

Artificial Intelligence Adoption and Sustainable Business Performance among Indian Msmes: An Empirical Investigation

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ABSTRACT

Artificial Intelligence (AI) has emerged as a transformative technology that enables organizations to enhance operational efficiency, optimize resource utilization, improve customer engagement, and support sustainable business practices. For Micro, Small, and Medium Enterprises (MSMEs), AI adoption presents significant opportunities to overcome resource constraints, improve competitiveness, and achieve long-term sustainability. Despite increasing government initiatives promoting digital transformation in India, empirical evidence regarding the relationship between AI adoption and sustainable business performance among Indian MSMEs remains limited. This study aims to examine the impact of Artificial Intelligence adoption on the economic, environmental, and social dimensions of sustainable business performance among Indian MSMEs.

The study adopts a quantitative research approach using a structured questionnaire administered to MSME owners, managers, and entrepreneurs across selected industrial clusters in India. Primary data are collected from 400 respondents through convenience and purposive sampling techniques. Statistical tools such as Descriptive Statistics, Reliability Analysis, Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Structural Equation Modeling (SEM), and Multiple Regression Analysis are employed to test the proposed hypotheses. The study considers AI adoption as the independent construct comprising intelligent automation, predictive analytics, customer relationship management, decision support systems, and process optimization, while sustainable business performance is measured through economic sustainability, environmental sustainability, and social sustainability indicators. The findings are expected to demonstrate that AI adoption significantly improves operational efficiency, innovation capability, environmental responsibility, and financial performance among MSMEs. The study also highlights the role of organizational readiness and digital capabilities in facilitating successful AI implementation. The research contributes to the growing literature on AI-enabled sustainability by providing empirical evidence from the Indian MSME sector and offers practical recommendations for policymakers, entrepreneurs, technology providers, and researchers. The outcomes of this study are expected to support India's vision of digital transformation, sustainable industrial development, and enhanced global competitiveness of MSMEs.

Keywords: Artificial Intelligence Adoption, Sustainable Business Performance, Indian MSMEs, Digital Transformation, Sustainability, Structural Equation Modeling.

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1. INTRODUCTION

Artificial Intelligence (AI) has become one of the most influential technological innovations transforming modern business operations across industries worldwide. AI technologies such as machine learning, predictive analytics, intelligent automation, natural language processing, and computer vision enable organizations to automate repetitive tasks, improve decision-making, reduce operational costs, and enhance customer experiences. In recent years, Indian Micro, Small, and Medium Enterprises (MSMEs) have increasingly recognized AI as a strategic tool for improving productivity, innovation, and competitiveness. As MSMEs contribute significantly to India's GDP, exports, employment generation, and industrial development, the integration of AI technologies has become crucial for

ensuring sustainable economic growth. Government initiatives such as Digital India, Make in India, Startup India, and MSME digitalization programs have further accelerated AI adoption among businesses seeking long-term resilience and market expansion.

Sustainable business performance extends beyond financial profitability and incorporates environmental stewardship, social responsibility, and efficient resource management. AI assists MSMEs in achieving sustainability by optimizing energy consumption, minimizing waste generation, forecasting customer demand, improving supply chain efficiency, and supporting environmentally responsible business practices. However, the adoption of AI among Indian MSMEs remains uneven due to financial limitations, technological

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complexity, inadequate digital infrastructure, and limited employee skills. Although numerous studies have explored AI adoption in large organizations, empirical research focusing specifically on Indian MSMEs and their sustainable business performance is still limited. Therefore, this study investigates the influence of AI adoption on sustainable business performance and provides empirical evidence to support strategic decision-making for policymakers, entrepreneurs, and industry practitioners.

2. STATEMENT OF THE PROBLEM

Artificial Intelligence has gained considerable attention as an innovative technology capable of improving organizational efficiency and supporting sustainable development. Nevertheless, many Indian MSMEs continue to struggle with adopting AI technologies because of limited financial resources, lack of technical expertise, inadequate digital infrastructure, cybersecurity concerns, and organizational resistance to technological change. While AI offers numerous advantages including automation, predictive decision-making, operational optimization, and improved customer relationship management, many MSMEs remain uncertain about its practical benefits and return on investment. Consequently, businesses often hesitate to invest in AI-based systems, thereby limiting their ability to compete effectively in an increasingly digital economy.

Existing literature primarily concentrates on AI implementation in large corporations and multinational enterprises, leaving a significant research gap regarding Indian MSMEs. Furthermore, previous studies generally emphasize operational efficiency and financial outcomes while providing limited empirical evidence on AI's contribution to comprehensive sustainable business performance encompassing economic, environmental, and social dimensions. The absence of empirical studies examining the direct relationship between AI adoption and sustainability among Indian MSMEs creates uncertainty for policymakers and business leaders seeking evidence-based strategies. Hence, this study addresses this research gap by empirically examining how AI adoption influences sustainable business performance in the Indian MSME sector.

3. NEED OF THE STUDY

The rapid digital transformation occurring across industries has increased the importance of Artificial Intelligence as a strategic business resource. Indian MSMEs account for nearly one-third of India's GDP and employ millions of people, making their sustainable growth essential for national economic development. AI technologies enable MSMEs to improve productivity, reduce operational costs, optimize resource utilization, enhance customer satisfaction, and support environmentally sustainable business practices. Despite these potential benefits, empirical evidence explaining the effectiveness of AI adoption within Indian MSMEs remains insufficient. Therefore, there is a strong need to investigate whether AI adoption significantly contributes

to sustainable business performance and organizational competitiveness.

The findings of this study will provide valuable insights for MSME owners, entrepreneurs, policymakers, technology providers, financial institutions, and academic researchers. The research will help businesses understand the strategic value of AI investments while identifying key factors influencing successful implementation. It will also assist government agencies in designing supportive policies that encourage digital transformation and sustainable industrial development. From an academic perspective, the study contributes to the emerging literature on AI-driven sustainability by providing empirical evidence using advanced statistical techniques and offering a comprehensive framework applicable to developing economies.

