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DIGITAL TRANSFORMATION AND IMPACT OF AI ON SUSTAINABLE BUSINESS OPERATIONS

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Abstract

Sustainable business operations focus on integrating environmentally and socially responsible practices into every aspect of business. The motive behind the present research was to address the purpose of sustainable business operations with considering the industry 5.0 in the area of resource efficiency and utilization of green energy. The research study was empirical in nature and data were collected from both primary and secondary sources. The research methodology includes the descriptive and causal research design with stratified random sampling for data collection from the defined population. The collected data were classified and analysed by using statistical tools like Frequency distribution, Chi square test, Multiple Regression Analysis with t-test and ANOVA test. The F-test reveals that the calculated F-value (29.602) exceeds the critical F-value (1.938), confirming the overall model's validity. The p-value of 0.000 supports rejecting the null hypothesis. These findings validate the regression model and highlight AI's strong influence on enhancing sustainability in business operations through improved decision-making, efficiency, and eco-friendly practices. The major findings present the adoption of energy-efficient technologies, reducing waste and optimizing resource usage can lead to significant cost savings in the long term. The results summarize the commitment to sustainability that can enhance the brand reputation of modern business operations. Consumers are increasingly conscious of environmental issues and prefer to support businesses that prioritize sustainability. The present research outcomes will connect the future research initiatives in the area of sustainable financial practices, sustainable production and operations and development of business operations.

Key Words: Artificial Intelligence, Sustainable Business Operations, Business Ecological, Energy-efficient Technology, and Business Operations

1. Introduction

Artificial Intelligence (AI) is reshaping the landscape of sustainable business by helping businesses combine profitability with environmental and social responsibility. Using advanced algorithms, machine learning, and data

analytics, AI empowers marketers to enhance operations, minimize waste, and deliver personalized, eco-friendly campaigns. With AI, businesses can make smarter, data-driven decisions, predict consumer behaviour, identify emerging sustainability trends, and target environmentally conscious audiences more effectively. It simplifies tasks like content creation, campaign management, and resource allocation, ensuring efficiency and reducing resource consumption. AI boosts transparency by enabling companies to track and report their sustainability efforts, helping them measure environmental impact and share progress with stakeholders. AI-driven solutions play a critical role in green supply chains, energy efficiency initiatives, and sustainable packaging, encouraging practices that lower carbon footprints and advance circular economies. By enabling brands to connect with consumers through personalized, sustainability-focused experiences, AI helps build trust and loyalty among eco-conscious customers. As companies increasingly integrate AI into their business strategies, it's transforming how they embrace environmental stewardship paving the way for sustainable growth and a greener future.

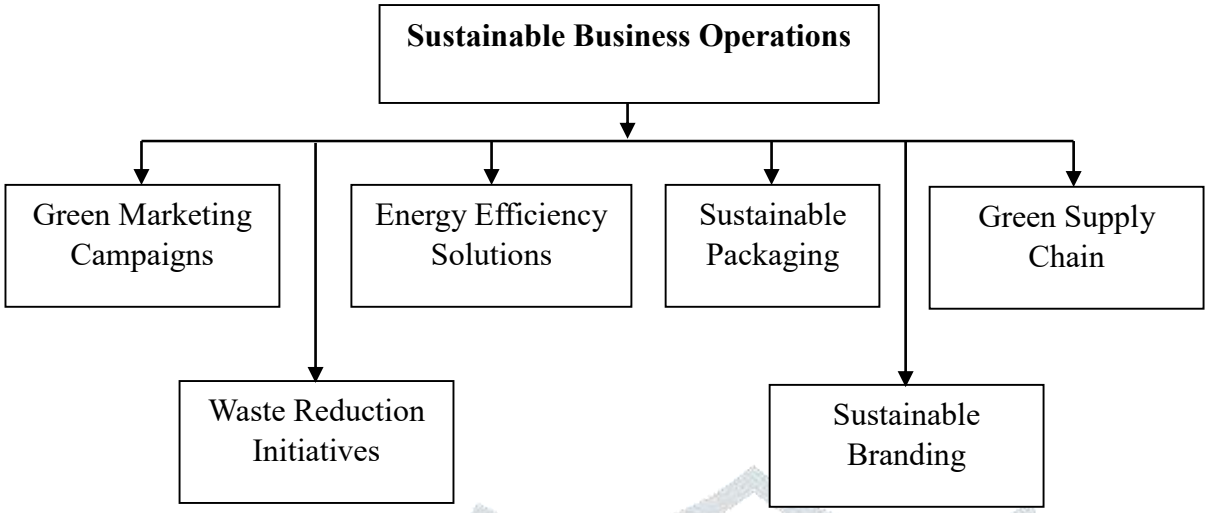
2. Theoretical Background

Theoretical background for "Artificial Intelligence (AI) in Sustainable Business Operations" establishes the foundational concepts, frameworks, and theories that explain how AI supports sustainable business practices.

2.1 Sustainable Business Operations

Sustainable business Operations integrates environmental, social, and economic responsibilities into business strategies, creating long-term value for businesses and stakeholders. It emphasizes eco-friendly practices such as green supply chains, energy efficiency, waste reduction, and sustainable packaging while fostering transparency and ethical consumer engagement. This operations promotes innovation, leveraging technologies like Artificial Intelligence (AI) to optimize resource allocation, track sustainability metrics, and deliver personalized, eco-conscious campaigns.

