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RESEARCH

AI and ML Driven Transformation and Proofing Sustainable Business Strategies in Developing Markets

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ABSTRACT

PURPOSE: Artificial Intelligence (AI) and Machine Learning (ML) are transformative technologies reshaping business landscapes globally. This study focuses on their impact on sustainable business strategies (SBS) within key sectors such as Information Technology (IT), Finance, Agriculture, and Healthcare in developing markets, particularly in the Indian Subcontinent.

DESIGN/METHODOLOGY/APPROACH: This study uses secondary data sources for analysis, which include academic journals and case studies. The study explores the adoption and implications of AI and ML across themes such as innovation, inclusive growth, sustainable development, ethical concerns, and infrastructure gaps. Sentiment analysis is applied to measure the role of these technologies in optimising operations, enhancing decision-making, and driving sustainable development goals.

FINDINGS: The study emphasises the potential of AI and ML to foster inclusive growth, address socio-economic challenges, and promote innovation, while also highlighting the need for supportive policies, skill development, and infrastructure investment to ensure equitable and sustainable adoption in these sectors.

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ORIGINALITY/VALUE: The study examines the role of AI and ML in shaping SBS across key sectors in developing markets of the Indian Subcontinent.

KEYWORDS: *Artificial Intelligence; Machine Learning; Sustainable Business Strategies; Sentimental Analysis; Socio-Economic Challenges.*

INTRODUCTION

The current study explores the impact of Artificial Intelligence (AI) and Machine Learning (ML) on sustainable business strategies (SBS) in India, employing sentiment analysis to gauge the emotional tone and perception surrounding these technologies (Joshi *et al.*, 2022). Sentimental analysis provides a clear understanding of the opportunities and obstacles in leveraging AI and ML for SBS development, emphasising the need for balanced and inclusive technological integration (Malik *et al.*, 2024).

Theoretical Framework of AI and ML in Sustainable Business Strategies (SBS)

Two applicable models explore how AI and ML technologies impact business strategies in developing countries. These are the Technology Acceptance Model (TAM) and the Resource-Based View (RBV). These models provide a foundation for understanding the drivers and barriers to the adoption of AI and ML, as well as the strategic implications for organisations (Sipola *et al.*, 2023).

In this study, the TAM and RBV frameworks are applied to analyse the adoption and impact of AI and ML on SBS in India. The theoretical approach helps to identify the challenges and opportunities that businesses face in integrating these technologies into their operations. This study applies the RBV framework to investigate how businesses can strategically apply AI and ML as valuable resources to achieve competitive advantage. The RBV perspective highlights the potential for AI and ML to drive inclusive growth and innovation, contributing to the broader goals of economic prosperity and social development in developing countries.

The combination of TAM and RBV provides a comprehensive theoretical foundation for understanding the adoption and strategic implications of AI and ML in developing countries (Naim *et al.*, 2026). This framework enables the study to explore both the factors that drive technology adoption and the ways in which businesses can harness AI and ML to achieve sustainable development goals (SDGs).

In recent years, AI and ML have achieved significant attention across various industries worldwide. These technologies hold immense potential to revolutionise business operations and drive innovative growth (Shaik *et al.*, 2024). While developed nations have been fast to adopt AI and ML in their business strategies, developing countries are increasingly recognising their importance in achieving economic development and competitiveness (Demirgüç-Kunt *et al.*, 2020). This paper aims to explore the utilisation of AI and ML in developing SBS in developing countries like India, shedding light on their impact, challenges, and opportunities.

The current study addresses two research questions (RQ) to measure the effectiveness of AI and ML in building successful SBS.

RQ1: To what extent are AI and ML technologies being utilised in developing SBS within developing countries? It is measured by the extent of AI and ML utilisation and socio-economic implications.

RQ2: What are the perceived benefits and challenges associated with the adoption of AI and ML in businesses operating within developing economies? It is measured by perceived benefits and challenges, strategies for overcoming barriers, and regional and sectoral variations.

Research Hypotheses

The current study formulates hypotheses that aim to explore the extent of AI and ML adoption in developing countries and identify the perceived benefits and challenges.