4. SCOPE OF THE STUDY

1. Geographical Scope: This study is geographically confined to selected states in India where MSMEs have shown significant adoption of digital technologies and Artificial Intelligence applications. The research covers major industrial regions such as Maharashtra, Tamil Nadu, Karnataka, Gujarat, Telangana, and Delhi NCR, which collectively account for a substantial share of India's MSME sector. These regions represent diverse economic activities, industrial clusters, and levels of technological advancement. The findings of the study are therefore intended to reflect the AI adoption practices and sustainable business performance of MSMEs operating within these selected locations. Although the results may provide valuable insights for other regions, the study is primarily limited to the selected geographical boundaries.

2. Industrial Scope: The research focuses on Micro, Small, and Medium Enterprises (MSMEs) operating in various sectors, including manufacturing, textiles, logistics, retail, food processing, engineering, healthcare, and information technology services. These industries are increasingly integrating Artificial Intelligence technologies into their operational and strategic activities. By including multiple sectors, the study aims to examine whether AI adoption influences sustainable business performance differently across industries. The industrial scope provides a comprehensive understanding of AI implementation in diverse business environments while maintaining the focus on MSMEs. The findings will help identify sector-specific opportunities and challenges related to AI-driven sustainability.

3. Functional Scope: The study examines the application of Artificial Intelligence across key business functions within MSMEs. These functions include production and operations management, supply chain management, inventory control, marketing analytics, customer relationship management, financial management, human resource management, and strategic decision-making. The research evaluates how

AI technologies contribute to improving operational efficiency, reducing costs, enhancing customer satisfaction, optimizing resource utilization, and supporting sustainable business practices. By covering multiple functional areas, the study provides a holistic assessment of AI's contribution to organizational performance and long-term sustainability.

4. **Conceptual Scope:** Conceptually, the study investigates the relationship between Artificial Intelligence adoption and sustainable business performance among Indian MSMEs. Artificial Intelligence adoption is considered the independent variable and includes dimensions such as intelligent automation, machine learning, predictive analytics, decision support systems, and AI-enabled customer services. Sustainable business performance is treated as the dependent variable and is measured through three dimensions: economic sustainability, environmental sustainability, and social sustainability. Additionally, the study considers organizational readiness and digital capabilities as supporting factors that facilitate successful AI implementation. This conceptual framework enables a comprehensive evaluation of AI's strategic role in promoting sustainability.
5. **Methodological Scope:** The study adopts a quantitative and empirical research design to examine the proposed relationships between Artificial Intelligence adoption and sustainable business performance. Primary data will be collected using a structured questionnaire administered to MSME owners, managers, entrepreneurs, and senior executives. A sample of respondents will be selected using appropriate sampling techniques from the chosen industrial regions. Statistical techniques such as Descriptive Statistics, Reliability Analysis (Cronbach's Alpha), Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Correlation Analysis, Multiple Regression Analysis, and Structural Equation Modeling (SEM) will be employed to analyze the collected data. The methodological approach ensures the reliability, validity, and empirical robustness of the research findings.

5. REVIEW OF LITERATURE

1. **Badghish, S. & Soomro, Y. A. (2024),** "Artificial Intelligence Adoption by SMEs to Achieve Sustainable Business Performance: Application of the Technology–Organization–Environment Framework", The authors examined the determinants influencing Artificial Intelligence (AI) adoption among Small and Medium Enterprises (SMEs) and its impact on sustainable business performance. The study applied the Technology–Organization–Environment (TOE) framework to understand how technological readiness, organizational capabilities, and environmental support affect AI implementation. The findings revealed that AI adoption significantly enhances operational efficiency, innovation capability, environmental sustainability, and financial performance. Government support and organizational readiness were identified as important drivers of AI adoption. The study also reported that firm size moderates the relationship between AI adoption and sustainability outcomes. The authors concluded that SMEs should strengthen digital infrastructure and employee competencies before implementing AI technologies. The research contributes to the growing literature on AI-enabled sustainability and offers practical implications for business managers and policymakers.
2. **Soomro, R. B.,(2025),** "A SEM–ANN Analysis to Examine the Impact of Artificial Intelligence Technologies on Sustainable Performance of SMEs", This study investigated the influence of Artificial Intelligence technologies on the sustainable performance of SMEs by integrating Structural Equation Modeling (SEM) and Artificial Neural Network (ANN) techniques. The research demonstrated that AI technologies significantly improve economic, environmental, and social performance. Digital capabilities and organizational innovation positively influenced AI implementation. The study further reported that AI enhances productivity, customer satisfaction, decision-making quality, and operational flexibility. The hybrid SEM–ANN approach improved the predictive accuracy of the research model. The findings encourage SMEs to invest in AI technologies to achieve sustainable competitive advantage. The study also recommends continuous technological innovation and employee skill development for successful AI implementation.
3. **Panigrahi, R. R.,(2023),** "AI Chatbot Adoption in SMEs for Sustainable Manufacturing Supply Chain Performance: A Mediatonal Research in an Emerging Country", The study explored the impact of AI chatbot adoption on sustainable manufacturing supply chain performance. It found that AI chatbots improve customer communication, inventory management, logistics coordination, and operational efficiency. The study confirmed that AI-enabled customer interaction positively influences sustainable supply chain performance. Operational efficiency was identified as a significant mediating factor between AI chatbot adoption and business performance. The findings highlighted that digital transformation plays an essential role in achieving sustainability objectives in manufacturing SMEs. The authors recommended increased investment in AI-enabled customer service technologies to improve organizational competitiveness and sustainability.
4. **Goyal, P. & Singh, V. P. (2024),** "Industry 4.0 Adoption by Indian MSMEs and its Effects on Competitive Advantage and Firm Performance: An Empirical Analysis", The research examined the adoption of Industry 4.0 technologies, including Artificial Intelligence, among Indian MSMEs. The

findings indicated that AI, automation, IoT, and digital technologies significantly improve operational efficiency, innovation capability, productivity, and market competitiveness. Performance expectancy, organizational readiness, and facilitating conditions positively influenced technology adoption. The study concluded that digital transformation enables MSMEs to achieve higher levels of business performance and long-term sustainability. The authors suggested that government initiatives and digital infrastructure should be strengthened to encourage greater technology adoption among MSMEs.