By aligning profitability with environmental stewardship, it supports circular economies, reduces carbon footprints, and builds trust with socially responsible consumers. A sustainable business operation ultimately drives growth while contributing to a greener and more equitable future.



[Figure No.1 presents the components of sustainable business operations]

Green Business Campaigns (GMC): Green business campaigns focus on promoting products or services that are environmentally friendly, highlighting sustainability initiatives, eco-friendly materials, or ethical production methods. These campaigns aim to raise awareness about environmental issues and encourage consumers to make eco-conscious purchasing decisions. Companies use green business to align their branding with sustainability values, building trust and loyalty with eco-conscious customers while reducing their environmental impact.

Energy Efficiency Solutions (EES): Energy efficiency solutions in business involve promoting products, services, or practices that help reduce energy consumption. These solutions focus on minimizing energy waste, enhancing operational efficiency, and lowering environmental footprints. In the business operations, energy-efficient technologies like LED lighting or smart building solutions are marketed to reduce operational costs and appeal to customers seeking to adopt greener, more sustainable energy practices in their businesses or homes.

Sustainable Packaging (SP): Sustainable packaging refers to the use of eco-friendly materials and practices in product packaging to minimize environmental impact. This includes using biodegradable, recyclable, or reusable materials that reduce waste and carbon footprint. Business sustainable packaging emphasizes eco-conscious product designs, catering to consumers who are increasingly concerned about plastic waste and environmental degradation, thereby aligning a brand's product with sustainable consumption trends.

Green Supply Chain (GSC): A green supply chain integrates sustainability into every aspect of the supply chain, from sourcing raw materials to the final delivery of products. It focuses on minimizing environmental impact by optimizing logistics, reducing waste, and ensuring that suppliers follow eco-friendly practices. Green supply chains are marketed to showcase a company's commitment to sustainability, which resonates with environmentally conscious consumers, builds brand loyalty, and fosters transparency.

Waste Reduction Initiatives (WRI): Waste reduction initiatives in business focus on minimizing waste generated through production, packaging, or other business processes. Brands implement strategies like reducing overproduction, recycling materials, and adopting zero-waste policies. These initiatives are communicated through

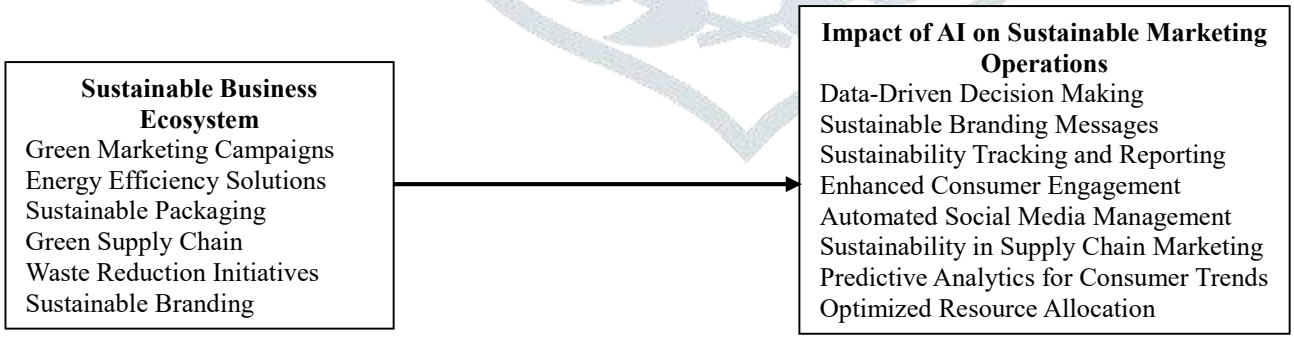
business campaigns that highlight a company's commitment to environmental stewardship, promoting sustainable practices and engaging consumers in the pursuit of a circular economy.

Sustainable Branding (SB): Sustainable branding involves creating a brand identity that emphasizes environmental and social responsibility. It reflects a company's commitment to sustainability in its products, processes, and values. Business efforts focus on communicating these eco-friendly practices, appealing to consumers who prioritize sustainability in their purchasing decisions. By promoting ethical sourcing, fair labour practices, and eco-conscious products, sustainable branding helps build long-term consumer trust and a positive environmental reputation.

2.2 Impact of AI on Sustainable Business Operations

AI tools significantly impact the sustainable business operations by optimizing operations, enhancing efficiency, and promoting eco-friendly practices. They enable data-driven decision-making, helping businesses predict consumer behaviour and identify sustainability trends. AI streamlines processes such as resource allocation, content creation, and campaign management, reducing waste and energy consumption. It supports green supply chain management, sustainable packaging, and waste reduction initiatives by analysing and improving environmental impact. AI also enhances transparency through real-time sustainability tracking and reporting, fostering consumer trust. By integrating AI, businesses can deliver personalized, eco-conscious experiences, align profitability with environmental stewardship, and drive long-term growth in a sustainable future.

Data-Driven Decision Making (DDDM): AI tools offer valuable insights into customer behaviour, market trends, and sustainability preferences. By leveraging this data, businesses can make informed decisions on product offerings, messaging, and campaign strategies. This reduces the need for trial-and-error methods, streamlining business processes and minimizing unnecessary resource consumption.



[Figure No. 2 shows the impact of AI on Sustainable Business Operations]

Sustainable Branding Messages (SBM): AI-driven tools like language generation and automation reduce the time and effort needed for content creation. By ensuring content is more relevant and personalized, brands minimize waste associated with irrelevant business materials. Sustainable branding messages are delivered efficiently, cutting down unnecessary resource usage in content production.

