile, 20.8% (25 individuals) have completed some college or hold an associate degree, making them the smallest group in the sample. Overall, the data suggests that a majority of respondents have attained at least a bachelor's degree, with a notable proportion holding advanced degrees.
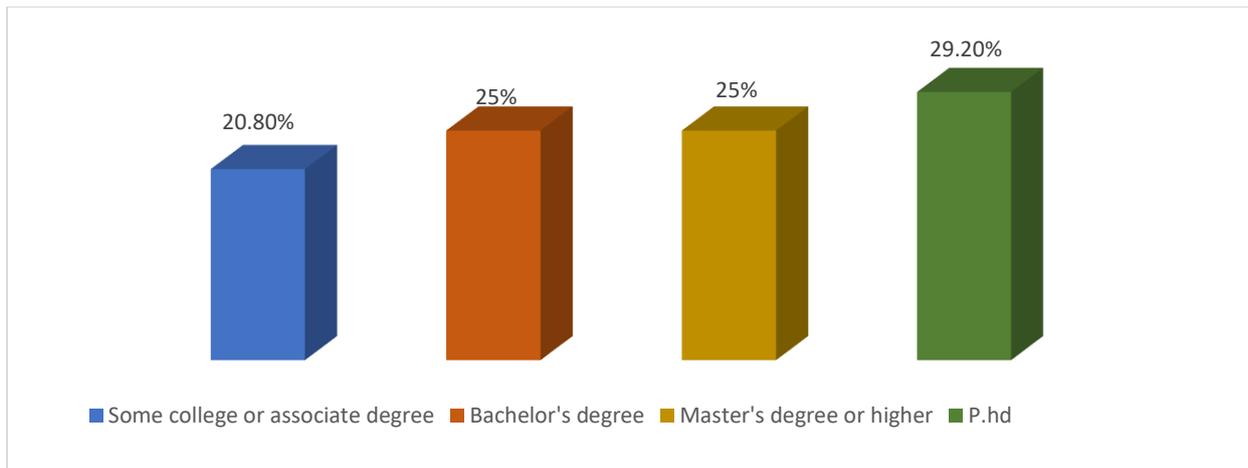
Figure 4: Education Level Distribution (Graphical Representation)

Table 4: Distribution of Job Positions Among Respondents

Job Position	Frequency	Percent
Entry-level	29	24.2
Mid-level	38	31.7
Senior management	27	22.5
Executive/Top management	26	21.7
Total	120	100

The given table represents the distribution of job positions among a sample of 120 individuals. The highest proportion of respondents, 31.7% (38 individuals), hold mid-level positions, indicating that a significant portion of the workforce has progressed beyond entry-level roles. Entry-level employees make up 24.2% (29 individuals) of the sample, suggesting a substantial number of early-career professionals. Senior management positions account for 22.5% (27 individuals), while executive or top management roles are held by 21.7% (26 individuals). The data reflects a well-distributed workforce across different levels, with a balanced representation of employees at various stages of their careers.
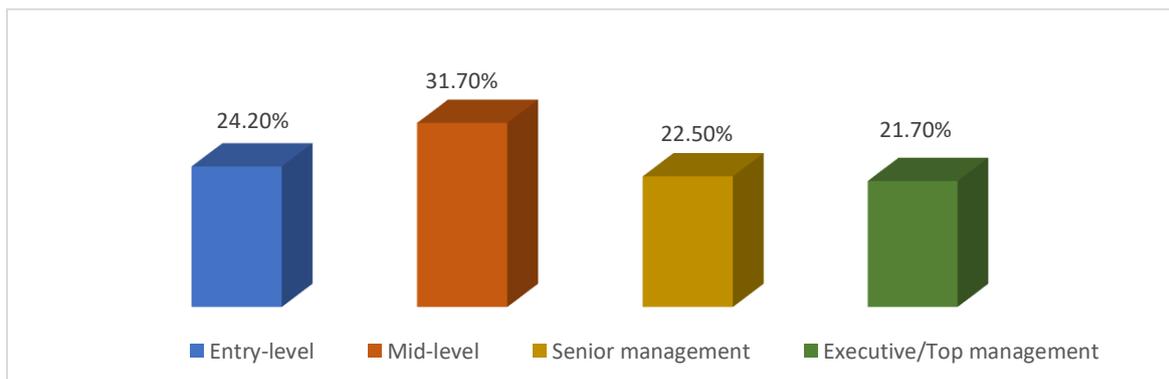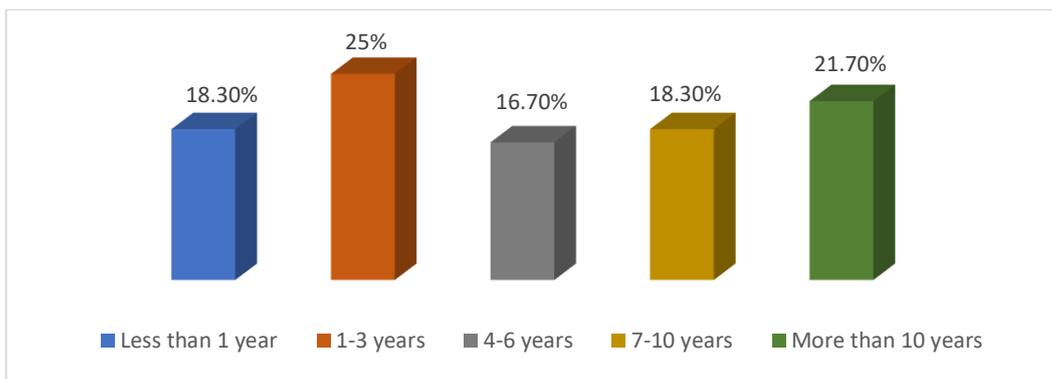
Figure 5: Job Position Distribution (Graphical Representation)