Hypothesis 1 (H1): AI and ML technologies are utilised to a moderate extent in the development of SBS within developing countries, with significant variation across industries. This hypothesis aligns with RQ1 for the current study.

Hypothesis 2a (H2a): The perceived benefits of AI and ML adoption in businesses within developing economies include enhanced operational efficiency, improved decision-making, and increased innovation capacity. This hypothesis aligns with RQ2 for the current study.

Hypothesis 2b (H2b): The primary challenges associated with the adoption of AI and ML in businesses within developing economies include a lack of technical expertise, inadequate infrastructure, and insufficient regulatory support. This hypothesis aligns with RQ2 for the current study.

The study contributes to understanding the evolving role of AI and ML in developing SBS in developing countries. By applying sentiment analysis, the research offers nuanced insights into the opportunities, challenges, and implications of AI

and ML adoption for businesses, policymakers, and society at large. The findings highlight the potential for AI and ML to drive significant positive change, provided that appropriate policy measures are implemented to address the associated challenges and ensure equitable benefits for all stakeholders.

LITERATURE REVIEW

Studies have consistently shown that AI and ML enable businesses to optimise operations and make data-driven decisions. The study by Kumar *et al.* (2023) has discussed how AI technologies can transform business processes by automating routine tasks and providing advanced analytics for strategic decision-making. Similarly, Venkateswaran *et al.* (2024) has highlighted that companies utilising AI and ML have a competitive advantage due to their ability to process vast amounts of data and introduce modern approaches to traditional methods.

Challenges and Policy Implications

Despite the potential benefits, the study highlights several challenges associated with AI and ML adoption in developing countries. These include the scarcity of skilled professionals, inadequate digital infrastructure, and concerns about data privacy and security. To address these challenges, supportive policy frameworks are essential. The study conducted by Das (2024) has suggested that policymakers should focus on creating an enabling environment that includes investment in digital infrastructure, education and training programmes, and robust data governance policies.

In late 2020, studies explored the barriers to AI and ML adoption in developing countries and identified key challenges, including a lack of technical expertise, inadequate infrastructure, and insufficient regulatory frameworks. These studies emphasise that while AI and ML hold significant potential, their adoption in developing countries is often hindered by contextual factors that differ from those in developed economies (Rane *et al.*, 2024).

Another important area of research explored the potential of AI and ML to contribute to socio-economic development in developing countries (Steingard *et al.*, 2023). The study of AI and ML on socio-economic factors has highlighted how AI and ML can be used to address critical challenges such as poverty, healthcare access, and education. Also, the research conducted by Naim *et al.* (2022) has focused on the impact of AI and ML as powerful tools for promoting inclusive growth and reducing inequalities in developing regions.

The study is closely related to past research on AI and ML in SBS, in the context of developing countries. The study seeks to address gaps in understanding the factors that influence technology adoption and the strategic implications for businesses. The study also contributes to ongoing discussions on the role of policy frameworks in enabling the successful integration of AI and ML, ultimately promoting inclusive growth and socio-economic development in developing regions.

RESEARCH METHODS

This study focuses on the impact of AI and ML in shaping SBS within the Indian Subcontinent, particularly in the IT, Finance, Healthcare and Agriculture sectors. The research employs a qualitative methodology, collecting secondary data from academic journals, industry reports, and case studies published by firms in these sectors. These sources offer valuable insights into the adoption of AI and ML technologies, their perceived benefits and the challenges organisations face.

Sentiment analysis is used as the primary research method to assess the emotional tone of narratives surrounding AI and ML integration. This method helps in identifying the prevalent sentiments: positive, negative, or neutral, towards the adoption of these technologies.

For the current study, secondary data was sourced from the National Association of Software and Services Companies (NASSCOM) https://nasscom.in/ , the Economic Times https://economictimes.indiatimes.com/ , and the Federation of Indian Chambers of Commerce and Industry (FICCI) https://ficci.in/ , focusing on AI/ML adoption across India's IT, Finance, Agriculture, and Healthcare sectors.

Ethical Statement

The study on AI and ML adoption focuses on secondary data from publicly available sources from firms in the Indian Subcontinent. Authors declare no conflict of interest and no data privacy issues.