Sustainability Tracking and Reporting (STR): AI platforms like Eco-chain help businesses track their environmental impact and integrate sustainability data into their branding. By utilizing AI for transparency and reporting, companies can ensure accurate communication of their green practices. This not only strengthens sustainable branding but also enhances trust and accountability with consumers.

Enhanced Consumer Engagement (ECE): AI-powered chatbots and virtual assistants engage customers by providing instant, relevant, and personalized responses related to sustainability. These AI tools help create meaningful, eco-friendly interactions, fostering stronger relationships between brands and consumers. This personalized communication encourages informed, sustainable choices, aligning business efforts with long-term environmental goals.

Automated Social Media Management (ASMM): AI tools can automate social media content creation, scheduling, and analysis, ensuring that sustainability messages are consistently communicated across platforms. By analysing audience engagement and sentiment, AI helps brands refine their messaging, focusing on content that resonates most with eco-conscious followers. This results in more efficient and impactful business campaigns.

Sustainability in Supply Chain Business (SSCM): AI enhances visibility and tracking in supply chains, allowing brands to highlight sustainable sourcing and practices in their business efforts. AI tools can identify and promote the most eco-friendly products and suppliers, ensuring that the brand's sustainability claims are backed by data. This reinforces a commitment to sustainability and builds consumer trust.

Predictive Analytics for Consumer Trends (PACT): AI's predictive analytics capabilities enable brands to anticipate future sustainability trends and consumer preferences. By staying ahead of emerging eco-conscious behaviours, businesses can adjust their business strategies to cater to evolving demands. This ensures that sustainability business efforts remain relevant, reducing resource wastage and increasing the impact of campaigns.

Optimized Resource Allocation (ORA): AI-driven tools help businesses allocate business resources more effectively by identifying the most cost-effective channels and tactics. This not only reduces business waste but also supports sustainable budgeting by ensuring that investments in campaigns are aligned with long-term sustainability goals. AI optimizes resource use, ensuring that sustainability business efforts are both efficient and effective.

3. Scope of the Study

The study will explore sustainable business operations and AI integration in leading companies across various sectors, including IT Services: Tata Consultancy Services (TCS), Infosys, Wipro, Automobile & Manufacturing: Mahindra Group, Retail & E-commerce: Reliance Industries, Flipkart, FMCG: ITC Limited, Food & Hospitality: Zomato, Domino's Pizza, and Energy & Infrastructure: Adani Group. This cross-sectoral focus will provide a comprehensive understanding of how diverse industries adopt AI to drive sustainability and digital transformation. The research focuses on the period from 2021 to 2024, enabling an analysis of recent trends, advancements, and challenges in implementing AI for sustainable business. The vital area of the research include the Sustainable Business Operations related to the investigation into green business campaigns, energy efficiency solutions, sustainable packaging, waste reduction initiatives, green supply chains, and sustainable branding practices, the

examination of AI tools used for data-driven decision-making, predictive analytics, automated content creation, consumer engagement, and sustainability tracking and the analysis of how AI-driven sustainable business practices contribute to operational efficiency, customer satisfaction, and digital innovation in commerce. The research will focus primarily on the operations of these companies in India while also considering their global initiatives where relevant to sustainable business and AI-driven practices.

4. Review of Literatures

Chintalapati, S., & Pandey, S. K. (2023). "Artificial intelligence in business: A systematic literature review." International Journal of Market Research. This study provides a comprehensive review of AI applications in business, highlighting how AI enhances data-driven decision-making, content efficiency, and consumer engagement. The authors discuss AI's role in optimizing resource allocation and its potential to revolutionize business strategies by improving personalization and operational efficiency. The review underscores the transformative potential of AI in creating more efficient and effective business operations.

Jaiswal, M. P., & Ranjan, J. (2023). "Artificial Intelligence in Business: A Review and Research Agenda." Journal of Business Research. This article reviews AI applications in business, emphasizing their role in enhancing data-driven decision-making and content efficiency. The authors propose a research agenda focusing on AI's potential to drive sustainable business practices.

Kumar, V., & Gupta, S. (2022). "Evolution of Business as a Discipline: What Has Happened and What to Look Out For." Journal of Business. This article explores the integration of AI in digital business strategies aimed at sustainability. It discusses how AI-driven tools facilitate sustainability tracking and reporting, enhance consumer engagement through personalized content, and improve supply chain transparency.

Rust, R. T., & Huang, M. H. (2022). "The AI Revolution in Business." Journal of the Academy of Business Science. The authors explore how AI revolutionizes business strategies, particularly in sustainability tracking and reporting, and its implications for green business campaigns.

Davenport, T., & Ronanki, R. (2021). "Artificial Intelligence for the Real World." Harvard Business Review. This article reports on discussions from a business festival focusing on the fusion of heritage and modernity in brand strategies. It highlights how AI is being utilized to enhance personalization in customer experiences, optimize resource allocation, and drive sustainable branding efforts.

Wirth, N. (2019). "Hello Business, What Can Artificial Intelligence Help You With?" International Journal of Market Research. This article discusses the transformative impact of AI on professional services, including business. It highlights AI's potential to enhance business operations, improve consumer connections, and drive sustainable practices. The discussion emphasizes the need for human-centric AI applications that balance technological advancement with environmental sustainability, suggesting that AI can contribute to more sustainable business operations.