5. **Khan, M. A. I. & Uddin, M. A. (2023)**, “Does Managerial Propensity towards Digitalization Enhance Firm Performance? A Case Study of Indian MSMEs”, The authors investigated the relationship between

managerial digital orientation and firm performance among Indian MSMEs. The study found that managers with strong digital capabilities are more willing to adopt Artificial Intelligence and other advanced technologies. AI adoption significantly improved productivity, innovation, operational flexibility, and customer satisfaction. Leadership commitment and employee digital skills were identified as important success factors for digital transformation. The study concluded that organizations with higher digital readiness achieved better financial and operational performance than firms with limited technological capabilities. The research emphasized the need for continuous digital skill development and organizational learning to maximize AI benefits.

6. OBJECTIVES AND HYPOTHESES

Objectives	Hypotheses
Objective 1: To examine the level of Artificial Intelligence adoption among Indian MSMEs.	H1: Artificial Intelligence adoption significantly varies among Indian MSMEs across different industrial sectors.
Objective 2: To analyze the influence of Artificial Intelligence adoption on sustainable business performance.	H2: Artificial Intelligence adoption has a significant positive effect on sustainable business performance among Indian MSMEs.
Objective 3: To evaluate the impact of AI adoption on economic, environmental, and social sustainability dimensions.	H3: Artificial Intelligence adoption positively influences the economic, environmental, and social dimensions of sustainable business performance.
Objective 4: To investigate the relationship between organizational readiness and successful AI adoption.	H4: Organizational readiness has a significant positive relationship with Artificial Intelligence adoption among Indian MSMEs.
Objective 5: To identify the role of digital capabilities in enhancing sustainable business performance through AI adoption.	H5: Digital capabilities significantly strengthen the relationship between Artificial Intelligence adoption and sustainable business performance among Indian MSMEs.

7. RESEARCH METHODOLOGY

S. No.	Research Methodology	Description
1	Research Design	The present study adopts a quantitative, descriptive, and explanatory research design to empirically examine the relationship between Artificial Intelligence (AI) adoption and sustainable business performance among Indian MSMEs. A structured questionnaire is used to collect primary data, and the research aims to test the proposed hypotheses using advanced statistical techniques.
2	Study Area	The study is conducted in selected industrial regions of India, covering MSMEs operating in Maharashtra, Tamil Nadu, Karnataka, Gujarat, Telangana, and Delhi NCR. These states represent major manufacturing and service clusters where AI adoption and digital transformation initiatives are rapidly increasing.
3	Target Population	The target population comprises owners, entrepreneurs, CEOs, directors, operations managers, production managers, IT managers, and senior executives of Indian Micro, Small, and Medium Enterprises (MSMEs). These respondents possess adequate knowledge regarding AI adoption and sustainable business practices within their organizations.
4	Sample Unit	The sample unit consists of individual respondents from MSMEs, including owners and managerial personnel directly involved in organizational decision-making and AI implementation. Each completed questionnaire represents one sample unit for the purpose of statistical analysis.
5	Sample Size	The study proposes a sample size of 400 respondents from selected MSMEs across different industrial sectors. This sample size is considered adequate for conducting advanced statistical analyses such as Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Multiple Regression Analysis, and Structural

		Equation Modeling (SEM).
6	Sampling Technique	The research employs a combination of Purposive Sampling and Convenience Sampling techniques. Purposive sampling is used to identify MSMEs that have adopted or are planning to adopt AI technologies, while convenience sampling facilitates easy access to respondents who are willing to participate in the survey.
7	Data Collection Sources & Instrument	The study uses both primary and secondary data. Primary data are collected through a structured questionnaire based on a Five-Point Likert Scale (1 = Strongly Disagree to 5 = Strongly Agree). Secondary data are obtained from Scopus-indexed journals, books, government reports, MSME Ministry publications, conference proceedings, and official websites to support the theoretical framework and literature review.
8	Statistical Tools Used	The collected data will be analyzed using IBM SPSS Statistics (Version 29) and AMOS/SmartPLS. The statistical techniques include Descriptive Statistics (Frequency, Percentage, Mean, Standard Deviation), Reliability Analysis (Cronbach's Alpha), Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Correlation Analysis, Multiple Regression Analysis, Structural Equation Modeling (SEM), and Model Fit Indices (CFI, TLI, RMSEA, SRMR, and Chi-square/df) to validate the proposed conceptual framework and test the research hypotheses.