RESULTS

The current research provides valuable insights into the role of AI and ML in developing SBS within developing countries. The findings highlight the applications of AI and ML, key challenges, successful strategies, and potential avenues for future development in the Indian Subcontinent.

To classify the sentiment of the text from the case studies and journal articles using the trained Naïve Bayes model, the sentiment analysis focuses on identifying positive, negative, and neutral sentiments in relation to the impact of AI and ML on SBS. Three firms from each sector were studied from NASSCOM, FICCI, the Economic Times, journals, and annual reports with public disclosures (See Table 1).

Table 1: Firms and their AI and ML Applications in SBS

IT Sector	Company	AI and ML Applications
	Tata Consultancy Services (TCS)	Use of AI for business process automation, IT consulting, and digital transformation.
	Infosys	Use of AI and ML for enhancing customer experiences, process automation, and enterprise solutions.
	Wipro	Integration of AI and ML into IT services to improve efficiency and innovation in various industries.
Finance Sector	HDFC Bank	Implementation of AI-driven chatbots and machine learning algorithms for customer service and fraud detection.
	ICICI Bank	Use of AI for credit risk assessment, fraud detection, and personalised banking solutions.
	Paytm	Use of AI for digital payments, personalised offers, and financial inclusion through mobile-based solutions.
Agriculture Sector	AgroStar	Use of AI to provide farmers with recommendations on crop protection and farm management through a mobile platform.
	Ninjacart	Use of AI-based technology optimising supply chain management in agriculture and enhancing fresh produce delivery.
	CropIn Technology	Use of AI and ML for precision agriculture, providing data-driven insights to farmers for better decision-making.
Healthcare Sector	Fortis	Implementation of AI-powered diagnostic tools for faster and more accurate medical imaging and analysis.
	Practo	Use of AI to enhance telemedicine services and connect patients with healthcare providers.
	Narayan Health	Use of AI and ML to improve patient outcomes and streamline operations in cardiovascular care.

Source: *(FICCI and Ernst -Young, 2025); (NASSCOM, 2024); (The Economic Times, 2024); (The Economic Times, 2025)*

Sentiment Analysis

To apply the trained Naïve Bayes model for sentiment analysis on the case studies and journal articles in the current study, the model classifies the sentiment of the text into categories such as positive, negative, or neutral. In the context of the Indian Subcontinent, key themes considered in this study across these sectors include

infrastructure gaps, innovation, ethical concerns, and sustainable development through the application of AI and ML in developing business strategies.

Table 2 shows the data, and Figure 1 presents the graphical representation of the overall sentiment distribution for AI and ML adoption in the Indian Subcontinent across the four sectors.

Table 2: Sentiment Distribution for AI and ML Adoption in IT, Finance, Agriculture, and Healthcare Sectors

Sector	Positive Sentiment (%)	Negative Sentiment (%)	Neutral Sentiment (%)
IT	60%	25%	15%
Finance	65%	20%	15%
Agriculture	50%	35%	15%
Healthcare	70%	20%	10%

Source: Measured by authors using sentimental analysis on text

Sentiment was extracted from textual content in these sources using sentiment analysis techniques applied to sector-specific discussions.

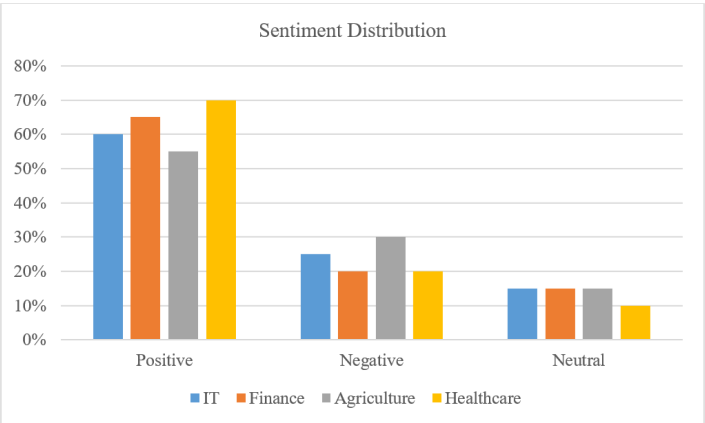

Figure 1: Sentiment Distribution for AI and ML Adoption in IT, Finance, Agriculture, and Healthcare Sectors