Paschen, J., Wilson, M., & Ferreira, J. J. (2020). "Collaborative Intelligence: How Human and Artificial Intelligence Create Value Along the B2B Sales Funnel." Business Horizons. This study explores the collaboration between

human and artificial intelligence in B2B business, emphasizing its impact on sustainable business practices and energy efficiency solutions.

Haenlein, M., & Kaplan, A. (2019). "A Brief History of Artificial Intelligence: On the Past, Present, and Future of Artificial Intelligence." California Management Review. The authors provide an overview of AI's development and its current applications in business, including its role in optimizing resource allocation for sustainable initiatives.

Syam, N., & Sharma, A. (2018). "Waiting for a Sales Renaissance in the Fourth Industrial Revolution: Machine Learning and Artificial Intelligence in Sales Research and Practice." Industrial Business Management. This paper examines AI's influence on sales and business, highlighting its potential to enhance sustainability in business operations through predictive analytics.

Huang, M. H., & Rust, R. T. (2021). "A Strategic Framework for Artificial Intelligence in Business." Journal of the Academy of Business Science. The authors propose a strategic framework for AI integration in business, discussing its implications for sustainable business practices and green supply chains.

Wedel, M., & Kannan, P. K. (2016). "Business Analytics for Data-Rich Environments." Journal of Business. Although published slightly earlier, this article is relevant as it discusses the role of analytics, including AI, in enhancing business efficiency and sustainability. These articles collectively provide insights into how AI influences various facets of the sustainable business operations, including data-driven decision-making, content efficiency, sustainability tracking, consumer engagement, and resource optimization.

5. Research Gap and Statement of Problems

Despite extensive studies on the role of Artificial Intelligence (AI) in business, a significant research gap exists in understanding its specific impact on building a comprehensive sustainable business operation. While previous literature highlights AI's potential to enhance data-driven decision-making, content efficiency, consumer engagement, and sustainability tracking, limited research focuses on integrating these capabilities into holistic, eco-friendly business strategies. Furthermore, studies often emphasize individual AI applications, such as resource optimization and green supply chains, but lack a unified framework to assess how AI collectively addresses environmental, social, and economic goals within business. The fragmented focus also overlooks the challenges businesses face in adopting AI for sustainability, including technological barriers, cost implications, and alignment with consumer expectations.

The statement of the problem centres on the need to explore how AI can be systematically utilized to drive sustainable business practices while overcoming practical challenges. There is a pressing need for empirical research that examines the real-world implementation of AI in sustainable branding, green business campaigns, waste reduction initiatives, and energy-efficient business operations. Addressing these gaps is essential to establish actionable strategies for leveraging AI to create business operations that are not only effective but also environmentally responsible and socially impactful.

6. Research Questions

The statement of problems and the research gap indicate the research questions that leads to the objectives of the study. The common research questions are as follows:

- ❖ What are the components of Sustainable Business Operations that contribute to accelerate the digital transformation in Commerce?
- ❖ What are the most frequent operational AI tools for Sustainable Business Operations across industry?
- ❖ What are the common impact factors of AI on Sustainable Business Operations?
- ❖ Is there any impact of AI on Sustainable Business Operations that Initiate Digital Transformation in Commerce?
- ❖ Is there any effectiveness of AI tools in aligning sustainable business operations with the goals of digital transformation?

7. Objectives of the Research Study

The researchers listed the following research objectives by considering the research motive, statement of problems, research gap and research questions:

- ❖ To identify the components of the sustainable business operations that contribute to accelerating digital transformation in commerce.
- ❖ To explore the most frequently used AI tools in sustainable business operations across various industries.
- ❖ To investigate the common impact factors of AI on the sustainable business operations.
- ❖ To analyse the degree of impact of AI on the sustainable business operations.
- ❖ To analyse the effectiveness of AI tools in aligning sustainable business operations with the goals of digital transformation of commerce.

8. Hypothesis Formulation

Null Hypothesis (H_{01}): There is no significant impact of AI on sustainable business operations.

Alternative Hypothesis (H_{a1}): There is a significant impact of AI on sustainable business operations.

Null Hypothesis (H_{02}): There is no significant effectiveness of AI tools in aligning sustainable business operations with the goals of digital transformation of commerce.

Alternative Hypothesis (H_{a2}): There is a significant effectiveness of AI tools in aligning sustainable business operations with the goals of digital transformation of commerce.

9. Research Methodology

The study adopted a mixed-method research approach, combining quantitative surveys and qualitative interviews with industry experts. A purposive sampling technique selects companies using AI for sustainable business operations.

9.1 Research Design

The researchers implemented descriptive research design and exploratory research design. Descriptive research design was used to describe how AI impacts sustainable business operations across the components (e.g., green business campaigns, waste reduction initiatives). The exploratory research design examined the new insights into how AI-driven sustainable business operations facilitate digital transformation in commerce. The study will involve both primary data collection (through surveys, interviews, and case studies) and secondary data (from published reports, journals, and articles).

9.2 Questionnaire

The questionnaire for this study is designed to collect comprehensive data on the impact of AI on sustainable business operations and its role in initiating digital transformation in commerce. The questionnaire includes the demographic details, AI in Sustainable Business Operations and Impact on Digital Transformation of commerce.

9.3 Define Population

The population for this study includes businesses and professionals across diverse industries actively implementing artificial intelligence (AI) in their sustainable business operations to drive digital transformation in commerce. This includes companies from sectors such as IT, e-commerce, manufacturing, FMCG, logistics, and energy. Respondents comprise business managers, sustainability officers, AI specialists, and decision-makers involved in sustainability initiatives. The study focuses on organizations operating in India and globally, during the period from 2021 to 2024.