8. ANALYSIS OF DATA

Table 1: Study Area-wise Distribution of Target Population

Study Area	MSME Owners	CEOs	Directors	Operations Managers	IT Managers	Production Managers	Senior Executives	Total
Maharashtra	18	9	8	14	10	11	10	80
Tamil Nadu	18	9	8	14	10	11	10	80
Karnataka	16	8	7	12	9	9	9	70
Gujarat	14	7	6	11	7	8	7	60
Telangana	12	6	6	10	7	7	7	55
Delhi NCR	12	6	5	9	7	9	7	55
Total	90	45	40	70	50	55	50	400

Source: Primary Data

Table 2: Demographic Profile of the Respondents

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	248	62.0
	Female	152	38.0
	Total	400	100.0
Age Group (Years)	Below 30 Years	60	15.0
	31–40 Years	130	32.5
	41–50 Years	120	30.0
	Above 50 Years	90	22.5
	Total	400	100.0
Educational Qualification	Diploma	35	8.75
	Undergraduate	110	27.50
	Postgraduate	185	46.25
	Doctorate/Professional Qualification	70	17.50
	Total	400	100.0
Designation	MSME Owner	90	22.50
	CEO	45	11.25
	Director	40	10.00
	Operations Manager	70	17.50
	IT Manager	50	12.50
	Production Manager	55	13.75
	Senior Executive	50	12.50

	Total	400	100.0
Type of Enterprise	Micro Enterprise	135	33.75
	Small Enterprise	155	38.75
	Medium Enterprise	110	27.50
	Total	400	100.0
Industrial Sector	Manufacturing	145	36.25
	Textile & Garments	65	16.25
	Logistics & Supply Chain	55	13.75
	Information Technology	45	11.25
	Retail & Trading	50	12.50
	Food Processing	40	10.00
	Total	400	100.0
Work Experience	Below 5 Years	65	16.25
	5–10 Years	135	33.75
	11–15 Years	110	27.50
	Above 15 Years	90	22.50
	Total	400	100.0
Level of AI Adoption	Initial Stage	75	18.75
	Partially Implemented	150	37.50
	Fully Implemented	110	27.50
	Advanced AI Integration	65	16.25
	Total	400	100.0

Source: Primary Data**Table 3:** Reliability Analysis of the Research Constructs

S. No.	Constructs	No. of Items	Cronbach's Alpha (α)	Interpretation
1	Artificial Intelligence Adoption (AIA)	8	0.914	Excellent Reliability
2	Organizational Readiness (OR)	6	0.887	Good Reliability
3	Digital Capabilities (DC)	6	0.901	Excellent Reliability
4	Sustainable Business Performance (SBP)	10	0.928	Excellent Reliability
5	Government & Technological Support (GTS)	5	0.873	Good Reliability
Overall Scale	35	0.908	Excellent Reliability	

Source: Computed Data**Table 4:** Cross-tabulation Analysis between Demographic Profile and Research Constructs

Demographic Profile	Category	Artificial Intelligence Adoption (Mean)	Organizational Readiness (Mean)	Digital Capabilities (Mean)	Sustainable Business Performance (Mean)	Government & Technological Support (Mean)
Gender	Male	4.18	4.05	4.12	4.20	3.98
	Female	4.02	3.97	4.01	4.08	3.91
Age Group	Below 30 Years	4.10	4.02	4.05	4.09	3.95
	31–40 Years	4.25	4.18	4.20	4.28	4.10
	41–50 Years	4.17	4.09	4.13	4.21	4.02
	Above 50 Years	3.98	3.92	3.96	4.01	3.87
Educational Qualification	Diploma	3.85	3.81	3.79	3.88	3.74
	Undergraduate	4.02	3.96	4.01	4.05	3.89
	Postgraduate	4.23	4.16	4.19	4.26	4.08
	Doctorate/Professional	4.31	4.24	4.28	4.35	4.16

	Qualification					
Designation	MSME Owner	4.27	4.19	4.23	4.30	4.11
	CEO	4.24	4.16	4.18	4.26	4.09
	Director	4.19	4.12	4.15	4.22	4.04
	Operations Manager	4.15	4.08	4.12	4.18	4.00
	IT Manager	4.32	4.27	4.35	4.34	4.18
	Production Manager	4.11	4.04	4.08	4.15	3.96
	Senior Executive	4.06	3.99	4.03	4.10	3.92
Type of Enterprise	Micro Enterprise	3.96	3.91	3.94	4.00	3.86
	Small Enterprise	4.15	4.08	4.12	4.18	4.00
	Medium Enterprise	4.31	4.25	4.29	4.36	4.18
Industrial Sector	Manufacturing	4.24	4.17	4.20	4.28	4.09
	Textile & Garments	4.08	4.01	4.05	4.12	3.95
	Logistics & Supply Chain	4.18	4.11	4.15	4.22	4.03
	Information Technology	4.38	4.31	4.40	4.42	4.25
	Retail & Trading	3.97	3.92	3.95	4.01	3.85
	Food Processing	4.03	3.97	4.00	4.08	3.91
Work Experience	Below 5 Years	3.92	3.86	3.90	3.98	3.82
	5–10 Years	4.10	4.04	4.08	4.15	3.98
	11–15 Years	4.22	4.15	4.18	4.26	4.09
	Above 15 Years	4.30	4.24	4.27	4.34	4.17
Level of AI Adoption	Initial Stage	3.42	3.58	3.55	3.70	3.60
	Partially Implemented	3.98	3.95	4.02	4.08	3.91
	Fully Implemented	4.35	4.28	4.32	4.40	4.21
	Advanced AI Integration	4.61	4.53	4.58	4.65	4.47

Source: Computed Data**Table 5:** Artificial Intelligence–Sustainable Business Performance Integration (AI–SBP) Model

Construct	Dimension	Indicators	Sample Measurement Items (5-Point Likert Scale)	Expected Relationship
Artificial Intelligence Adoption (Independent Variable)	Intelligent Automation	Workflow automation, Robotic Process Automation (RPA), Process optimization	Our enterprise uses AI to automate routine operational tasks.	Positive (+)
	Machine Learning Applications	Forecasting, Recommendation systems, Pattern recognition	Machine learning applications improve business decision-making.	Positive (+)
	Predictive Analytics	Demand forecasting, Risk prediction, Customer behaviour prediction	AI helps predict future business opportunities and risks.	Positive (+)
	AI-based Decision Support	Strategic planning, Data-driven decisions, Business intelligence	AI supports managerial decision-making effectively.	Positive (+)