Table 5: Years of Experience Distribution Among Respondents

Years of Experience	Frequency	Percent
Less than 1 year	22	18.3
1-3 years	30	25
4-6 years	20	16.7
7-10 years	22	18.3
More than 10 years	26	21.7
Total	120	100

The given table represents the distribution of years of experience among a sample of 120 individuals. The largest proportion of respondents, 25% (30 individuals), have 1-3 years of experience, indicating a significant presence of early-career professionals. Those with more than 10 years of experience make up 21.7% (26 individuals), reflecting a considerable number of highly experienced professionals. Both less than 1 year and 7-10 years of experience categories have an equal share of 18.3% (22 individuals each), while 16.7% (20 individuals) fall within the 4-6 years range. This distribution suggests a well-balanced workforce with a mix of fresh entrants, mid-career professionals, and seasoned employees.


Figure 6: Years of Experience Distribution (Graphical Representation)

Table 6: Industry-Wise Distribution of Respondents

Industry	Frequency	Percent
Technology	18	15
Healthcare	19	15.8
Finance/Banking	13	10.8
Retail	19	15.8

Manufacturing	13	10.8
Education	24	20
Government/Non-profit	14	11.7
Total	120	100

The given table presents the distribution of respondents across different industries within a sample of 120 individuals. The education sector has the highest representation, accounting for 20% (24 individuals), indicating a strong presence of professionals in this field. Healthcare and retail industries each comprise 15.8% (19 individuals each), closely followed by the technology sector, which represents 15% (18 individuals). The government/non-profit sector accounts for 11.7% (14 individuals), while both finance/banking and manufacturing industries have an equal share of 10.8% (13 individuals each). The distribution suggests a diverse workforce with notable participation across multiple sectors, with education, healthcare, and retail leading the sample.
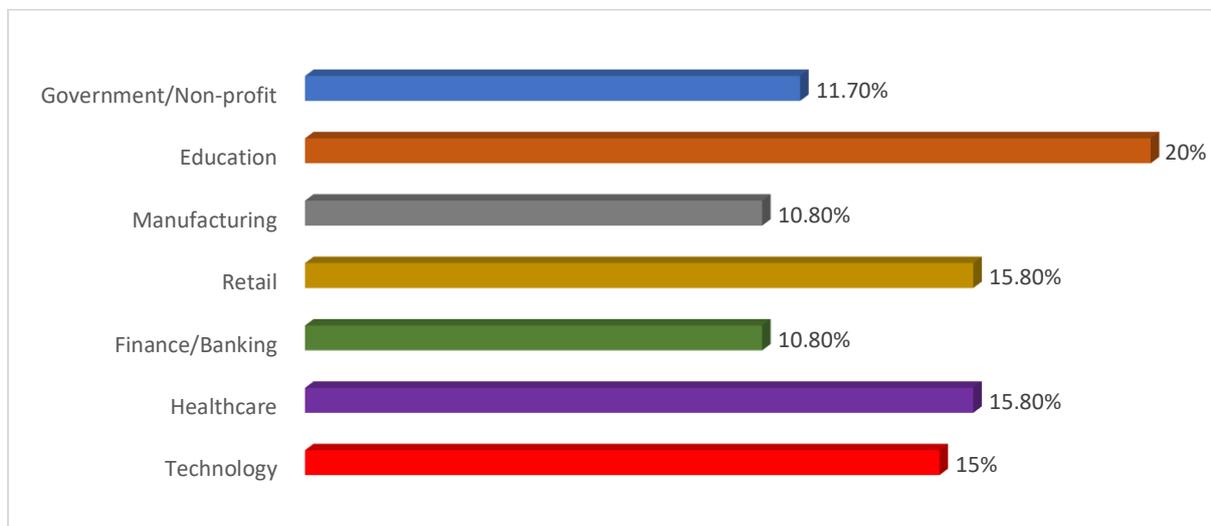

