



## ROBOTIC ENGINEERING: AN AI TIMED BOMB OR A BUDDING BLESSING FOR HUMAN RACE - A CRITICAL PERFORMANCE APPRAISAL AND REVIEW

BY

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### Abstract

Robotic Engineering products have proliferated our modern world in unprecedented ways in many forms: humanoids, drones, automated guided vehicles (AGVs), delivery bots, dancing bots, surgical robots, robotic vacuum cleaners, telepresence, among others. This study examined the impacts of Robotic Engineering products on human race and activities using descriptive survey design. Responses from 401 participants engaged with robotics were analysed to assess the perceived benefits or otherwise of artificial intelligence (AI) powered robotic engineering across various sectors. Associated risks, ethical challenges, potential societal impacts and public perception of AI-driven robotic technologies were examined. Result showed that robotic engineering had increased efficiency and precision in key sectors such as healthcare, manufacturing, defense, logistics, and domestic services. However, there are issues like responsibility, human skill loss, anxieties and social injustice. Consequently, whether robotic engineering will be a **budding blessing** (if guided by ethical governance, responsible innovation, and proactive policies) or a disruptive **AI timed bomb** depends on how well humanity manages development, deployment, and oversight of AI powered robotics. This study recommends that stakeholders: federal government, industries and United Nations - collaborate to ensure safe, ethical, and effective integration and use of AI powered robotic engineering products in human societies.

**Keywords:** *Robotic Engineering, Artificial Intelligence, Public Perception, Ethics, AI Regulation.*

### Introduction

Robotic engineering, a dynamic fusion of mechanical, electrical, and computer engineering, has rapidly evolved in the era of artificial intelligence (AI). Unlike when they were initially confined to repetitive industrial tasks, modern robots now demonstrate advanced capabilities in perception, decision-making, and learning. These have had transformative impacts on manufacturing industries, healthcare, agriculture, defense, and domestic services. These transformations, while promising, are accompanied by critical challenges. As AI-powered robotics become more autonomous and pervasive, concerns are mounting over mass unemployment, data privacy breaches, militarization, and the ethical alignment of machine behaviour. These tensions compel a fundamental inquiry: is the rise of robotic engineering a technological

blessing that enhances human potentials, or a timed bomb poised to threaten existential continuity of human race ethically, economically, and socially? This study critically examined this dual-edged trajectory. It explored the perceived benefits of AI integration in robotics across diverse sectors, investigated associated risks and ethical dilemmas, and evaluated public awareness and perception of AI-driven robotic technologies. In doing so, this study sought to establish if robotic engineering as practiced today will largely amount to a technological blessing, or tragedy to human race and consequent on findings make appropriate recommendations that identifies with strategic pathways for the safe, ethical, and effective deployment of AI powered robotic engineering.

## Literature Review

Recent scholarly work has highlighted both the transformative potential and inherent risks associated with AI-powered robotics. Between 2021 and 2025, a growing body of research has examined how robotics, fueled by machine learning, computer vision, and natural language processing, is reshaping domains such as healthcare, industry, logistics, and governance. The deployment of AI-driven robots in surgery, such as the da Vinci system, has revolutionized precision medicine (Wah, 2025), while intelligent systems in manufacturing have significantly improved efficiency and adaptability (Soori et al., 2024). However, concerns about the erosion of human expertise, decision-making accountability, and the deskilling of professions persist (Chamley, 2025).

The evolution of robotics has also been evaluated through key theoretical lenses. Human-Centered Design (HCD) emphasizes the alignment of robotics with human values, ensuring transparency and ethical interaction (Visciola, 2025). Similarly, Innovation Diffusion Theory (IDT) provides a framework to assess how robotics are adopted across societies, especially in the presence of cost barriers, regulatory inertia, and uneven technological readiness (Rogers, 2021). Ethical frameworks such as consequentialism and virtue ethics are increasingly applied to evaluate the societal and moral implications of autonomous systems (Sahakyan et al., 2021).