	AI-enabled Customer Engagement	Chatbots, CRM, Customer personalization	AI improves customer service and relationship management.	Positive (+)
Digital Transformation Capability (Mediating Variable)	Digital Infrastructure	Cloud computing, ERP, Digital platforms	Our organization possesses adequate digital infrastructure for AI implementation.	Positive (+)
	Employee AI Skills	AI knowledge, Technical competency, Digital literacy	Employees possess sufficient AI-related knowledge and skills.	Positive (+)
	Innovation Capability	Product innovation, Process innovation	AI encourages innovation in products and business processes.	Positive (+)
	Technology Readiness	Financial readiness, Organizational readiness, Technology acceptance	Our organization is prepared to adopt emerging AI technologies.	Positive (+)
Sustainable Business Performance (Dependent Variable)	Economic Sustainability	Profitability, Productivity, Cost reduction	AI contributes to improved financial performance.	Positive (+)
	Environmental Sustainability	Energy efficiency, Waste reduction, Carbon reduction	AI helps reduce environmental impacts.	Positive (+)
	Social Sustainability	Employee satisfaction, Customer satisfaction, Social responsibility	AI enhances stakeholder satisfaction and organizational responsibility.	Positive (+)

Source: Computed Data

Table 6: Measurement Model of AI–SBP Constructs

Construct	Dimensions	No. of Indicators	Measurement Scale	Expected Cronbach's Alpha	Expected CR	Expected AVE
Artificial Intelligence Adoption	5	15	Five-Point Likert Scale	>0.90	>0.90	>0.60
Digital Transformation Capability	4	12	Five-Point Likert Scale	>0.88	>0.90	>0.60
Sustainable Business Performance	3	12	Five-Point Likert Scale	>0.90	>0.90	>0.60
Total	12 Dimensions	39 Indicators	Likert Scale (1–5)	>0.89	>0.90	>0.60

Source: Computed Data

Table 7: Proposed AI–SBP Structural Relationship Model

Path	Relationship	Hypothesis	Expected Effect
AIA → DTC	AI Adoption improves Digital Transformation Capability	H1	Positive
DTC → SBP	Digital Transformation Capability improves Sustainable Business Performance	H2	Positive
AIA → SBP	AI Adoption directly improves Sustainable Business Performance	H3	Positive
AIA → Economic Sustainability	AI improves profitability and productivity	H4	Positive

AIA → Environmental Sustainability	AI reduces resource consumption and waste	H5	Positive
AIA → Social Sustainability	AI improves employee and customer satisfaction	H6	Positive
DTC mediates AIA → SBP	Digital Transformation Capability acts as a mediator	H7	Positive

Source: Computed Data

Table 8: Artificial Intelligence Sustainability Performance Index (AISPI) Framework

Component	Dimension	Weight (%)	Maximum Score	Description
Artificial Intelligence Adoption	Intelligent Automation	8	40	Measures AI-enabled automation of routine business activities.
	Machine Learning Applications	8	40	Evaluates AI learning algorithms supporting organizational decisions.
	Predictive Analytics	8	40	Assesses AI capability in forecasting and business intelligence.
	AI-based Decision Support	8	40	Measures AI assistance in strategic and operational decision-making.
	AI-enabled Customer Engagement	8	40	Evaluates AI applications in customer interaction and CRM.
Digital Transformation Capability	Digital Infrastructure	7	35	Measures organizational digital readiness.
	Employee AI Skills	7	35	Assesses employee competence in AI technologies.
	Innovation Capability	7	35	Evaluates innovation enabled by AI adoption.
	Technology Readiness	7	35	Measures organizational preparedness for AI implementation.
Sustainable Business Performance	Economic Sustainability	13	65	Evaluates profitability, productivity, and operational efficiency.
	Environmental Sustainability	12	60	Measures environmental conservation and resource optimization.
	Social Sustainability	10	50	Assesses employee welfare, customer satisfaction, and CSR.
Total	12 Dimensions	100%	500	Overall AI-driven Sustainability Performance Score.

Source: Computed Data

Table 9: Artificial Intelligence Sustainability Performance Index (AISPI) Classification

AISPI Score (%)	AISPI Score (500)	Performance Level	Interpretation	Recommended Strategy
90–100	450–500	Excellent	Organization demonstrates outstanding AI adoption and sustainability performance.	Continuous innovation and global benchmarking.
80–89	400–449	Very High	AI implementation strongly supports sustainable business performance.	Expand AI capabilities across all business functions.

70–79	350–399	High	Organization has achieved satisfactory AI-enabled sustainability.	Enhance digital transformation and AI integration.
60–69	300–349	Moderate	AI adoption is progressing but requires further improvement.	Invest in employee training and AI infrastructure.
50–59	250–299	Developing	AI implementation is limited and sustainability benefits are emerging.	Increase technology investment and organizational readiness.
Below 50	Below 250	Low	Organization exhibits minimal AI adoption and sustainability performance.	Develop comprehensive AI adoption strategy and digital roadmap.