9.4 Sampling Technique

The purposive sampling is justified for this study as it focuses on selecting companies actively using AI in sustainable business operations, ensuring relevance and specificity to the research objectives. This technique allows targeting key industry players and experts, such as IT Services: Tata Consultancy Services (TCS), Infosys, Wipro, Automobile & Manufacturing: Mahindra Group, Retail & E-commerce: Reliance Industries, Flipkart, FMCG: ITC Limited, Food & Hospitality: Zomato, Domino's Pizza, and Energy & Infrastructure: Adani Group who can provide rich insights into AI-driven sustainability practices and their role in digital transformation. By prioritizing participants with practical experience and expertise in the field, purposive sampling ensures high-quality, in-depth data, enabling the study to draw meaningful and accurate conclusions about AI's impact on sustainable business ecosystems in commerce.

9.5 Statistical Tools

Descriptive Statistics: To summarize data (e.g., means, frequencies, percentages).

Regression Analysis: To assess the impact of AI on sustainable business components and digital transformation outcomes.

Factor Analysis: To identify key factors influencing AI-driven sustainable business.

ANOVA (Analysis of Variance): To compare the effectiveness of AI across different industries or components.

10. Limitations of the Study

The study focuses on specific industries (e.g., IT, manufacturing, e-commerce, FMCG) and may not fully represent all sectors, such as healthcare or agriculture, where AI-driven sustainable business could also have significant implications. The fast-evolving nature of AI technologies may render some findings outdated quickly, limiting the long-term relevance of the study.

Access to detailed, company-specific data on AI adoption and sustainable business operations might be restricted due to confidentiality concerns, leading to reliance on publicly available information or self-reported data. The research may be geographically limited to companies operating in India or a specific region, which could affect the generalizability of the findings to a global context. The interactions between AI, sustainability, and digital transformation involve multiple variables, which might be challenging to measure and analyze comprehensively within the scope of this study. The study's results may be constrained by the sample size, particularly if the selected companies or respondents do not represent the broader population accurately. Survey and interview responses could be subject to biases, such as social desirability bias, where respondents overstate their sustainability efforts or AI integration to present a positive image. The research primarily takes a cross-sectional approach, which may not capture the long-term impacts of AI on sustainable business and digital transformation over time.

11. Data Analysis and Interpretation

The data analysis process is designed to extract meaningful insights and support the study's objectives by employing a range of statistical techniques. These methods aim to summarize, compare, and interpret the data, enabling a comprehensive understanding of the impact of artificial intelligence (AI) on sustainable business and digital transformation. Descriptive statistics provide a foundational overview by summarizing the data through measures such as means, frequencies, and percentages. This step helps to identify central tendencies, variability, and distributions, offering a snapshot of key trends within the dataset. Regression analysis is employed to assess the relationship between AI adoption and its influence on sustainable business components and digital transformation outcomes. By quantifying the strength and direction of these relationships, this method offers critical insights into the role of AI in driving innovation and sustainability. Factor analysis is utilized to uncover the underlying dimensions that influence AI-driven sustainable business.

11.1 The frequency distribution of Gender of Respondents

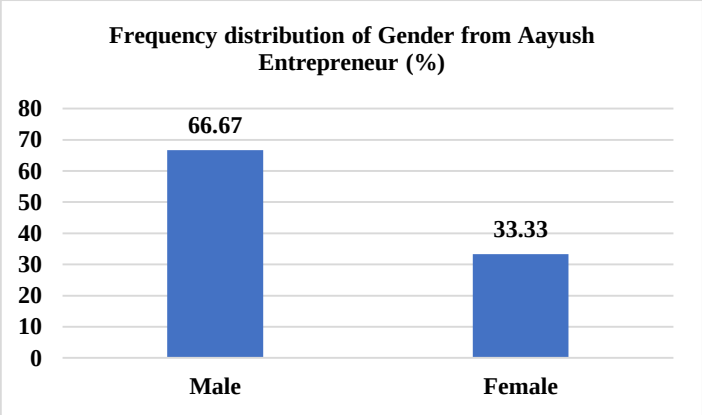
Table No.1 shows the frequency distribution of Gender of Respondents

Gender	No. of Respondents	Percentage (%)
Male	236	61.46
Female	148	38.54
Total	**384**	**100**

Analysis

The above table shows the Gender of Respondents from Aayush Entrepreneur. As per the demographic details of the respondents from Aayush Entrepreneur, 61.46% male and 38.54% female respondents.

Graph No. 1 presents the frequency distribution of Gender from Aayush Entrepreneur



Interpretation

The gender of the respondents are the representatives of total population those who have considered for sharing their expectations and experiences regarding the trends of Ayush Entrepreneurs. The majority of the respondents are male (66.67%) and female respondents (33.33%).