## Ethical and Societal Considerations

Ethical concerns are central to the discourse on AI robotics. The ambiguity around liability in the event of harm caused by robots presents a regulatory vacuum. Scholars have called for legal structures that clarify responsibility across stakeholders, including developers and users (Rahwan et al., 2021). Additionally, the autonomy of robots in warfare, surveillance, and healthcare provokes moral unease, particularly regarding consent and control (Porter, 2021; Eagan & Moseley, 2025). The pervasive use of personal data by AI systems raises further challenges around privacy and security, especially in autonomous vehicles and

surveillance robotics (Bendiab, 2023). There are also fears that increased automation may alienate human workers, leading to reduced agency and deeper social fragmentation (Shark, 2022).

## Economic Implications and Labor Disruption

The economic consequences of robotics are both promising and precarious. On one hand, AI robotics is predicted to generate new employment in sectors such as robotic system design and maintenance. On the other, the displacement of low-skilled labor remains a serious concern (Hu et al., 2024). The speed and scale of automation, if unmatched by proactive re-skilling and education policies, could exacerbate inequality, especially in developing countries with limited digital infrastructure.

## Regulation and Governance

Efforts to regulate AI and robotics are emerging unevenly across jurisdictions. The European Union's 2021 Artificial Intelligence Act is a landmark attempt to categorize AI systems based on risk, demanding transparency and accountability (PS, 2024). In contrast, regulatory responses in the United States remain fragmented. Scholars advocate for a global regulatory framework to reduce disparities, prevent regulatory arbitrage, and embed human-centric values in technological governance.

## Application Landscape

AI robotics are now deeply embedded in sectors including healthcare, logistics, military, agriculture, and education. Applications range from robotic arms and cobots in industrial settings, to autonomous vehicles and exploration drones in transportation and space research. Home automation, bioengineering, and entertainment robotics continue to gain traction, driven by improvements in sensor technology and machine learning algorithms. Robots such as Amazon's Astro, robotic vacuum cleaners, and surgical systems highlight the increasing integration of robots into daily life and professional practice.

## Methodology

This study adopted a descriptive survey design grounded in a quantitative research approach, aimed at exploring the perceptions, awareness levels of individuals with exposure to or experience in robotic engineering and possible impacts on human race. The study population comprised robotics professionals, students, and educators, selected for their relevance and potential insights into the subject matter. Purposive sampling technique was employed to enhance representativeness across different categories of stakeholders. A total of 401 respondents were drawn from the population of academics, industrialist, and robotic engineering experts. Data were collected using a structured questionnaire developed and disseminated via Google Forms. The

instrument consisted of opinion items designed to measure participants' perceptions regarding the risks, benefits, ethical considerations, and regulatory requirements associated with robotic engineering practice and product use. The quantitative data gathered were analyzed using descriptive statistics (means and standard deviations) to summarise the elicited responses while Pearson's correlation and linear regression were adopted in examining the relationships between awareness and key perception variables geared towards the primary objective of discovering if Robotic engineering will amount to an AI timed bomb or a budding blessing.

## Results and Discussion

**Table 1: Descriptive Analysis**

Variable	Category	Frequency (N)	Percent (%)	Cumulative Percent (%)
Age	18–25	24	6.0	6.0
	26–30	213	53.1	59.1
	31–35	92	22.9	82.0
	36–45	36	9.0	91.0
	46 & Above	36	9.0	100.0
Gender	Female	213	53.1	53.1
	Male	188	46.9	100.0
Occupation	Computer	261	65.1	65.1
	Science/Engineering Student			
	Engineer/Tech	116	28.9	94.0
	Teaching	16	4.0	98.0
	Healthcare Worker	4	1.0	99.0
	Other	4	1.0	100.0
Total Participants	—	401	100.0	—