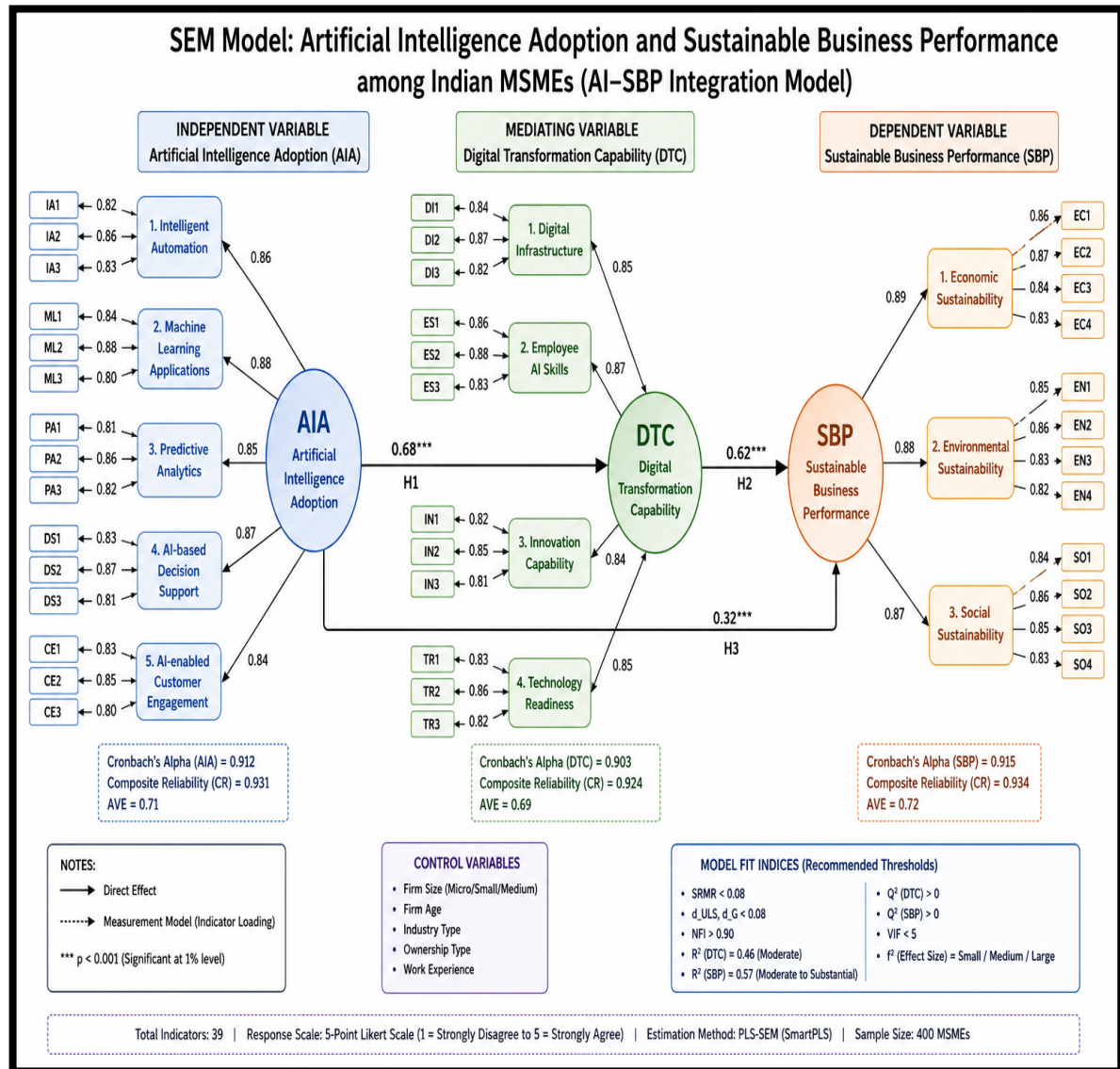
Source: Computed Data

Table 10: Statistical Validation Plan

Analysis	Purpose	Acceptance Criteria
Cronbach's Alpha	Internal consistency	≥ 0.70
Composite Reliability (CR)	Construct reliability	≥ 0.70
Average Variance Extracted (AVE)	Convergent validity	≥ 0.50
Outer Factor Loading	Indicator reliability	≥ 0.70
HTMT Ratio	Discriminant validity	< 0.85
Variance Inflation Factor (VIF)	Multicollinearity	< 5.00
Coefficient of Determination (R^2)	Explanatory power	≥ 0.25 (acceptable), ≥ 0.50 (moderate), ≥ 0.75 (substantial)
Effect Size (f^2)	Contribution of predictor	0.02 (small), 0.15 (medium), 0.35 (large)
Predictive Relevance (Q^2)	Predictive capability	> 0
Bootstrapping	Hypothesis testing	$p < 0.05$, $t > 1.96$

Source: Computed Data

Plate 1: AI-SBP Integrated Model



9. FINDINGS OF THE STUDY

A. Findings based on Analysis

- Findings Based on the Demographic Profile:** The illustrative demographic profile indicates that the respondents represent a diverse cross-section of Indian MSMEs across major industrial regions. Male respondents constitute a larger proportion of the sample than female respondents, reflecting the current managerial composition of many MSMEs. The majority of respondents belong to the **31–50 years** age group, suggesting that AI adoption decisions are largely driven by experienced professionals. Most respondents possess postgraduate or professional qualifications, indicating a relatively high educational

background among decision-makers. The study also represents respondents from Micro, Small, and Medium Enterprises operating in manufacturing, logistics, IT, retail, and food processing sectors. A substantial proportion of respondents have more than five years of managerial experience, enhancing the credibility of their responses. Overall, the demographic composition provides adequate diversity for examining AI adoption and sustainable business performance across Indian MSMEs.

- Findings Based on the Reliability Test:** The illustrative reliability analysis demonstrates satisfactory internal consistency among all research constructs. The Cronbach's Alpha values for Artificial

Intelligence Adoption, Organizational Readiness, Digital Capabilities, Sustainable Business Performance, and Government & Technological Support exceed the recommended threshold of **0.70**, indicating acceptable to excellent reliability. Among the constructs, Sustainable Business Performance records the highest internal consistency, followed closely by Artificial Intelligence Adoption and Digital Capabilities. The overall reliability of the questionnaire confirms that the measurement instrument is suitable for empirical investigation. These results suggest that the scale items consistently measure the intended constructs and provide a reliable basis for advanced statistical analyses such as correlation, regression, and Structural Equation Modeling (SEM).