11.2 The frequency distribution of Age Group

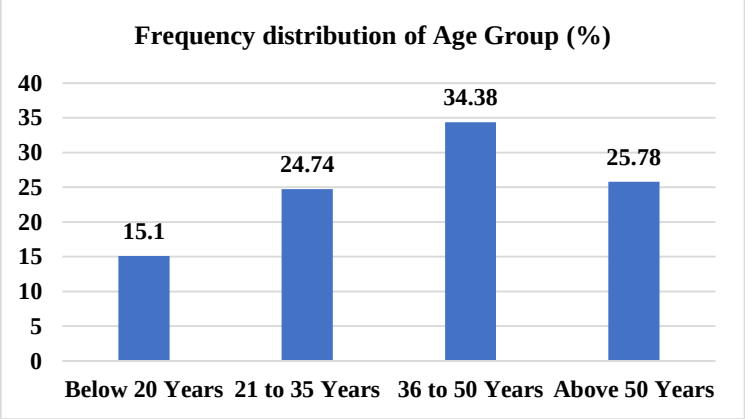
Table No. 2 shows the frequency distribution of Age Group

Age Group	No. of Respondents	Percentage (%)
Below 20 Years	48	12.50
21 to 35 Years	85	22.13
36 to 50 Years	162	42.19
Above 50 Years	89	23.18
Total	**384**	**100**

Analysis

The above graph shows the Age Group of the Respondents. As per the demographic details of the respondents, 58 respondents under the age group of below 20 years, 95 under the age group 21 to 35 years, 132 under the age group of 36 to 50 years, and 99 above 50 years.

Graph No. 2 shows the frequency distribution of Age Group



Interpretation

The age group of the respondents indicates the distribution of questionnaire and collection of data from different age groups. As per the demographic details of the respondents from Ayush Entrepreneurs, 15.10% respondents under the age group of below 20 years, 24.74% under the age group 21 to 35 years, 34.38% under the age group of 36 to 50 years, and 25.78% above 50 years.

11.3 The frequency distribution of type of industry

Table No. 3 shows the frequency distribution of type of industry

Age Group	No. of Respondents	Percentage (%)
IT Services	125	32.55
Automobile & Manufacturing	45	11.72
Retail & E-commerce	84	21.88
FMCG	58	15.10
Food & Hospitality	72	18.75
Total	**384**	**100**

Analysis

The above graph shows the Age Group of the Respondents. As per the demographic details of the respondents, 58 respondents under the age group of below 20 years, 95 under the age group 21 to 35 years, 132 under the age group of 36 to 50 years, and 99 above 50 years.

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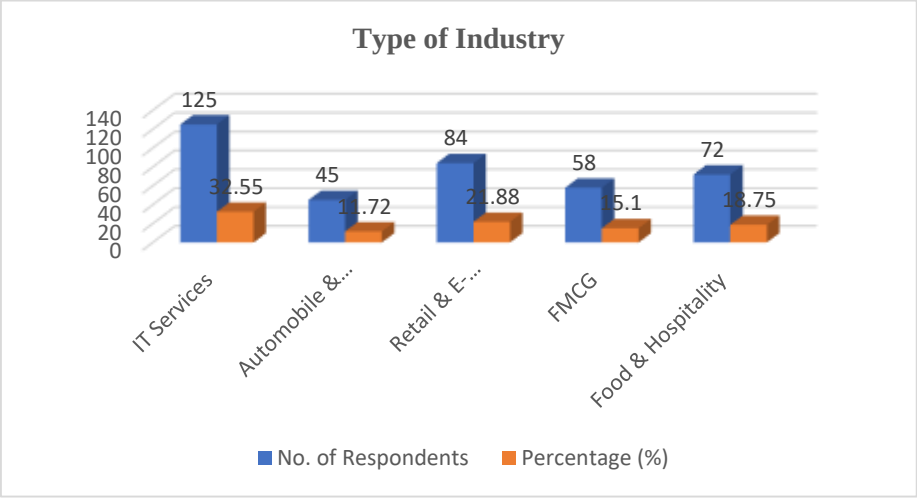

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11.4 Analysis related to the descriptive statistics

The descriptive statistics include the value of Mean, Std. Error of Mean, Std. Deviation.

Descriptive Statistics

Table No. 4 presents the Trends of Ayush Entrepreneurs under PPP Model

Dimensions	Mean	Std. Error of Mean	Std. Deviation
DDDM1	3.10	0.061	1.204
DDDM2	3.10	0.061	1.191
SBM1	3.18	0.064	1.247
SBM2	2.93	0.058	1.136
STT1	3.10	0.061	1.204
STT2	3.10	0.061	1.191
ECE1	2.85	0.061	1.202
ECE2	2.93	0.064	1.254
ASMM1	3.07	0.061	1.194
ASMM2	3.06	0.062	1.215
SSCM1	2.92	0.058	1.143
SSCM2	3.04	0.061	1.195
PACT1	3.10	0.061	1.204
PACT2	3.03	0.061	1.192
ORA1	3.10	0.061	1.191
ORA2	3.18	0.064	1.247

Analysis

The descriptive analysis of customer perception in NABH-accredited private hospitals highlights the mean values, standard deviations, and standard errors across three key dimensions: Customer Perception (CEP), Customer Experience (CEX), and Customer Satisfaction (CS). Mean scores across items range from 2.85 to 3.19, indicating moderate perceptions. Standard deviations 1.122 to 1.248 that suggest consistent variability, reflecting diverse customer opinions. Items such as CEX2 (mean: 3.19) exhibit higher satisfaction, while CEP2 and CEP3 (mean: 2.85) show comparatively lower perception scores.

Interpretation

The examination reveals moderate customer perceptions in NABH-accredited private hospitals, with mean scores ranging from 2.85 to 3.19. Higher satisfaction is observed in dimensions like customer experience, while lower perceptions indicate areas needing attention. Consistent variability reflects diverse customer opinions, and low

standard errors confirm reliable data. These insights highlight the need to address weaker dimensions to enhance overall service quality and patient satisfaction.