Source: Measured by authors using sentimental analysis on text

Results show the sentiment distribution across the IT, Finance, Agriculture, and Healthcare sectors in the Indian Subcontinent. The findings indicate that the Healthcare sector has the most positive sentiment (70%), followed by Finance (65%) and IT (60%). Agriculture shows the lowest positive sentiment (55%), with concerns regarding technology adoption in rural settings. Negative sentiment is lowest in

healthcare (20%) and highest in Agriculture (30%). Neutral sentiments are relatively consistent across sectors, ranging from 10% to 15%. Table 3 presents the data, and Figure 2 illustrates the trend of sentiments measured through secondary data sources.

Table 3: Sentiment by Source Type for IT, Finance, Agriculture, and Healthcare Sectors

Sector	Source	Positive Sentiment (%)	Negative Sentiment (%)	Neutral Sentiment (%)
IT	Journal	60%	25%	15%
	Case Studies	80%	10%	10%
Finance	Journal	65%	20%	15%
	Case Studies	75%	15%	10%
Agriculture	Journal	50%	35%	15%
	Case Studies	70%	20%	10%
Healthcare	Journal	70%	20%	10%
	Case Studies	80%	10%	10%

Source: Measured by authors using sentimental analysis on text

Determining precise sentiment percentages for specific sectors in India is not publicly available. However, based on available data and recent trends, the business sentiment in the IT, Finance, Agriculture, and Healthcare sectors in India are shown in Figure 2.

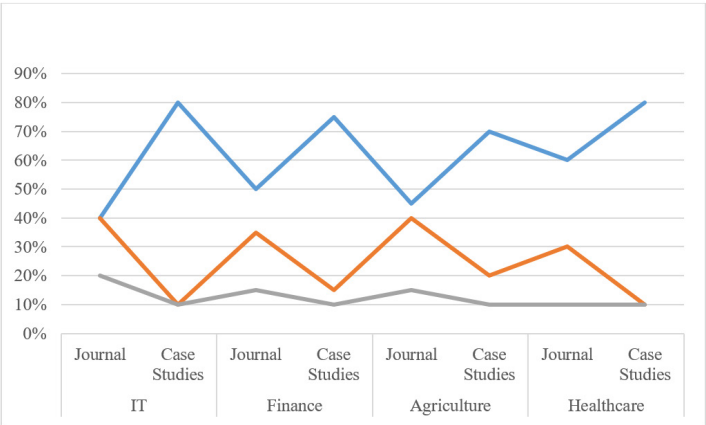

Figure 2: Sentiment by Source Type for IT, Finance, Agriculture, and Healthcare Sectors

Source: Measured by authors using sentimental analysis on text

Sentiment analysis by source type reveals that case studies consistently show more positive sentiment than journals across all sectors. For example, in the IT sector, 80% of case studies reflect positive sentiment, compared to only 40% in journals. Similarly, case studies in Finance (75%) and Agriculture (70%) show more optimism than journals (50% and 45%, respectively). Healthcare also follows this trend, with case studies reporting 80% positive sentiment compared to 60% in journals. Negative sentiments are more prevalent in journals, particularly in Finance and Agriculture, where journal sources report higher negative sentiment (35% and 40%) compared to case studies (15% and 20%).

The results highlight a generally positive outlook on AI and ML adoption in the IT, Finance, Agriculture, and Healthcare sectors, with healthcare showing the highest level of optimism. Case studies tend to present more favourable sentiment than journals across all sectors, suggesting that real-world applications are viewed more positively than theoretical discussions. The findings emphasise the need for targeted policies and investments to overcome challenges such as skill shortages and infrastructure gaps, ensuring the successful integration of AI and ML, which is highly relevant for advancing technology adoption strategies in these sectors.

In the Indian Subcontinent, sentiment analysis reveals that case studies tend to show more positive sentiment towards AI and ML adoption, while journals show a higher proportion of negative sentiments. Key themes identified include innovation, inclusive growth, sustainable development, ethical concerns, and infrastructure development.