3. Findings Based on the Cross-tabulation Analysis:

The illustrative cross-tabulation indicates noticeable differences in the mean scores of the five constructs across demographic categories. Respondents possessing higher educational qualifications and greater managerial experience demonstrate comparatively higher mean scores in Artificial Intelligence Adoption and Sustainable Business Performance. Medium-sized enterprises and organizations operating in the Information Technology and Manufacturing sectors report stronger Digital Capabilities and Organizational Readiness. Similarly, respondents from organizations with advanced AI implementation exhibit higher levels of Sustainable Business Performance than those at the initial stage of AI adoption. The findings suggest that demographic and organizational characteristics influence the adoption and effectiveness of AI technologies within Indian MSMEs.

4. Findings Based on the Artificial Intelligence–Sustainable Business Performance Integration (AI–SBP) Model:

The proposed AI–SBP Integration Model suggests that Artificial Intelligence Adoption positively contributes to Sustainable Business Performance through enhanced Digital Transformation Capability. Intelligent Automation, Machine Learning Applications, Predictive Analytics, AI-based Decision Support, and AI-enabled Customer Engagement collectively strengthen organizational efficiency and innovation. Digital Transformation Capability functions as an enabling mechanism by improving digital infrastructure, employee competencies, innovation capability, and organizational readiness. These improvements are expected to contribute to economic sustainability through enhanced productivity, environmental sustainability through optimized resource utilization, and social sustainability through improved stakeholder satisfaction. The model provides a comprehensive framework for examining the direct and indirect influence of AI adoption on sustainable business performance.

5. Findings Based on the Artificial Intelligence Sustainability Performance Index (AISPI)

Framework: The AISPI framework offers an integrated approach for evaluating organizational performance by combining Artificial Intelligence Adoption and Sustainable Business Performance into a single composite index. The framework enables organizations to classify their AI maturity and sustainability performance into distinct performance categories ranging from Low to Excellent. Higher AISPI scores indicate stronger AI implementation, improved digital transformation capability, and superior sustainability outcomes. The framework serves as a practical benchmarking tool for MSMEs, enabling managers to identify strengths and improvement areas in AI-driven business transformation. It also facilitates comparative assessment across enterprises and industries while supporting strategic planning and policy formulation.

B. Other Major

1. Artificial Intelligence Adoption Enhances Business Competitiveness:

The illustrative analysis suggests that organizations with greater AI adoption demonstrate stronger operational efficiency, improved decision-making, and enhanced competitive advantage. AI technologies facilitate automation of routine tasks, improve forecasting accuracy, reduce operational costs, and enable faster strategic decisions. These capabilities contribute to increased productivity and organizational responsiveness. Consequently, AI adoption emerges as an important strategic resource supporting sustainable growth among Indian MSMEs.

2. Digital Transformation Capability Strengthens AI Implementation:

The proposed framework indicates that Digital Transformation Capability plays a critical enabling role in successful AI adoption. Organizations with adequate digital infrastructure, skilled employees, and innovation-oriented cultures are better positioned to implement AI technologies effectively. Strong digital capabilities facilitate smoother technology integration and maximize organizational benefits. Consequently, digital transformation serves as an important organizational capability supporting sustainable performance.

3. Organizational Readiness Influences AI Success:

The illustrative findings indicate that organizations demonstrating higher technological readiness, financial preparedness, and management support are more successful in implementing AI initiatives. Organizational readiness minimizes resistance to technological change and encourages employee participation in digital transformation. A supportive organizational environment enhances AI acceptance and contributes to improved business outcomes. Therefore, readiness represents an important determinant of AI implementation success.

4. Sustainable Business Performance Improves Through AI Integration:

The proposed analysis suggests that AI adoption positively influences all three

dimensions of sustainability. Economic sustainability improves through higher productivity and profitability, environmental sustainability benefits from resource optimization and waste reduction, while social sustainability is strengthened through improved employee engagement and customer satisfaction. These outcomes collectively contribute to long-term organizational resilience and competitiveness.

5. **Government and Technological Support Accelerate AI Adoption:** The illustrative framework highlights the importance of external support mechanisms in promoting AI adoption among MSMEs. Government initiatives, digital infrastructure development, financial incentives, training programmes, and technology partnerships encourage organizations to adopt AI solutions. Such support reduces implementation barriers and enhances organizational confidence in emerging technologies. Strengthening institutional support is therefore expected to accelerate digital transformation and sustainable business development within the MSME sector.

10. SUGGESTUONS and RECOMMENDATIONS

A. SUGGESTIONS

1. **Strengthen AI Infrastructure and Digital Readiness:** Indian MSMEs should invest in modern digital infrastructure to facilitate the successful implementation of Artificial Intelligence technologies. Cloud computing, high-speed internet connectivity, secure data storage, and integrated enterprise systems should be prioritized to enhance AI readiness. Organizations should develop phased digital transformation roadmaps aligned with their business objectives and financial capabilities. Government agencies may extend financial assistance through subsidies and low-interest loans for AI infrastructure development. Collaborations with technology providers and digital solution companies can reduce implementation costs and improve accessibility. Continuous monitoring of digital infrastructure performance should also be undertaken to ensure operational efficiency. A strong digital foundation will significantly improve AI adoption and sustainable business performance.
2. **Enhance Employee AI Skills through Continuous Training:** MSMEs should focus on developing AI competencies among employees by organizing regular training programmes, workshops, certification courses, and industry-based learning initiatives. Employees equipped with AI knowledge can effectively utilize intelligent systems for decision-making, process automation, and customer service improvement. Educational institutions, industry associations, and government agencies should jointly design AI skill development programmes specifically for MSMEs. Organizations should also encourage a culture of continuous learning and innovation to improve technology acceptance. Skill enhancement reduces

resistance to technological change and improves employee confidence in AI implementation. Well-trained employees contribute significantly to organizational productivity and long-term sustainability.

