EXAMINING THE MODERATING EFFECT OF EMPLOYEE READINESS ON TECHNOLOGY-DRIVEN PERFORMANCE IN THE MANUFACTURING SECTOR

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Abstract:

Research points that most technological development not innovative and this effect negatively on employee performance. New technological innovation will help employees to work effectively and increase their output dramatically. The aim of this study is to explore more information towards the technology innovation that influence the employee performance. This study examines the relationship between advanced robotics, artificial intelligence (AI) and electronic monitoring system with employee performance in manufacturing industry can be moderated by employee readiness. In addition, this research is intended to examine the relationship between several variables in a quantitative technique. In contrast, 384 respondents are the sample size. Therefore, this study seeks to gather at least 384 respondents from targeted respondents. The unit of research is individual. This research uses convenience sampling since it is readily accessible for the sample to be collected. To conduct this research, researcher use the primary data collection method to gather the data. The questionnaire method is recorded in this research instruments and measurement to collect quantitative data. Moreover, the data analysis is discussed in five studies such as frequency analysis, descriptive analysis, reliability analysis, Pearson correlation analysis and multiple regression analysis. There are six hypotheses tested in this study. In conclusion, there were only four accepted hypotheses and two rejected hypotheses.

Introduction

Background of The Study

Since the Industrial Revolution, technological advances have caused the manufacturing industry to constantly change. By integrating innovative technology such as robotics, artificial intelligence (AI), the Internet of Things (IoT), and electronic monitoring systems (EMS), Industry 4.0 has accelerated this transition recently (Kagermann et al., 2023; Deloitte, 2020). These technologies enable smart manufacturing systems to feature automation, real-time data interchange, predictive maintenance, and integrated production processes. The manufacturing industry can thus increase flexibility in responding to shifting consumer expectations, lower production costs, improve operational efficiency, and improve product quality (PwC, 2022; World Economic Forum, 2022). Furthermore, in the manufacturing facility setting, digital technologies and data analytics improve operational responsiveness and decision-making procedures (McKinsey & Company, 2021).

Malaysia's manufacturing industry continues to play a significant role in both employment and the country's economic growth. Malaysian manufacturing companies, especially small and medium-sized businesses (SMEs), are urged to implement Industry 4.0 technologies to remain competitive in a market that is becoming more and more globalized. But infrastructure and systems alone are not enough to support technological innovation; human potential and organizational preparedness are also necessary. Employee adaptability and efficient use of technologies like robotics, artificial intelligence, and emergency medical services are critical to their efficacy.

Task performance (such as accuracy, productivity, and efficiency) and contextual performance (such as flexibility, collaboration, and creative behavior) are also components of employee performance in manufacturing. Technology adoption can increase productivity and lower operational mistakes, according to earlier research (Baskaran et al., 2020). However, organizational and human factors, such as employee engagement and leadership styles, affect how well such implementation goes (Rehman et al., 2021; Hong & Zainal, 2023). Consequently, one of the most important factors in determining whether technological innovation results in better performance outcomes is employees' readiness, which is defined as individuals' technical skills, knowledge, psychological preparedness, and flexibility.

Problem Statement

Numerous manufacturing companies continue to experience inconsistent increases in employee performance despite large investments in industry 4.0 technologies. Although robotics, artificial intelligence, and electronic monitoring systems are meant to increase operational efficiency and productivity, their effects on workers are frequently inconsistent and situation-specific (Baskaran et al., 2020).

Employee readiness is one of the main issues. Research shows that the effectiveness of technology adoption in manufacturing settings is limited by digital skills, training, and resistance to change (Hong & Zainal, 2023; Rehman et al., 2021). Unprepared employees may struggle to adjust to new systems, feel less satisfied with their jobs, and suffer from technology anxiety. As a result, the anticipated increases in productivity from improved technology may not fully materialize.

Moreover, a large portion of the current literature uses cross-sectional designs, which offer little understanding of the dynamic and long-term impacts of technological innovation on employee performance (Ang et al., 2020). Resource limitations, a lack of structured training programs, and inadequate change management procedures make it more difficult for the Malaysian manufacturing industry to successfully adopt new technologies (Ismail et al., 2025). The impact of some Industry 4.0 technologies on employee performance and the ways in which employee readiness influences this relationship are thus not well supported by empirical data.

Research Gap

Furthermore, previous research has demonstrated a positive correlation between technological innovation and organizational effectiveness, yet significant gaps remain. First, a lot of research treats technological innovation as a general term without making a distinction between particular technologies like robots, artificial intelligence, and electronic monitoring systems. It is still unclear how these technologies specifically affect certain aspects of worker performance. Second, employee readiness has received little empirical attention as a key explanatory factor, despite prior research acknowledging the influence of organizational culture and human resource policies on innovation results (Rehman et al., 2021; Hong & Zainal, 2023). The Malaysian manufacturing industry has not thoroughly investigated the significance of digital skills, psychological readiness, flexibility, and technological confidence.