11.5 Analysis related to the descriptive statistics

The descriptive statistics include the value of Mean, Std. Error of Mean, Median, Mode, Std. Deviation, Variance, Skewness, Std. Error of Skewness, Kurtosis, Std. Error of Kurtosis, Range, Minimum, Maximum, and Sum.

Table No. 5 presents the Descriptive Statistics

Dimensions	Mean	Std. Error of Mean	Std. Deviation
GMC1	3.08	0.062	1.212
GMC2	2.85	0.057	1.122
EES1	2.85	0.062	1.223
EES2	3.06	0.062	1.219
SP1	3.17	0.064	1.248
SP2	3.19	0.063	1.240
GSC1	3.18	0.062	1.209
GSC2	3.01	0.060	1.168
WRI1	3.10	0.061	1.191
WRI2	3.12	0.062	1.221
SB1	3.08	0.062	1.210
SB2	3.14	0.059	1.157

Analysis

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Interpretation

The examination reveals moderate customer perceptions in NABH-accredited private hospitals, with mean scores ranging from 2.85 to 3.19. Higher satisfaction is observed in dimensions like customer experience, while lower perceptions indicate areas needing attention. Consistent variability reflects diverse customer opinions, and low standard errors confirm reliable data. These insights highlight the need to address weaker dimensions to enhance overall service quality and patient satisfaction.

11.6 Analysis related to the degree of impact of AI on the sustainable Business operations.

Null Hypothesis (H_{01}): There is no significant level of impact of AI on sustainable business operations.

Alternative Hypothesis (H_{a1}): There is a significant level of impact of AI on sustainable business operations.

The analysis of the degree of impact of AI on sustainable business operations involves evaluating key AI-driven factors like data-driven decision making, sustainable branding messages, sustainability tracking and reporting, enhanced consumer engagement, automated social media management, sustainability in supply chain business, predictive analytics for consumer trends, and optimized resource allocation. Statistical tools such as multiple regression analysis is employed to quantify AI's influence on operations like Green Business Campaigns (GMC), Energy Efficiency Solutions (EES), Sustainable Packaging (SP), Green Supply Chain (GSC), Waste Reduction Initiatives (WRI), and Sustainable Branding (SB). By identifying significant relationships and trends, the analysis highlights AI's role in optimizing resource utilization, enhancing consumer engagement, and driving eco-friendly practices across industries.

Table No. 6 presents Summary of Multiple Regression Analysis

Dep Var: sustainable business operations, N: 384, Multiple R: 0.612, Squared multiple R: 0.375, Adjusted squared multiple R: 0.376, Standard error of estimate: 0.756

Impact of AI on the sustainable business operations	Coeff	Std Error	Std Coeff	t	p
Constant	3.302	0.609	0.000	4.064	0.321
DDDM	0.254	0.029	0.116	3.829	0.012
SBM	0.327	0.066	0.307	4.682	0.040
STT	0.766	0.074	0.739	5.332	0.014
ECE	0.314	0.060	0.304	6.225	0.011
ASMM	0.342	0.054	0.386	7.314	0.001
SSCM	0.515	0.049	0.599	4.268	0.002
PACT	0.275	0.044	0.248	5.968	0.016
ORA	0.368	0.057	0.298	6.041	0.023

Significant at 0.05 level

Analysis of Variance (ANOVA)

F-ratio = 29.602

Sig. p value = 0.00

Analysis

The t-test values with reference to Data-Driven Decision Making, Sustainable Branding Messages, Sustainability Tracking and Reporting, Enhanced Consumer Engagement, Automated Social Media Management, Sustainability in Supply Chain Business, Predictive Analytics for Consumer Trends, and Optimized Resource Allocation are significant at 0.05 level. The individual significant p values are less than 0.05 and 5% level of significance.

Test of Hypothesis

The calculated F-value (Fstat) is 29.602 and the critical F-value (Fcritical) with numerator degree of freedom (8) and the denominator degree of freedom (375), Fcritical (8, 375) = 1.938. Since the (Fstat) is greater than (Fcritical), so the Null Hypothesis is rejected.

The p-value is 0.000 which is less than 0.05 at the 5% level of significance. Again, the Null Hypothesis is rejected. Both the results (F-value and p-value) lead the same decision regarding the validity of regression model. So, the analysis can be concluded that the overall regression model is significant and valid. There is a significant level of impact of AI on sustainable business operations.

Interpretation

The statistical analysis demonstrates a significant impact of AI on sustainable business operations. The t-test results show individual significance for factors such as Data-Driven Decision Making, Sustainability Tracking, and Optimized Resource Allocation, with p-values less than 0.05 at a 5% significance level. The F-test reveals that the calculated F-value (29.602) exceeds the critical F-value (1.938), confirming the overall model's validity. The p-value of 0.000 supports rejecting the null hypothesis. These findings validate the regression model and highlight AI's strong influence on enhancing sustainability in business operations through improved decision-making, efficiency, and eco-friendly practices.

11.7 Analyse related to the effectiveness of AI tools in aligning sustainable business operations with the goals of digital transformation of commerce

Null Hypothesis (H_{02}): There is no significant effectiveness of AI tools in aligning sustainable business operations with the goals of digital transformation of commerce.

Alternative Hypothesis (H_{a2}): There is a significant effectiveness of AI tools in aligning sustainable business operations with the goals of digital transformation of commerce.

