COMPARATIVE ANALYSIS OF ARTIFICIAL INTELLIGENCE AND SUSTAINABLE DEVELOPMENT PERCEPTIONS: AN ANOVA-BASED STUDY OF IT INDUSTRY PROFESSIONALS

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Abstract

Artificial Intelligence (AI) is now a major game-changer in the Information Technology (IT) arena, as it is transforming the way IT systems are designed, managed, and optimized. The problem of this study is centered on the disconnect between the technical adoption of Artificial Intelligence (AI) and its actual integration into sustainable development frameworks within the IT sector. *To address this problem the author developed two research questions: They are i)* Whether there is a significant differences exist between Artificial Intelligence and Environmental Sustainability ? ii) Is significant differences exist between Artificial Intelligence and Social Sustainability ? iii) Whether there is a significant differences exist between Artificial Intelligence and Governance Sustainability ?. *The result shows* shows that sustainability perspectives—environmental, social, and governance—are not peripheral but central to how AI is perceived, accepted, and trusted. Environmental and social sustainability factors segment users into distinct groups with fundamentally different attitudes toward AI, while governance sustainability is directly shaped by how AI is implemented and managed.

Keywords: *ANOVA, AI, SD*
JEL Classification: *C25, C83, H19, 03, Q01*

INTRODUCTION

The rapid evolution of Artificial Intelligence (AI) has positioned it as a dual-force in the modern industrial landscape, acting simultaneously as a catalyst for innovation and a challenge to traditional sustainability frameworks. In the IT industry, professionals are at the forefront of this transition, navigating the complex intersection between high-performance computing and the global mandate for Sustainable Development. While AI offers unprecedented opportunities for optimizing resource efficiency and driving economic growth, it also raises critical concerns regarding energy consumption, algorithmic bias, and institutional accountability. Consequently, understanding how the creators and managers of these technologies perceive the alignment between AI and sustainability is essential for responsible technological advancement.

Sustainable Development is traditionally analyzed through the "Triple Bottom Line" of Environmental, Social, and Governance (ESG) pillars. However, the perception of these pillars is rarely uniform among IT professionals. Variations in professional experience, organizational values, and technical roles create distinct "camps" of opinion regarding the utility and safety of AI. For instance, while some may view AI as a primary tool for environmental waste reduction, others may prioritize the social risks associated with job displacement or the governance challenges of maintaining algorithmic transparency. These diverse perspectives directly influence how AI systems are designed, deployed, and regulated within the global marketplace.

This study utilizes a Comparative Analysis based on Analysis of Variance (ANOVA) to investigate the statistically significant differences in how AI perceptions—specifically Perceived Usefulness, Ease of Use, Trust, and Risk—vary across different levels of ESG sustainability focus. By examining data from IT industry professionals, this research aims to move beyond generic assumptions about technology adoption. Instead, it seeks to uncover the specific sustainability drivers that shape professional attitudes, providing a data-driven foundation for developing AI integration strategies that are not only technologically superior but also ethically and environmentally sound.

REVIEW OF LITERATURE

Bo Wang (2025) had analysed Ethical AI for sustainable development: user perceptions across the united nations sustainable Development Goals. These seventeen goals, grouped into societal, economic, and environmental domains, present both opportunities and risks when intersecting with artificial intelligence. While artificial intelligence has the capacity to accelerate sustainable development, it may also exacerbate inequalities, environmental degradation, or other unintended harms if ethical concerns are not adequately addressed. Despite a growing body of research on ethical frameworks for artificial intelligence, there remains a lack of empirical understanding of how users perceive its potential, its ethical implications, and the principles that should guide its deployment in sustainable development contexts. It is natural to raise the questions: How do Sustainable Development Goals and goal groups affect these user perceptions? To answer these questions, they conducted a comprehensive human-subject study examining variations in user perceptions across 17 Sustainable Development Goals and three overarching goal groups. author findings reveal substantial variation in perceived potential and ethical priorities depending on the specific goal, while the perceived importance of ethical considerations remains consistent across goal groups. The novelty of this study lies in combining the AI–SDG context with empirical and perception-based evidence, and their results highlight the necessity of incorporating user perspectives into the design and governance of artificial intelligence systems to ensure ethically aligned and socially accepted progress toward sustainable development.