Figure 7: Industry-Wise Distribution (Graphical Representation)

Table 7: Organization Size Distribution Among Respondents

Organization Size	Frequency	Percent
Small (1-50 employees)	27	22.5
Medium (51-500 employees)	32	26.7
Large (501-5000 employees)	28	23.3
Enterprise (5001+ employees)	33	27.5
Total	120	100

The given table represents the distribution of respondents based on organization size within a sample of 120 individuals. The highest proportion, 27.5% (33 individuals), work in enterprise-level organizations with 5001+ employees, indicating a significant number of employees in large-scale corporations. This is closely followed by those in medium-sized organizations (51-500 employees), making up 26.7% (32 individuals) of the sample. Large organizations (501-5000 employees) account for 23.3% (28 individuals), while small businesses (1-50 employees) have the lowest representation at 22.5% (27 individuals). The distribution suggests that the workforce is fairly spread across different organization sizes, with a slight preference for larger enterprises.
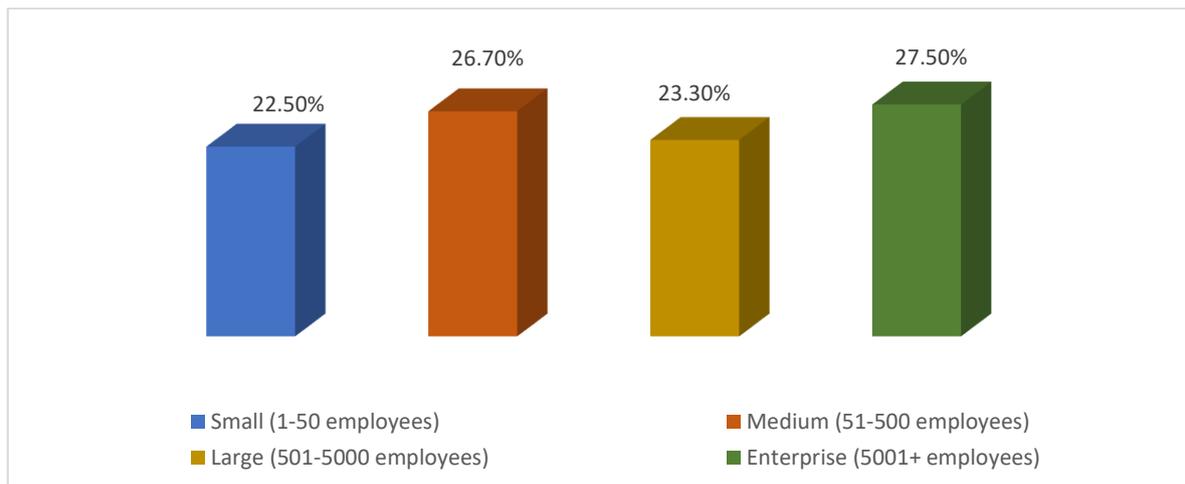
Figure 8: Organization Size Distribution (Graphical Representation)

Table 8: Descriptive Statistics

Descriptive Statistics

	N	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error
Age	120	3.05	1.365	-.011	.221
Gender	120	1.53	.501	-.135	.221
Education Level	120	2.63	1.116	-.136	.221
Job Position	120	2.42	1.081	.158	.221
Years of Experience	120	3.00	1.432	.070	.221
Industry	120	3.98	2.021	-.045	.221
Organization Size	120	2.56	1.121	-.039	.221
BIS Adoption	120	11.8583	3.07414	-.039	.221
Adoption Process Factors	120	27.3750	4.08741	-.445	.221

Strategic Factors	120	26.4417	4.77704	-.191	.221
Organizational Factors	120	27.4250	4.00769	-.117	.221
Technological Factors	120	27.1333	4.35009	.395	.221
Environmental Factors	120	18.1750	3.79443	-.092	.221
Valid N (listwise)	120				