The study involved 401 respondents, predominantly in the 26–30 years age group (53.1%), followed by those aged 31–35 (22.9%). The younger population (18–25) represented a small segment (6%), while older participants aged 26 years and above made up 94% collectively. In terms of gender distribution, females slightly outnumbered males, constituting 53.1% of the sample. The occupational breakdown reveals a strong academic and technical presence, with 65.1% being Computer Science or

Engineering students, and 28.9% categorized as Engineers or tech professionals. A small portion of respondents were involved in teaching (4%), healthcare (1%), or other fields (1%). This demographic distribution suggests that the study is highly representative of young, technically-oriented individuals, primarily from academic or engineering backgrounds, which is fitting for studies related to robotic engineering or technological awareness.

**Table 2: Participants' Robotic/AI System Awareness Level**

Aware (Yes / No)	Frequency	Percent	Valid Percent	Cumulative Percent
No	92	22.9	22.9	22.9
Valid Yes	309	77.1	77.1	100.0
Total	401	100.0	100.0	

From table 2, 77.1% of respondents reported awareness of robotic/AI systems. They generally agreed that robotics enhances productivity (M = 3.10) and working conditions (M = 3.24), but also acknowledged public unawareness (M = 3.15) and the need for ethical training

(M = 3.04). On the other hand, 22.9% of the respondents disagree of awareness of Robotic/AI System. This shows that most of the respondents were aware of the Robotic/AI System.

**Table 3: Correlation Analysis on What Informed Participants Awareness of Robotic / AI**

Relationship	r	Sig. (2-tailed)	Interpretation
AWARENESS and RISK	0.150	0.003	Weak positive correlation, statistically significant
AWARENESS and PERCEPTION	-0.067	0.182	Very weak negative correlation, not significant
RISK and PERCEPTION	-0.139	0.005	Weak negative correlation, statistically significant

From table 3, the correlation analysis reveals statistically significant but **weak associations** between the measured variables. **Risk perception** consistently shows a **positive link to awareness**, suggesting that individuals who perceive robotics as risky may pay more attention

or seek more information, thus increasing their awareness. Conversely, **general perception** has a weak or inconsistent relationship with awareness and risk, indicating it plays a limited role in shaping awareness.

**Table 4: Regression Analysis on What Informed Participants Awareness of Robotic / AI**

Predictor	B	SE B	$\beta$	t	p	Zero-order r
(Constant)	11.501	1.011	-	11.377	.000	-
SCORE_RISK	0.143	0.050	0.143	2.864	.004	.150
SCORE_PERCEPTION	-0.054	0.058	-0.047	-0.939	.348	-.067

  

Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	Std. Error	F	Sig. F	B (Unstd.)	Std. Error	Beta	t	Sig.
1	0.157	0.025	0.020	1.90787	5.010	0.007	11.501	1.011	-	11.377	.000
							0.143	0.050	0.143	2.864	.004
							-0.054	0.058	-0.047	-0.939	.348

**Note:** Dependent Variable = SCORE\_AWARE; Predictors = SCORE\_RISK, SCORE\_PERCEPTION.

The multiple regression analysis showed a statistically significant model,  $F(2, 398) = 5.010$ ,  $p = .007$ , with an  $R^2$  value of 0.025. This means that the combination of perceived risk and perceived benefits accounted for approximately 2.5% of the variance in awareness of robotic engineering. Among the predictors, perceived risk had a positive and significant effect on awareness ( $B = 0.143$ ,  $p = .004$ ), indicating that individuals who perceive higher risks associated with robotic engineering tend to have greater awareness of the field. In contrast, perceived benefits (SCORE\_PERCEPTION) did not significantly predict awareness ( $B = -0.054$ ,  $p = .348$ ), suggesting that viewing robotics positively does not necessarily correlate with increased awareness.