José Manuel Santos-Jaén (2025) This study investigates how university students' perceptions of AI influence their educational and professional development, a previously unexplored relationship, emphasizing the demand for AI training through Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis on 725 students. The present research offers novel insights into the mediating effects of professional development and the nonlinear role of fear in shaping AI training demand. Findings indicate that students view AI implementation in companies as enhancing business performance through automation and optimized decision-making, thus improving learning and professional development opportunities. High-performing companies are seen as offering valuable internships and motivating students to enhance their skills, thereby increasing the demand for AI training. Students with prior AI knowledge feel more confident and require less additional training. Conversely, perceived risks associated with AI may incentivize academic engagement under certain conditions, but excessive fear may cause mental blocks, reducing participation in educational programs and interest in AI training. This study provides a comprehensive view of how students' perceptions of AI affect their academic and professional paths. These findings offer concrete guidance for curriculum designers and educators aiming to foster AI literacy and pedagogical strategies aligned with technological transformation in business and education. It highlights the importance of educational strategies that incorporate realistic applications and limitations of AI, preparing students for they safe and effective use of technology in their careers. These findings emphasize the need to adapt curricula to the realities of AI in the future workplace.

Troy strader, Yu-Hsiang (John) Huang and Yu-Ju Tu (2025) founded Environmental sustainability is one of the most important and complex issues currently facing our global society. One solution to some aspects of this problem could come from artificially intelligent systems and data analytics methods. The objective for this study is to identify the range of recently published research that addresses issues involving the convergence of artificial intelligence (AI) and environmental sustainability. A systematic literature review produced a sample of 62 journal articles from 2018-2024 that were each categorized into one of six research themes that included studies of AI and the ways in which it impacted natural

resources, energy and waste management, manufacturing and supply chain management, policy and governance, UN sustainable development goals, and public attitudes. Each identified study was reviewed within its category and the findings provide a description of the current relationship between AI and environmental sustainability along with directions for future research. In some studies, AI methods are used for analysis of large data sets to identify the factors that impact environmental sustainability outcomes. In other studies, they looked at strategies and regulations that enable effective AI use. Studies also note that AI can produce negative outcomes due to increased energy demand, potential for perpetuating bias in decision models, and violation of individual privacy rights.

Shin-cheng yeh and others (2021) has investigated public perception of Artificial Intelligence and its connections to the Sustainable Development Goals. This study designed a survey to collect 1018 samples of educated people with access to the internet in Taiwan regarding their perceptions of AI and its connections to the Sustainable Development Goals (SDGs). Respondent had a very positive attitude toward AI but at the same time thought AI was risky. In general, people in Taiwan could be "rational optimists" regarding AI. They also examined how people think of the linkages between AI and the SDGs and found that SDG 4, SDG 9, and SDG 3 had the highest "synergy" and lowest rates of "trade-off". Significant differences for some key questions were also identified concerning the demographic variables such as gender, age, education, and college major. According to the data analysis, education played as the base to construct a sustainable AI-aided town with an embedded innovative circular economy and high-quality water and energy services, making the residents live healthier lives. The findings of this study can be referred to when the perceptions of AI and sustainability issues are of interest for an emerging high-tech economy such as Taiwan and other Asian countries.

STATEMENT OF THE PROBLEM

The problem of this study is centered on the disconnect between the technical adoption of Artificial Intelligence (AI) and its actual integration into sustainable development frameworks within the IT sector. While AI is recognized as a transformative tool for achieving Sustainable Development.Goals, many IT professionals in Coimbatore perceive it primarily as a technical or operational upgradation. This study uses primary data from employees of major IT firms in Coimbatore, such as CTS, Bosch, Wipro, Infoys, and TCS to evaluate whether these perceptions vary significantly across different professional demographics using an ANOVA-based approach.

