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Evaluating The Role of AI in Advancing Sustainable Development Goals (SDGS) within Coimbatore IT Firms

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Abstract: *Artificial Intelligence (AI) has emerged as one of the most transformative technologies of the 21st century, reshaping industries, economies, and societies across the globe. This research addresses the problem of how Coimbatore's IT industry can bridge this disconnect, ensuring that AI adoption is not merely a technical upgrade but a statistically reliable driver of environmental integrity, social welfare, and corporate transparency. The problems objective is to evaluate whether the adoption and effectiveness of Artificial Intelligence in Coimbatore's IT sector to meet the expected standards for advancing the Sustainable Development.this study will focus only on five firms: CTS, Bosch, Wipro, Infosys, and TCS. This is because these firms employ a substantial number of people in the period between 2025 and 2026. To minimize bias when gathering data, a total of 43 participants will be chosen using the simple random sampling method. Findings shows All variables achieved* ***high statistical significance*** *(p<.001), confirming that the observed perceptions are not due to random chance. The study concludes that these attitudes are deeply held and not the result of random chance or sampling bias*

Keywords: Ttest, descriptive statistics, ESG, perceived trust, risk, usefulness and easy to use

I. INTRODUCTION

In the modern industrial era, the intersection of technological innovation and environmental responsibility has become a focal point for global progress. Artificial Intelligence (AI) is no longer merely a tool for automation; it has emerged as a critical enabler for the United Nations' Sustainable Development Goals (SDGs). By optimizing resource management, reducing energy consumption, and enhancing data-driven decision-making, AI offers a transformative pathway for industries to align economic growth with ecological and social well-being.

Known traditionally as the "Manchester of South India" for its industrial prowess, Coimbatore has rapidly evolved into a significant Tier-II IT hub. The city's IT ecosystem, characterized by a mix of multinational corporations and homegrown startups, serves as a vital contributor to Tamil Nadu's digital exports. As this sector expands, the pressure to adopt sustainable practices increases. However, the extent to which these firms are successfully leveraging AI to meet specific sustainability targets remains a subject of empirical inquiry.

II. REVIEW OF LITERATURE

Raluca-Giorgiana (Chivu) Popa/Switzerland (2025) examined the factors influencing the adoption of AI-powered tools by consumers. This study employs a quantitative, cross-sectional research design to investigate the determinants of consumer adoption of AI-powered tools. Data were collected through a structured online questionnaire developed based on validated scales from the literature, adapted to fit the context of AI usage in both personal and professional domains. The target population comprised individual users of digital technologies with varying degrees of exposure to AI-based tools. A non-probabilistic purposive sampling technique was used to ensure participation from individuals with at least

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minimal familiarity with AI applications (e.g., smart assistants, recommendation systems, AI chatbots). A total of 240 valid responses were collected over a one-month period. The findings confirm that both cognitive evaluations (e.g., perceived usefulness, ease of use) and affective and contextual influences (e.g., trust, workplace experience, intrinsic motivation) play significant roles in shaping behavioral intention toward AI adoption. Notably, trust in AI systems emerged as a key mediator, while marketing personalization Sustainability 2025, 17, 6901 15 of 17 had the strongest influence on trust, highlighting the strategic role of well-designed, user centric AI interactions.

Anamaria Nastasa (2024) The current work aims to analyze the main themes related to artificial intelligence (AI) and sustainable development during the pandemic period. This study provides an overview of the specialized literature related to AI and sustainability from the beginning of the pandemic through 2023. The present paper analyses scientific literature emphasizing both artificial intelligence's positive and negative impacts on sustainable development objectives (SDGs). To conduct the research, we employed bibliometric analysis and text-mining techniques to identify the major themes in the literature indexed in the Web of Science and Scopus databases. Firstly, we used descriptive measures to identify the authors' impact, the article production by country, the main keywords used, and other descriptive data. We further used data reduction methods based on co-word analysis (such as multiple correspondence analysis) on authors' keywords to show patterns in the themes explored in the literature. Bibliometric analysis was supplemented by text mining using Latent Dirichlet allocation (LDA) and structural topic modeling on abstracts to provide a comprehensive view of scientific debates on AI and sustainable development. Our research has identified various themes in the literature related to AI and sustainable development. These themes include social sustainability, health-related issues, AI technologies for energy efficiency, sustainability in industry and innovation, IoT technologies for smart and sustainable cities, urban planning, technologies for education and knowledge production, and the impact of technologies on SDGs. We also found that there is a significant positivity bias in the literature when discussing the impact of AI on sustainable development. Despite acknowledging certain risks, the literature tends to focus on the potential benefits of AI across various sectors. In addition, the analysis shows a growing emphasis on energy efficiency, which is facilitated by the use of AI technologies. Our study contributes to a better understanding of current scholarly discussion trends and emerging scientific avenues regarding AI and sustainable development. It also highlights the areas where research is needed and the implications for practitioners and policymakers.