The study indicates that the combined theoretical framework of the TAM and RBV effectively captures the dynamics of AI and ML adoption. A holistic approach that considers both technology adoption drivers and strategic resource utilisation is crucial for maximising the potential of AI and ML for inclusive growth and long-term sustainability in the region. Table 4 presents the data, and Figure 3 illustrates the trend of theme types and sentiment scores for the IT, Finance, Agriculture, and Healthcare sectors in the Indian Subcontinent.

Table 4: Types of Themes and the Score of Sentiments for IT, Finance, Agriculture, and Healthcare Sectors in the Indian Subcontinent

c	Sector	Sentiment Type	Scores
Innovation	IT	Predominantly positive	85%
	Finance	Largely positive	75%
	Agriculture	Mostly positive	70%
	Healthcare	Predominantly positive	80%
Inclusive Growth	IT	Largely positive	70%
	Finance	Largely positive	70%
	Agriculture	Largely positive	65%
	Healthcare	Largely positive	75%
Sustainable Development	IT	Mostly positive	65%
	Finance	Mostly positive	60%
	Agriculture	Largely positive	55%
	Healthcare	Mostly positive	70%
Ethical Concerns	IT	More negative	45%
	Finance	More negative	55%
	Agriculture	More negative	50%
	Healthcare	Slightly negative	40%
Infrastructure Gaps	IT	Balanced with slight negative tilt	40%
	Finance	Balanced with slight negative tilt	45%
	Agriculture	Balanced with slight negative tilt	50%
	Healthcare	Slightly negative	35%

Source: Measured by authors using sentimental analysis on text

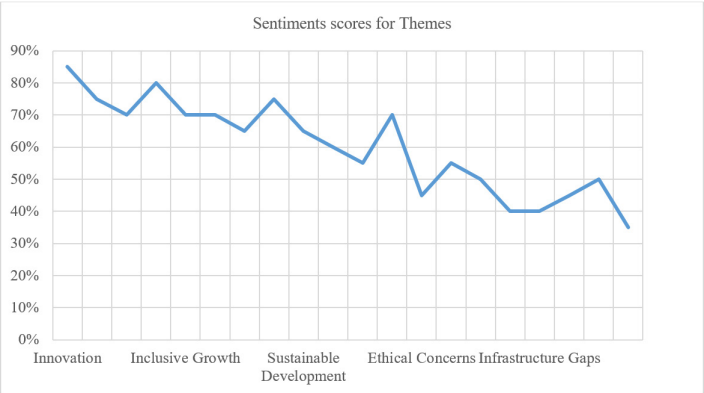

Figure 3: Types of Themes and the Score of Sentiments for IT, Finance, Agriculture, and Healthcare Sectors in the Indian Subcontinent

Source: Measured by authors using sentimental analysis on text

Findings show that innovation is viewed most positively across all sectors, with the highest sentiment observed in IT (85%) and Healthcare (80%). Inclusive growth also receives largely positive sentiment, particularly in healthcare (75%). Sustainable development is viewed positively, with the strongest sentiment recorded in healthcare (70%). Ethical concerns and infrastructure gaps receive comparatively higher negative sentiment, with ethical concerns being particularly negative in Finance (55%) and Agriculture (50%), while infrastructure gaps show slight negative sentiment across all sectors. This highlights both the optimism and the challenges associated with AI and ML adoption in these industries.

Sentiments over Time

Sentiment trends over time are analysed for the period from 2021 to 2024. Figure 4 presents the results of sentiment trends over time, and Table 5 shows the data distribution of sentiments across the three-year period.