Research questions:

- Whether there is a significant differences exist between Artificial Intelligence and Environmental Sustainability ?
- Is significant differences exist between Artificial Intelligence and Social Sustainability ?
- Whether there is a significant differences exist between Artificial Intelligence and Governance Sustainability ?

OBJECTIVES OF THE STUDY

- To determine significant differences between Artificial Intelligence and Environmental Sustainability.
- To explore significant differences between Artificial Intelligence and Social Sustainability.
- To identify significant differences between Artificial Intelligence and Governance Sustainability.

HYPOTHESES OF THE STUDY

H_{01}: There is no significant difference between AI and ES.

H_{02}: There is no significant difference between AI and SS.

H_{03}: There is no significant difference between AI and GS.

RESEARCH METHODOLOGY

The current research is adopted a quantitative research design and will also use an analytical approach, where primary data will be collected from IT professionals based in Coimbatore. Although there are around 750 IT companies functioning in this region, this research will particularly concentrate on five major companies: CTS, Bosch, Wipro, Infosys, and TCS, based on their huge employee count for the 2025-2026 period. With a simple random sampling approach, a sample size of 43 employees has been determined for this research to avoid biased data collection. The data collection for this research had taken place in December 2025 and January 2026, and ANOVA analysis had performed to check the

relationships.constructs: for AI - perceived usefulness, perceived easy to use, perceived trust, perceived risk, and for sustainability development, the constructs used for this research are environment, social, and governance.

Table 1
Anova for AI and ES
ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Perceived_Usefulness	Between Groups	310.957	9	34.551	6.094	.000
	Within Groups	187.090	33	5.669		
	Total	498.047	42			
Perceived_Easy_Of_Use	Between Groups	311.405	9	34.601	5.580	.000
	Within Groups	204.641	33	6.201		
	Total	516.047	42			
Perceived_Trust	Between Groups	578.503	9	64.278	9.020	.000
	Within Groups	235.171	33	7.126		
	Total	813.674	42			
Perceived_Risk	Between Groups	258.000	9	28.667	2.810	.014
	Within Groups	336.698	33	10.203		
	Total	594.698	42			

Source: Primary Data
Abbreviation: AI - Artificial Intelligence
ES - Environmental Sustainability

Table 1 shows Anova for AI and ES, here All four variables—Perceived Usefulness, Ease of Use, Trust, and Risk—show statistically significant differences across the Environmental Sustainability groups. Because the "Sig." (p-value) for every variable is less than 0.05, can conclude that at least one sustainability group differs significantly from the others in each category.

Table 2
Anova for AI and SS
ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Perceived_Usefulness	Between Groups	215.599	6	35.933	4.580	.002
	Within Groups	282.448	36	7.846		
	Total	498.047	42			
Perceived_Easy_Of_Use	Between Groups	282.718	6	47.120	7.270	.000
	Within Groups	233.329	36	6.481		
	Total	516.047	42			
Perceived_Trust	Between Groups	411.493	6	68.582	6.139	.000
	Within Groups	402.181	36	11.172		
	Total	813.674	42			

Perceived_Risk	Between Groups	274.631	6	45.772	5.148	.001
	Within Groups	320.067	36	8.891		
	Total	594.698	42			

Source: Primary Data

Abbreviation: AI - Artificial Intelligence

SS - Social Sustainability

Table 2 indicates a **statistically significant difference** across all four variables (Perceived Usefulness, Ease of Use, Trust, and Risk) based on the groupings provided. In every case, the "Sig." value (p-value) is less than **0.05**, meaning the differences observed between the groups are not due to random chance. Concluding that different levels or categories of social sustainability lead to distinct differences in how people perceive the usefulness, ease of use, trust, and risk of AI technologies.