Third, knowledge of the continuous and changing character of technological transformation is limited by the majority of current studies' reliance on cross-sectional study approaches (Ang et al., 2020). There is still a dearth of longitudinal and industry-specific research, especially in SMEs, which account for a sizable share of Malaysia's manufacturing sector (Ismail et al., 2025). To gain a more thorough grasp of how Industry 4.0 technologies affect employee performance and the circumstances in which they yield the best results, these gaps must be filled.

Importance of The Study in The Manufacturing Context

The study is significant both conceptually and practically. The theoretical examination of the specific effects of robots, artificial intelligence, and electronic monitoring systems on employee performance enhances the discourse on Industry 4.0 and technological innovation. The study

extends existing frameworks that link technological innovation with employee performance by incorporating employee readiness as a critical variable (Baskaran et al., 2020; Hong & Zainal, 2023). From a leadership perspective, the findings will offer practical advice to manufacturing executives and SME owners. By understanding the role of employee readiness, the manufacturing industry can develop targeted training programs, strengthen digital competencies, and effectively implement change management strategies. As a result, the return on investment in advanced manufacturing technologies may increase.

From a policy perspective, the study supports Malaysia's digital transformation agenda by identifying the barriers and enabling factors that influence the successful implementation of Industry 4.0 technologies. Policymakers can use the findings to design workforce development initiatives and SME support programs that align with emerging technologies (World Economic Forum, 2022). Ultimately, improving employee performance through effective technology innovation will enhance manufacturing competitiveness, operational efficiency, and long-term sustainability in Malaysia's evolving industrial landscape.

Research Objectives

RO1: To test if advanced robotics has any relationship between employee performance in manufacturing industry.
RO2: To test if artificial intelligence has any relationship between employee performance in manufacturing industry.
RO3: To test if electronic monitoring systems have any relationship between employee performance in manufacturing industry.
RO4: To test if advanced robotics has any relationship between employee performance in manufacturing industry can be moderated by employee readiness.
RO5: To test if artificial intelligence has any relationship between employee performance in manufacturing industry can be moderated by employee readiness.
RO6: To test if electronic monitoring systems have any relationship between employee performance in manufacturing industry can be moderated by employee readiness.

Literature Review

Employee Performance

Employee performance describes the degree to which individuals proficiently execute their job duties and advance organizational objectives. It encompasses work habits, adaptability, and behaviors that enhance productivity and foster an excellent work environment. The notion of performance is elucidated through several motivating ideas. Herzberg's two-factor theory (1959) differentiates between hygiene elements that avert unhappiness and motivators that improve job satisfaction and performance. Expectancy theory posits that employees exhibit enhanced performance when they see a correlation between their efforts and desirable outcomes, whereas goal-setting theory underscores the significance of explicit and ambitious goals in augmenting performance. Employee performance is affected by both individual and organizational factors. Personal attributes such as motivation and personality influence employees' job engagement, whereas organizational elements like training, leadership style, and the work environment impact employees' capacity and readiness to execute (Noe, 2020). Organizations evaluate performance using traditional methods like performance reviews and key performance indicators (KPIs), as well as modern tools like objectives and key results

(OKRs) and 360-degree feedback. Nonetheless, subjectivity continues to pose a barrier in performance assessment (Aguinis, 2019). Consequently, enhancing employee performance necessitates tactics including incentives, employee engagement, effective leadership, and ongoing feedback to facilitate improved outcomes (Goleman, 2020; Denison, 2020).

Advance Robotics

The discipline of advanced robotics seeks to create adaptable, intelligent, and autonomous devices proficient at functioning within intricate and unpredictable settings. Recent advancements have been propelled by developments in cloud computing, sensor technologies, machine learning, and robotics integration. Currently, advanced robots are extensively utilized in manufacturing, healthcare, logistics, and service sectors, with surgical robots and collaboration robots (cobots) revolutionizing medical procedures and industrial processes. Robots' capacity to comprehend their environment, make independent judgments, and adapt in real time has been markedly improved by technologies such as deep learning, simultaneous localization and mapping (SLAM), and cloud robotics (Cadena et al., 2025). Notwithstanding these gains, obstacles persist in sustaining public trust, confronting ethical dilemmas, and alleviating fears regarding job displacement (Sharkey, 2024). Future advancements in soft robotics, biomimetic designs, and emotional intelligence are expected to enhance the integration of robots into daily life, healthcare, and education. To guarantee that advanced robotic systems yield social advantages while mitigating hazards, continuous interdisciplinary research and the implementation of responsible innovation are essential.