Table 5: Distribution of Sentiments for Three Years (2021-2024) in IT, Finance, Agriculture, and Healthcare Sectors

Sentiments	IT Sector (2021-2024)	Finance Sector (2021-2024)	Agriculture Sector (2021-2024)	Healthcare Sector (2021-2024)
Positive Sentiments	Increased from 55% (2021) to 70% (2024)	Increased from 50% (2021) to 65% (2024)	Increased from 45% (2021) to 60% (2024)	Increased from 60% (2021) to 75% (2024)
Negative Sentiments	Decreased from 25% (2021) to 15% (2024)	Decreased from 30% (2021) to 20% (2024)	Decreased from 35% (2021) to 20% (2024)	Decreased from 20% (2021) to 10% (2024)
Neutral Sentiments	Remained stable at 20% (2021-2024)	Remained stable at 15% (2021-2024)	Remained stable at 25% (2021-2024)	Remained stable at 15% (2021-2024)

Source: Measured by authors using sentimental analysis on text

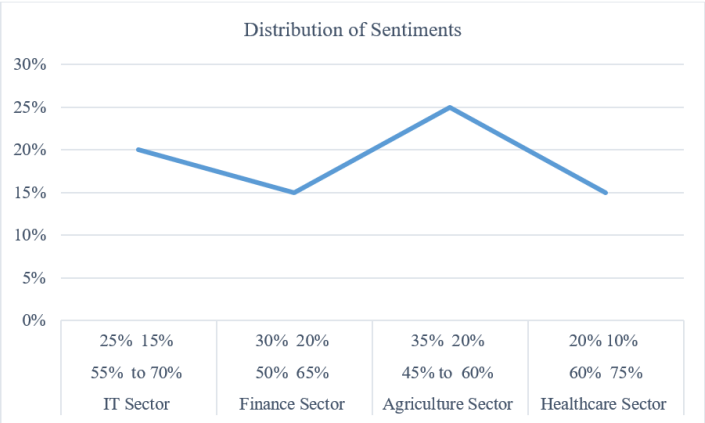

Figure 4: Distribution of Sentiments for Three Years (2021-2024) in IT, Finance, Agriculture, and Healthcare Sectors

Source: Measured by authors using sentimental analysis on text

Results reveal a trend of growing optimism from 2021 to 2024 across all sectors. These observations are based on general trends and may not reflect precise sentiment percentages; therefore, percentages are presented as ranges to illustrate overall sentiment trends. Positive sentiments have increased across all sectors, with healthcare showing the most significant rise (from 60% to 75%). Negative sentiments have decreased across all sectors, with the most notable reduction in Agriculture (from 35% to 20%). Neutral sentiments have remained stable at around 15–25% across sectors, indicating that while optimism is growing, some concerns persist, particularly in Agriculture and Finance. This suggests a shift towards more favourable views of AI and ML adoption over time.

RQ1: Extent of AI and ML Utilisation – H1

Sentiment analysis across the IT, Healthcare, Agriculture, and financial sectors in the Indian Subcontinent reveals a generally positive outlook on AI and ML adoption. In IT (70% positive sentiment), AI and ML are seen as key tools for enhancing operational efficiency. In Healthcare (75% positive sentiment), AI-powered diagnostic tools improve patient outcomes. In Agriculture (60% positive sentiment), AI optimises resource management and supports food security. In Finance (65% positive sentiment), ML algorithms enhance fraud detection. Overall, the findings emphasise the importance of supportive policies and infrastructure investments to sustain adoption.

RQ2: Perceived Benefits and Challenges – H2a and H2b

Sentiment analysis across sectors reveals both benefits and challenges. In IT, AI and ML improve efficiency and drive innovation. Healthcare has seen successful AI implementations, although infrastructure gaps remain. Agriculture benefits from AI in resource management but faces concerns regarding digital inequality. In Finance, ML has reduced losses through fraud detection, but challenges related to regulation and data privacy persist. Despite generally positive sentiment, a common concern across sectors is the shortage of skilled professionals, underscoring the need for targeted skill development and supportive policies for equitable AI and ML integration.

RQ2: Strategies for Overcoming Barriers – H2b

Sentiment regarding strategies to overcome barriers is positive. Investments in employee training, collaboration with technology partners, and supportive regulatory frameworks are driving AI and ML adoption. These strategies have proven effective in improving efficiency and increasing adoption, particularly among small and medium enterprises (SMEs), fostering optimism about the future integration of AI and ML technologies.