III. STATEMENT OF THE PROBLEM

Despite the rapid integration of Artificial Intelligence within Coimbatore's IT sector, there remains a critical gap in aligning these technological advancements with the United Nations' Sustainable Development Goals (SDGs). While AI is recognized for its functional utility, many firms struggle to move beyond basic operational efficiency to address complex sustainability outcomes. Specifically, there is an over-reliance on AI as a high-level risk management tool for the environment, often overlooking its potential for proactive ecological innovation. Furthermore, while AI adoption shows a strong correlation with environment, social and governance improvements, the influence of factors like "risk", "usefulness", "trust" and "ease of use" remains statistically insignificant or significant. This research addresses the problem of how Coimbatore's IT industry can bridge this disconnect, ensuring that AI adoption is not merely a technical upgrade but a statistically reliable driver of environmental integrity, social welfare, and corporate transparency.

Research questions:

what extent do the adoption and functional effectiveness of Artificial Intelligence within Coimbatore's IT firms align with and fulfill the expected international standards for advancing Environmental, Social, and Governance (ESG) sustainability?

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OBJECTIVES OF THE STUDY

To evaluate whether the adoption and effectiveness of Artificial Intelligence in Coimbatore's IT sector to meet the expected standards for advancing the Sustainable Development.

HYPOTHESES OF THE STUDY

H_{01}: There is no impact between AI adoption and Sustainability Development.

IV. RESEARCH METHODOLOGY

The proposed research methodology will involve the use of a quantitative research approach, alongside the analysis method, whereby data will be gathered from IT workers in Coimbatore through surveys. While there are approximately 750 firms in this area dealing in information technology, this study will focus only on five firms: CTS, Bosch, Wipro, Infosys, and TCS. This is because these firms employ a substantial number of people in the period between 2025 and 2026. To minimize bias when gathering data, a total of 43 participants will be chosen using the simple random sampling method. Data will be collected in the months of December 2025 and January 2026, while regression analysis will be used to determine the relationship between AI and Sustainability Development.

V. ANALYSIS AND RESULTS

TABLE 1: DESCRIPTIVE STATISTICS FOR AI ADOPTION AND SUSTAINABILITY DEVELOPMENT

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Perceived_Usefulness	43	10.6279	3.44358	.52514
Perceived_Easy_Of_Use	43	10.3721	3.50526	.53455
Perceived_Trust	43	11.2326	4.40150	.67122
Perceived_Risk	43	10.5349	3.76291	.57384
Envornmental_Sustainability	43	7.7674	2.55266	.38928
Social_Sustainability	43	20.7674	7.40282	1.12892
Governance_Sustainability	43	10.3488	3.41484	.52076

The above table 1 shows descriptive statistics for sample of 43 participantsacross all categories.The Mean value shows Highest Scoring: Social Sustainability (20.77) has the highest mean by far.Moderate Scores: Perceived Trust (11.23) is the next highest, followed closely by Perceived Usefulness (10.63), Perceived Risk (10.53), Perceived Ease of Use (10.37), and Governance Sustainability (10.35).Lowest Scoring: Environmental Sustainability (7.77) has the lowest average score in your dataset. In Standard Deviation (variation) shows how much the participants' answers differed from one another. Social Sustainability (7.40) and Perceived Trust (4.40) have the highest standard deviations. This means the participants had widely varying views on these variables. Environmental Sustainability (2.55) has the lowest standard deviation. This suggests your participants were more "in sync" or consistent with their scores in this area.The Standard Error (SE) tells you how accurate your sample mean likely is compared to the "true" population mean.Lowercase values (like 0.38 for Environmental Sustainability) suggest that if you ran this study again with a different group of 43 people, you would likely get a very similar average.The higher value for Social Sustainability (1.13) indicates a bit more "noise" or uncertainty in that specific average due to the high variation in answers.