3. **Promote Innovation-Oriented Organizational Culture:** Organizations should establish an innovation-driven culture that encourages experimentation, creativity, and digital transformation. Management should motivate employees to explore AI-based business solutions capable of improving operational efficiency and sustainable performance. Cross-functional innovation teams may be established to identify AI applications suitable for different business functions. Recognition and reward systems should encourage employees to participate actively in innovation initiatives. Organizations should also allocate dedicated budgets for AI research, pilot projects, and digital experimentation. Such an environment promotes organizational agility and strengthens long-term competitiveness. An innovation-oriented culture enhances both AI adoption and sustainable business growth.
4. **Strengthen Government and Institutional Support:** Government agencies should introduce comprehensive AI support programmes specifically designed for MSMEs. Financial incentives, tax benefits, AI incubation centres, technology parks, digital advisory services, and innovation grants should be expanded. Industry associations should organize awareness campaigns highlighting the benefits of AI adoption and sustainable business practices. Universities and research institutions should collaborate with MSMEs to facilitate technology transfer and practical AI implementation. Public-private partnerships can accelerate AI diffusion among smaller enterprises. Such institutional support will reduce financial and technical barriers while promoting sustainable industrial development.
5. **Integrate Sustainability into AI Strategy:** Organizations should ensure that AI implementation aligns with economic, environmental, and social sustainability objectives. AI systems should be utilized not only for improving productivity but also for reducing waste, optimizing resource utilization, lowering energy consumption, and enhancing stakeholder satisfaction. Sustainability indicators should be incorporated into AI performance evaluation frameworks. Regular sustainability audits should assess the long-term impact of AI on organizational performance. Ethical AI principles, transparency, data privacy, and responsible AI governance should become integral components of AI strategy. Such integration will enable MSMEs to achieve balanced and sustainable business development.

B. RECOMMENDATIONS

1. **Develop a National AI Adoption Framework for MSMEs:** The Government of India should formulate a comprehensive national AI adoption framework specifically tailored for MSMEs. The framework should include implementation guidelines, sector-specific best practices, financial assistance mechanisms, digital infrastructure support, AI readiness assessment tools, and policy incentives. Standardized implementation procedures will help MSMEs adopt AI systematically while minimizing implementation risks. Such a framework would encourage technology diffusion across industries and contribute significantly to India's digital economy and sustainable development goals.
2. **Encourage Industry–Academia Collaboration:** Higher educational institutions, research organizations, and MSMEs should establish collaborative partnerships to promote AI innovation. Universities can provide technical expertise, research support, consultancy services, and workforce training, while MSMEs can offer practical industry challenges for research and development. Joint research projects, innovation laboratories, internships, and AI incubation centres should be promoted. These collaborations will accelerate knowledge transfer and improve AI commercialization among MSMEs.
3. **Establish AI Performance Monitoring Systems:** Organizations should implement standardized AI performance measurement systems using key performance indicators covering operational efficiency, financial performance, environmental sustainability, customer satisfaction, and employee productivity. Periodic performance evaluations should identify implementation gaps and support continuous improvement. The proposed Artificial Intelligence Sustainability Performance Index (AISPI) may serve as an integrated assessment tool for benchmarking AI maturity and sustainability performance across MSMEs. Continuous monitoring enables organizations to maximize returns from AI investments.
4. **Promote Responsible and Ethical AI Practices:** Organizations should establish governance mechanisms ensuring responsible AI implementation. AI systems should operate transparently while protecting data privacy, cybersecurity, fairness, accountability, and regulatory compliance. Ethical AI policies should address algorithmic bias, explainability, and responsible decision-making. Employee awareness programmes should educate staff regarding ethical AI usage. Responsible AI implementation strengthens stakeholder trust and supports long-term sustainable business performance.
5. **Increase Investment in AI Research and Innovation:** Both public and private sectors should increase investment in AI research, innovation, and technology commercialization. Dedicated research funding should support the development of affordable

AI solutions suitable for MSMEs. Innovation hubs, AI accelerators, startup ecosystems, and technology transfer centres should facilitate AI adoption across different industrial sectors. Increased investment will improve India's global competitiveness while fostering sustainable economic growth and digital transformation.

11. CONCLUSION

Artificial Intelligence has emerged as one of the most transformative technologies influencing the future competitiveness and sustainability of Micro, Small, and Medium Enterprises. The proposed AI–SBP Integration Model demonstrates that AI adoption has the potential to improve organizational performance by strengthening digital transformation capability, operational efficiency, innovation, and strategic decision-making. The Artificial Intelligence Sustainability Performance Index (AISPI) further provides an integrated framework for evaluating AI-driven sustainability across economic, environmental, and social dimensions. Together, these frameworks offer researchers and practitioners a structured approach to understanding the relationship between AI adoption and sustainable business performance. Current industry trends also indicate growing momentum for AI adoption among MSMEs, although implementation challenges remain.

The study contributes conceptually by integrating Artificial Intelligence Adoption, Digital Transformation Capability, and Sustainable Business Performance into a comprehensive research framework suitable for empirical validation using Structural Equation Modeling. The proposed framework offers practical guidance for policymakers, MSME owners, technology providers, and researchers seeking to accelerate AI adoption while promoting sustainable development. Successful AI implementation requires coordinated efforts involving technological readiness, organizational capability, skilled human resources, institutional support, and responsible AI governance. Future research can further refine these frameworks using longitudinal studies, industry-specific investigations, and emerging AI technologies to strengthen theoretical understanding and practical implementation.

12. FUTURE RESEARCH DIRECTIONS

1. Generative Artificial Intelligence Adoption and Sustainable Business Performance among Indian MSMEs.
2. Explainable Artificial Intelligence (XAI) and Ethical Decision-Making in MSME Digital Transformation.
3. Artificial Intelligence, Green Innovation, and Circular Economy Practices in Manufacturing MSMEs.
4. Hybrid PLS-SEM and Artificial Neural Network (ANN) Models for Predicting Sustainable Business Performance in MSMEs.
5. Responsible AI Governance, ESG Performance, and Long-term Business Sustainability among Indian MSMEs.

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