The descriptive statistics table provides insights into the distribution and variability of different variables in a sample of 120 individuals. The age variable has a mean of 3.05 with a nearly symmetrical distribution (skewness: -0.011) and a moderate spread (standard deviation: 1.365). Gender (mean: 1.53, skewness: -0.135) indicates a slightly higher proportion of females. Education level (mean: 2.63, skewness: -0.136) and job position (mean: 2.42, skewness: 0.158) show a fairly balanced distribution. Years of experience (mean: 3.00, skewness: 0.070) and industry distribution (mean: 3.98, skewness: -0.045) indicate an even spread. Organization size (mean: 2.56, skewness: -0.039) is also well-balanced. For BIS adoption and related factors, the BIS adoption score (mean: 11.86, skewness: -0.039) shows a symmetrical distribution. Adoption process factors (mean: 27.38, skewness: -0.445) and strategic factors (mean: 26.44, skewness: -0.191) are slightly left-skewed, indicating more responses in the higher range. Organizational factors (mean: 27.43, skewness: -0.117) and environmental factors (mean: 18.18, skewness: -0.092) have near-normal distributions. However, technological factors (mean: 27.13, skewness: 0.395) are slightly right-skewed, showing a higher concentration of responses on the lower end. Overall, the dataset exhibits a well-balanced distribution with minor skewness variations in specific factors.

4.4 Summary of Hypotheses Results

Hypothesis	Statement	Result	Significance (p-value)	Effect Direction	R² Value
H₁₁: Adoption Process Factors	There is a significant relationship between Adoption Process Factors and BIS adoption.	Accepted	0.006	Negative	0.061
H₁₂: Strategic Factors	There is a significant relationship between Strategic Factors and BIS adoption.	Accepted	0.024	Negative	0.042
H₁₃: Organizational Factors	There is a significant relationship between Organizational	Accepted	0.042	Negative	0.035

	Factors and BIS adoption.				
H₁₄: **Technological Factors**	There is a significant relationship between Technological Factors and BIS adoption.	Accepted	0.015	Negative	0.049
H₁₅: **Environmental Factors**	There is a significant relationship between Environmental Factors and BIS adoption.	**Rejected**	0.054	Not significant	0.031

The given table presents the results of hypothesis testing regarding the relationship between various factors and the adoption of Business Information Systems (BIS). The analysis reveals that four out of the five hypothesized relationships are statistically significant and therefore accepted. These include Adoption Process Factors ($p = 0.006$), Strategic Factors ($p = 0.024$), Organizational Factors ($p = 0.042$), and Technological Factors ($p = 0.015$). All these variables show a negative effect direction, suggesting that as perceived challenges or complexities in these areas increase, the level of BIS adoption decreases. The R^2 values for these variables range from 0.035 to 0.061, indicating a modest proportion of variance in BIS adoption explained by each factor. In contrast, the hypothesis concerning Environmental Factors (H₁₅) was rejected, as its significance level ($p = 0.054$) exceeds the conventional threshold of 0.05, indicating no statistically significant relationship. Overall, the findings highlight the importance of internal organizational dynamics over external environmental conditions in influencing BIS adoption.

Conclusion

In Conclusion, the factors that affect Indian MSMEs' (micro, small, and medium-sized enterprises) adoption of business intelligence systems (BIS), especially in the face of technological and strategic uncertainty. A conceptual framework comprising five independent variables—adoption process factors, strategic alignment, organizational readiness, technological compatibility, and environmental influences was empirically tested in this study using a quantitative research design and data from 120 professionals in a variety of sectors. The results make it abundantly evident that the adoption process, organizational, technological, and strategic aspects all have a statistically significant and adverse effect on the adoption of BIS, underscoring the internal obstacles that MSMEs have when putting such systems into place. However, adoption decisions were not shown to be highly influenced by environmental factors, indicating that when it comes to BIS implementation in Indian MSMEs, internal organizational dynamics are far more important than external conditions. This study fills a significant gap in the literature by including uncertainty into the BIS adoption framework. It also offers a more practical, context-sensitive model that is suited to the requirements and limitations of MSMEs. The findings highlight how crucial organizational preparedness,

strategic clarity, and technology readiness are to the effective implementation of BIS. The paper offers useful information to MSME decision-makers, technology vendors, and policymakers from a practical perspective. It highlights the necessity of focused tactics that enhance internal skills, lessen the perceived complexity of adoption, and match corporate objectives with BIS implementation. Furthermore, in order to optimize the effectiveness of their assistance programs, government programs encouraging MSMEs to digitize must take these internal barriers into account. In summary, by offering an empirically supported paradigm for BIS adoption in the face of ambiguity, this study makes a theoretical and practical contribution. It demands that MSMEs adopt a new strategy to digital transformation, one that is more proactive, internally led, resilient, informed, and in line with long-term growth goals, rather than reactive, externally influenced decisions.

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