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Table - 2: One-Sample Test

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Perceived_Usefulness	20.238	42	.000	10.62791	9.5681	11.6877
Perceived_Easy_Of_Use	19.404	42	.000	10.37209	9.2933	11.4509
Perceived_Trust	16.734	42	.000	11.23256	9.8780	12.5871
Perceived_Risk	18.359	42	.000	10.53488	9.3768	11.6929
Envornmental_Sustainability	19.954	42	.000	7.76744	6.9819	8.5530
Social_Sustainability	18.396	42	.000	20.76744	18.4892	23.0457
Governance_Sustainability	19.873	42	.000	10.34884	9.2979	11.3998

The table 2 result shows a One-Sample T-Test comparing the sample's averages against a Test Value of 0. Since the values (Sig.) are all .000, the results are highly statistically significant. The means for every single variable the participantsscores are significantly higher than zero. Since this is less than 0.05, you reject the null hypothesis for all variables. There is essentially a 0% chance that these results happened by random accident.Magnitude of Impact: Social Sustainability is the strongest perception in this dataset, while Environmental Sustainability is significantly lower than the others.The T-values are very high (ranging from 16.7 to 20.2), which indicates a very strong "signal" relative to the "noise" (variation) in your data.The actual mean (average) score for each category (because you are subtracting 0 from the mean). Social Sustainability (20.77) has the largest difference from zero, while Environmental Sustainability (7.77) has the smallest.95% Confidence Interval: This gives you a range where the "true" population average likely sits. For example, you can be 95% sure that the true average for Perceived Usefulness is between 9.57 and 11.69.

VI. FINDINGS

From Descriptive Statistics

In Social Sustainability, it is a most visible factor. with a mean of 20.77, it scored significantly higher than any other category. However, it also had the highest level of disagreement among participants (SD 7.40), indicating that while it's a dominant factor, views on it are quite polarized.

In Environmental Sustainability, it is the lowest and most consistent factor has average score of 7.77, but participants were the most in sync about it (SD 2.55). This suggests a strong consensus among the group regarding its lower standing or impact compared to other variables.

Perceived Trust, Usefulness, Risk, and Ease of Use all fall within a narrow range (10.37 to 11.23). This indicates that participants generally view the functional and psychological aspects of the study with a similar level of moderate importance.

The low standard error across the board particularly for environmental sustainability 0.38, suggests that the sample means are likely an accurate reflection of the broader population of the study.

Despite being related concepts, Perceived Trust (11.23) scored higher than Governance Sustainability (10.35), suggesting participants may rely more on interpersonal or systemic trust than on formal governance structures.

From one sample T test

Every variable measured—from Social Sustainability to Perceived Ease of Use—is highly statistically significant ($p<.001$). This confirms that none of these scores occurred by chance; they represent genuine perceptions held by the participants.The high T-values (16.7 to 20.2) indicate that the participants' responses were not just higher than zero, but consistently and strongly so. The "signal" of their opinions far outweighs any random variation in the data.The test reinforces that Social Sustainability (20.77) is the most powerful driver in the dataset, while Environmental

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Sustainability (7.77), though still significant, has a much smaller magnitude of impact.The 95% Confidence Intervals are relatively narrow (e.g., 9.57 to 11.69 for Perceived Usefulness). This means the findings are precise, and can be very confident that the true population averages fall within these specific ranges.The result successfully rejected the null hypothesis for every category. This proves that participants have a definitive, non-neutral opinion on all aspects of the study, particularly regarding the functional "Perceived" categories which all show strong, positive scores.

VII. SUGGESTIONS

Prioritize Trust-Building Mechanisms: For practical applications, suggest that managers or developers focus on transparency and trust-building rather than just tightening "Governance" or "Rules," as users respond more positively to trust.Refine the Social Metrics: Given the high standard error for Social Sustainability (1.13), suggest using more specific sub-indicators in future surveys to capture exactly which parts of social impact (e.g., equity, community, safety) are causing the variation in answers.

VIII. CONCLUSION

The study concludes that Social Sustainability is the primary driver of participant perception. Its high mean (20.77) suggests it is the most recognized or valued dimension, though the high standard deviation reveals it is also the most subjective and debated among individuals. There is a clear, collective consensus and uniformity in Environmental Sustainability. It is a lower priority or less visible factor in this context. The low mean combined with the lowest SD indicates this isn't just a low average, but a unified agreement among participants.The finding that Perceived Trust outranks Governance Sustainability suggests that users value relational and systemic reliability over formal rules and institutional frameworks. The "Perceived" variables (Ease of Use, Usefulness, Risk) are viewed with moderate, stable importance. This confirms that the functional foundation of the subject is solid and statistically significant, providing a reliable platform for the higher-scoring social impacts.With p <. 001 and high T-values across all variables, the study concludes that these attitudes are deeply held and not the result of random chance or sampling bias.

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