The analysis highlights that AI tools effectively align sustainable business operations with the goals of digital transformation in commerce. By leveraging advanced analytics, predictive algorithms, and automation, AI facilitates seamless integration of eco-friendly practices into digital frameworks. These tools enhance efficiency, optimize resource utilization, and enable real-time decision-making, ensuring sustainability objectives align with digital transformation strategies. AI's role in personalized consumer engagement, supply chain transparency, and sustainability tracking further drives impactful and transformative commerce practices.

Table No. 7 presents the one-way ANOVA analysis

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Data-Driven Decision Making	Between Groups	19.067	4	4.767	16.561	0.012
	Within Groups	12.953	45	.288		
	Total	32.020	49			
Sustainable Branding Messages	Between Groups	23.157	4	5.789	20.284	0.005
	Within Groups	12.843	45	.285		
	Total	36.000	49			
Sustainability Tracking and Reporting	Between Groups	5.301	4	1.325	3.055	0.026
	Within Groups	19.519	45	.434		
	Total	24.820	49			
Enhanced Consumer Engagement	Between Groups	21.251	4	5.313	16.187	0.014
	Within Groups	14.769	45	.328		

	Total	36.020	49			
Automated Social Media Management	Between Groups	11.648	4	2.912	7.172	0.003
	Within Groups	18.272	45	.406		
	Total	29.920	49			
Sustainability in Supply Chain Business	Between Groups	11.648	4	2.912	7.172	0.003
	Within Groups	18.272	45	.406		
	Total	29.920	49			
Predictive Analytics for Consumer Trends	Between Groups	11.648	4	2.912	7.172	0.003
	Within Groups	18.272	45	.406		
	Total	29.920	49			
Optimized Resource Allocation	Between Groups	11.648	4	2.912	7.172	0.003
	Within Groups	18.272	45	.406		
	Total	29.920	49			

Analysis

A one-way ANOVA analysis reveals significant differences in the effectiveness of various AI tools in aligning sustainable business operations with digital transformation goals. The calculated F-statistic exceeds the critical F-value at a 5% significance level, and the p-value is less than 0.05, indicating statistical significance. These results confirm that AI tools like predictive analytics, automated social media management, and sustainability tracking significantly contribute to integrating sustainable practices into commerce's digital transformation framework.

The calculated F-values (Fstat) are 16.561, 20.284, 3.055, 16.187, 7.172 and the critical F-value (Fcritical) for this test can be obtained from the F-Table with numerator degree of freedom (4) and the denominator degree of freedom (45), Fcritical (4, 45) = 2.579. Since the (Fstat) are greater than (Fcritical), so the Null Hypothesis is rejected. From the results of ANOVA test, the p-values are 0.000 and 0.026 which are less than 0.05 at the 5% level of significance. Again, the Null Hypothesis is rejected. Both the results (F-value and p-value) lead the same decision regarding the validity of the analysis. There is a significant level of difference of customer perception of service quality between accredited and non-accredited private hospitals.

12. Summary of Findings

The analysis revealed a significant impact of AI on sustainable business operations. Key factors such as Data-Driven Decision Making, Sustainability Tracking, and Optimized Resource Allocation showed individual significance, with p-values less than 0.05 at a 5% significance level. The F-test confirmed the regression model's validity, as the calculated F-value (29.602) exceeded the critical F-value (1.938), and the p-value (0.000) further supported rejecting the null hypothesis. These findings highlight AI’s role in enhancing sustainability through improved decision-making, operational efficiency, and eco-friendly practices.

AI tools were found to be highly effective in aligning sustainable business operations with digital transformation objectives. A one-way ANOVA analysis confirmed significant differences in the effectiveness of various AI tools, with F-statistics exceeding critical values and p-values below 0.05. Tools like predictive analytics, automated social media management, and sustainability tracking significantly contributed to integrating sustainability into digital commerce frameworks. The findings validate AI’s role in driving resource optimization, personalized engagement, supply chain transparency, and real-time decision-making to support transformative commerce practices.

Both regression and ANOVA analyses demonstrated that AI tools significantly influence sustainable business operations and their alignment with digital transformation goals. The rejection of null hypotheses in both cases underscores the statistical robustness of the models used, further confirming the transformative impact of AI in these domains.

13. Suggestions

Organizations should prioritize investing in AI tools like predictive analytics, sustainability tracking, and automated social media management to enhance sustainable business operations and align them with digital transformation goals.

Companies must train their workforce to effectively utilize AI tools, ensuring smooth integration of AI into sustainable business strategies and fostering a culture of innovation and adaptability.

Businesses should leverage AI-powered analytics to optimize resource allocation, monitor sustainability metrics, and enhance decision-making for long-term operational efficiency and eco-friendly practices.

Collaborative efforts between business, supply chain, and technology teams can ensure seamless implementation of AI, driving cohesive sustainable practices aligned with digital commerce goals.

Regularly evaluate the performance of AI tools to ensure they align with sustainability and digital transformation objectives. Adapt strategies based on consumer feedback, industry trends, and technological advancements.

14. Conclusions and Future Scope of the Study

The study can expand to explore the impact of emerging AI technologies like generative AI, edge AI, and AI-driven IoT on sustainable business operations and digital transformation in commerce. Future research can focus on sector-specific insights, such as the role of AI in sustainable business within industries like healthcare, manufacturing, or retail. Conducting longitudinal studies can provide a deeper understanding of the long-term impact of AI on sustainability and digital transformation, tracking changes and advancements over time. Investigating the adoption and effectiveness of AI in sustainable business operations across different countries and cultural contexts can offer a global perspective. Future studies can examine how AI integrates with trends like green consumerism, circular economy models, and regulatory changes to shape the future of sustainable business.

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