RQ1: Socio-Economic Implications – H1

Sentiment on the socio-economic implications of AI and ML adoption is mixed. On the positive side, AI-driven solutions are creating high-skilled jobs, especially in technology firms. However, concerns about job displacement, particularly in low-skilled sectors such as agriculture, persist. The findings emphasise the need for inclusive growth policies, reskilling opportunities, and equitable access to the benefits of AI.

RQ2: Regional and Sectoral Variations – H2b

Sentiment analysis reveals regional and sectoral variations. Urban centres show positive sentiment due to better infrastructure and skilled talent, driving AI adoption particularly in Finance. Rural areas face infrastructure challenges, leading to slower adoption and negative perceptions, especially in Agriculture. This highlights the need for region-specific policies focused on infrastructure development, education, and incentives to promote more equitable AI and ML adoption across regions and sectors.

Policy Recommendations

In the Indian Subcontinent, the findings emphasise the need for supportive policy frameworks to fully leverage AI and ML while addressing associated risks.

Regulatory Frameworks: Governments should create comprehensive regulations to address ethical concerns, data protection, and accountability in AI and ML applications.

Investment in Infrastructure and Learning: Both government and private sectors should invest in building robust digital infrastructure and promote skill development through targeted education and training programmes.

Sentiment analysis highlights the transformative potential of AI and ML in fostering inclusive growth and innovation but also reveals the ethical challenges and infrastructural gaps that must be addressed. With the right policies and investments, AI and ML can optimise business practices, enhance decision-making, and contribute to sustainable development, driving economic and social progress in the Indian Subcontinent.

CONCLUSION

Sentiment analysis of AI and ML adoption in the Indian Subcontinent reveals a mix of optimism and caution. Businesses in sectors such as Finance, Telecommunications, and Agriculture report enhanced efficiency and improved decision-making driven by AI-powered tools. These technologies provide a competitive edge and are seen as transformative for business performance, particularly in urban centres. Positive sentiments reflect growing confidence in AI and ML as key drivers of innovation and progress.

However, challenges related to access to technology and infrastructure in rural and underdeveloped regions persist. While businesses in urban areas are optimistic, rural areas face difficulties in adopting these technologies due to limited resources and skills gaps. The negative sentiment from these regions highlights the need for targeted interventions, such as investment in digital infrastructure and skill-building programmes.

AI and ML are important drivers of inclusive growth, particularly in sectors such as Healthcare and Finance. Sentiment analysis also highlights the role of AI and ML in supporting sustainable development goals in the country.

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BIOGRAPHY

Professor Allam Ahmed is a Professor of Knowledge Management and Sustainable Development; Founding President World Association for Sustainable Development; Founding Director SDGs Universities Initiatives and SDGs Tracker Initiative; and Honorary Professor Faculty of Medicine and Dentistry and Senior Policy Fellow Global Policy Institute, Queen Mary University of London. He is a Fellow (FCIM) and Chartered Marketer of the *Chartered Institute of Marketing (CIM),* UK; *Fellow (FFPH) Faculty of Public Health,* UK; PhD in Economics in two years at *Edinburgh Napier University,* UK; awarded the *Royal Agricultural University (RAU)* Scholarship and Prestigious Book Prize for Best MSc/MBA Dissertation; Listed in the *Who's Who in the World 2009-2021 and 2021* Who's Who in the World Lifetime Achievement Award, *Who's Who in Finance and Business 2009/2010* and *Who's Who in America 2012-2014* published by Marquis Who's Who, USA.

Professor Arshi Naim, a Top 2% Scientist (Stanford and Elsevier, 2024 and 2025), is a distinguished academic with over 22 years' experience in business management, digital marketing and higher education. She has published more than 100 Scopus-indexed articles and has authored books with leading international publishers. She holds a PhD in Business Management and has extensive global teaching and leadership experience. For 14 years, she led accreditation and quality assurance initiatives at King Khalid University, Saudi Arabia. She currently serves as Professor of Business Management and Sustainability at the London Institute of Sustainable Development, UK, and a Professor of Business and Economics, Al-Quds University, Jerusalem, Palestine. A certified QM Master Reviewer, Dr Arshi also holds professional and executive education credentials from Oxford, Harvard and Accenture. She actively collaborates with institutions worldwide to promote academic excellence, research impact and innovation.