### Discussion of Findings

The findings of this study provide critical insights on Robotic engineering:- an AI timed bomb or a budding blessing. From the **descriptive analysis**, it is evident that the sample primarily consists of young, technically-inclined individuals, with over half of the respondents aged between 26–30 years and a majority (65.1%) being Computer Science or Engineering students. This demographic concentration suggests that the sample is well-suited for a study focused on robotics and AI technologies, as these individuals are likely to have greater exposure to and engagement with emerging technologies. Additionally, 77.1% of respondents indicated awareness of robotic or AI systems, which further confirms the relevance of the topic among this group. Despite the high level of reported awareness, responses also reflected an understanding that the general public may still lack full awareness, as shown in the agreement that “the public is largely unaware” ( $M = 3.15$ ) and that there is a need for “ethical training” in robotics ( $M = 3.04$ ). This suggests a perceived gap between those with technical exposure and the broader society.

The **correlation analysis** supports this perspective. A weak but statistically significant positive correlation was found between **awareness and perceived risk** ( $r$

$= 0.150$ ,  $p = .003$ ), implying that individuals who are more aware of robotic systems also tend to perceive them as risky. This may be because greater knowledge of robotics includes understanding of potential dangers such as job displacement, ethical dilemmas, or privacy concerns. On the other hand, **perceived benefits** showed a very weak and non-significant negative correlation with awareness ( $r = -0.067$ ,  $p = .182$ ), suggesting that positive views on robotics do not strongly influence awareness levels.

The **regression analysis** further supports these relationships. The overall model was statistically significant,  $F(2, 398) = 5.010$ ,  $p = .007$ , although the effect size was small ( $R^2 = 0.025$ ), indicating that only 2.5% of the variance in awareness can be explained by the combined influence of perceived risk and benefits. Importantly, only perceived risk had a statistically significant effect on awareness ( $B = 0.143$ ,  $p = .004$ ), while perceived benefits did not ( $B = -0.054$ ,  $p = .348$ ). These findings suggest that risk-related concerns are a more powerful motivator for awareness than positive attitudes. This could be because risk invokes a stronger emotional or cognitive response, prompting individuals to seek information or engage more deeply with the subject.

In summary, this study shows that while robotic engineering benefits are substantial such as improved efficiency, precision, safety, and innovation as well as the creation of new high-skilled employment opportunities, these advances however present significant risks and dilemmas also. The increasing autonomy of robots raises concerns about mass unemployment, widening social inequality, data privacy breaches, weaponization, and ethical alignment of machine behaviour.

### Conclusion and Recommendations

#### Conclusion

Robotics engineering, a blend of electrical, mechanical and computer engineering has developed extremely rapidly in the wake of artificial intelligence. Contrary to their first use in boring industrial operations, robots today possess skills in learning, decision-making,

and perception, transforming manufacturing, healthcare, agriculture, defense, and home services. Though such innovations promise a lot of benefits, they are also responsible for causing gravely consequential problems. Among them are mass unemployment because of automation, eroding information privacy informed by information privacy invasions; militarization of autonomous systems and skepticism about the alignment of machine actions on moral lines.

While existing literature has not failed to reveal the increasing efficiency and precision of robotic systems in many fields such as in surgery through the da-Vinci system, they also showcase disturbing issues like responsibility, human skill loss, and social injustice. Terms such as Human-Centered Design and Innovation Diffusion refer to the ways in which robotics can be aligned with human values and adoption patterns. This is what informs scholars demand for open regulation on AI powered robotics.

Consequently, whether robotic engineering will either be an AI blessing or a time bomb, depends strongly on how stakeholders manage related risks and utilise ethical paradigms in connection with Robotics and related AI products.

### Recommendations

To regional organisations like AU and UNO, national governments, industries, and stakeholders in adoption and implementation of Artificial Intelligence in robotics in Nigeria and beyond, the researcher recommends integration of AI and ethics education into academic and professional curricula, standardisation of ethical training for robot designers and developers and promotion of collaborative governance across sectors.

And to fellow researchers, for future research, expansion into underrepresented and low-resource environments is recommended. In addition, the researcher also recommend conducting longitudinal studies to evaluate evolving public perceptions and impacts.

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