Table 3
Anova for AI and GS
ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Perceived_Usefulness	Between Groups	406.031	16	25.377	7.171	.000
	Within Groups	92.015	26	3.539		
	Total	498.047	42			
Perceived_Easy_Of_Use	Between Groups	376.804	16	23.550	4.397	.000
	Within Groups	139.242	26	5.355		
	Total	516.047	42			
Perceived_Trust	Between Groups	557.962	16	34.873	3.546	.002
	Within Groups	255.712	26	9.835		
	Total	813.674	42			
Perceived_Risk	Between Groups	369.228	16	23.077	2.661	.013
	Within Groups	225.470	26	8.672		
	Total	594.698	42			

Source: Primary Data

Abbreviation: AI - Artificial Intelligence

GS - Governance Sustainability

Table 3 reveals a statistically significant relationship between **Artificial Intelligence (AI)** and all four dimensions of **Governance Sustainability (GS)**. Since the "Sig." (p-value) for every variable is less than **0.05**, we reject the null hypothesis for each case. This means that changes or differences in AI implementation significantly impact how usefulness, ease of use, trust, and risk are perceived. Reveals **AI is a major driver of Governance Sustainability.** The way AI is integrated directly and significantly shapes user perceptions of utility, usability, trust, and risk management within the governance framework.

FINDINGS

Anova for AI and ES

- Environmental Sustainability levels significantly influence how users perceive AI across all tested metrics.
- Users do not view AI the same way; their sustainability values create distinct "camps" of opinion.
- Since all p-values are < 0.05, these differences are statistically robust and not due to random chance.

Anova for AI and SS

- Social Sustainability levels are a definitive factor in how people evaluate and accept AI technologies.
- People in different social sustainability categories (e.g., low vs. high engagement) hold unique, non-overlapping views on AI.
- All p-values are < 0.05, confirming that the impact of social sustainability on these perceptions is consistent and measurable.

Anova for AI and GS

- AI integration is a "major driver" that fundamentally alters the landscape of Governance Sustainability.
- AI doesn't just affect one area; it reshapes the entire governance framework, from operational utility to safety protocols.
- With all p-values < 0.05, the data confirms that AI implementation strategies directly dictate the success of governance outcomes.

SUGGESTIONS

- Don't use a "one-size-fits-all" message. Create specific campaigns for "Eco-Conscious" users that highlight AI's role in energy efficiency or waste reduction.
- Since opinions are split into "camps," provide clear data on the carbon footprint of your AI models to win over skeptical environmental groups.
- Because views are "non-overlapping," conduct focus groups across different social classes and backgrounds. Ensure the AI interface (Ease of Use) doesn't create a digital divide.
- Address the "Trust" and "Risk" variables by publishing AI ethics guidelines that specifically mention job protection and bias mitigation.
- Since AI "dictates the success" of governance, implement rigorous audit trails. High-quality governance depends on AI that is auditable and transparent.
- Prioritize "Risk" management modules in your AI rollout. Users view AI as the primary driver of safety; any failure here will collapse the entire governance framework.

\CONCLUSION

The analysis clearly shows that sustainability perspectives—environmental, social, and governance—are not peripheral but central to how AI is perceived, accepted, and trusted. Environmental and social sustainability factors segment users into distinct groups with fundamentally different attitudes toward AI, while governance sustainability is directly shaped by how AI is implemented and managed. The consistently significant statistical results ($p < 0.05$) confirm that these relationships are strong, reliable, and actionable.

Taken together, the findings and recommendations point to a single strategic direction: AI adoption cannot succeed with uniform approaches. Instead, organizations must adopt a targeted, transparent, and responsibility-driven strategy. This includes tailoring communication to different sustainability mindsets, addressing trust and risk concerns through ethical guidelines and transparency, and ensuring inclusive design to avoid social disparities. At the governance level, the success of AI depends heavily on robust oversight mechanisms, including auditability, risk management, and clear accountability structures.

In essence, AI's long-term success is not just a technological issue but a sustainability-aligned challenge. Organizations that integrate environmental responsibility, social inclusivity, and strong governance into their AI strategies will be better positioned to gain user trust, reduce resistance, and achieve sustainable, scalable adoption.

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