Artificial Intelligence (AI)

Artificial intelligence (AI) pertains to the creation of machines capable of reproducing characteristics of human intelligence, such as learning, reasoning, and problem-solving. Principal domains of artificial intelligence are computer vision, robotics, natural language processing, and machine learning. Recent advancements, especially in deep learning and reinforcement learning, have empowered AI to execute intricate jobs in healthcare, finance, autonomous cars, and education. The practical applications of AI currently encompass disease diagnosis, autonomous vehicle operation, and the functionality of virtual assistants. Even though AI has many benefits, it also brings significant ethical and social challenges, like biased algorithms, lack of clarity, and concerns about data privacy, which has led to calls for AI research that is responsible, focused on people, and transparent (Floridi et al., 2021). The quest for Artificial General Intelligence (AGI), systems that can execute any cognitive task achievable by humans, constitutes a primary objective of AI research (Goertzel & Pennachin, 2020). As AI technologies progress, robust governance frameworks and interdisciplinary collaboration will be crucial to guarantee that AI's influence is ethical, equitable, and advantageous to society.

Electronic Monitoring System

Electronic Monitoring Systems (EMS) are systems that observe, document, and communicate behavior in real time and are extensively utilized in healthcare, employment, and the criminal justice system (Gable, 2019). In the realm of criminal justice, electronic monitoring systems, like GPS ankle trackers, can contribute to the reduction of incarceration rates and recidivism. Critics contend that these methods extend governmental surveillance into the private lives of individuals (Nellis, 2025). In professional environments, the excessive or ineffective

application of EMS may degrade employee trust, morale, and privacy, notwithstanding its role in monitoring productivity and safety (Jeske & Santuzzi, 2025). EMS utilizes cloud-based technologies, GPS, and biometrics, with a rising reliance on machine learning to improve predictive analytics (Aungst & Belliveau, 2025). Notwithstanding these advancements, apprehensions regarding user autonomy, system dependability, and data privacy endure. Concerns about ethics, like getting permission and the mental impact of being watched all the time, have sparked calls for clear, fair, and respectful EMS rules (Marx, 2024). Although EMS can enhance efficiency, safety, and operational control, its deployment requires meticulous management to safeguard civil liberties, uphold human dignity, and guarantee responsible utilization.

The Relationship Between Advanced Robotics and Employee Performance

The integration of robotics in the workplace has significantly influenced employee performance across industries. By automating repetitive, hazardous, or precision-intensive tasks, robots allow employees to focus on more complex, strategic, and creative responsibilities, particularly when robots assist rather than replace human labour (Bogue, 2022; Colgate et al., 2021). Implementing robotics often requires employees to acquire new technical skills, making investment in training essential to sustain performance levels (Arntz et al., 2023). While some employees benefit from these changes, others may experience job insecurity or reduced performance due to challenges in adapting to new technologies (Frey & Osborne, 2022). Additionally, psychological effects such as fear of unemployment can further decrease motivation and morale (Acemoglu & Restrepo, 2020). When implemented thoughtfully, robotics can shift employees from manual labour to more fulfilling tasks, enhance workplace safety, reduce injuries, and strengthen long-term engagement. Overall, the impact of advanced robotics on employee performance is multifaceted and largely depends on how organisations manage technological change.

The Relationship Between Artificial Intelligence and Employee Performance

Artificial intelligence (AI) has also reshaped employee performance, offering both opportunities and challenges. By automating routine tasks, supporting data-driven decision-making, and enhancing training processes, AI enables employees to focus on strategic, creative, and interpersonal work, improving productivity and job satisfaction (Brynjolfsson & McElheran, 2021). AI tools, such as virtual assistants and performance analytics platforms, provide real-time feedback, facilitate goal setting, and optimise workflows, fostering efficient work practices (Jarrahi, 2022). However, AI can negatively affect motivation, trust, and mental well-being, raising concerns about job displacement, skill redundancy, and heightened monitoring (Acemoglu & Restrepo, 2020). The extent to which AI enhances performance depends on organisational readiness, ethical deployment, and employee acceptance (Raisch & Krakowski, 2021). A balanced, human-centred approach ensures that AI supports employee performance while safeguarding well-being and engagement.

The Relationship Between Electronic Monitoring Systems and Employee Performance

Electronic monitoring systems (EMS) are increasingly adopted to manage remote work, enhance productivity, and ensure compliance, using tools such as biometric devices, computer activity trackers, and surveillance cameras. EMS can improve focus and accountability, as employees become more conscious of their actions and time management, while providing

managers with real-time data to address performance gaps (Ball, 2020; Ravid et al., 2020). Nevertheless, excessive or non-transparent monitoring can increase stress, reduce intrinsic motivation, and lower job satisfaction (Jeske & Santuzzi, 2025). The effectiveness of EMS largely depends on transparent implementation and employees perceiving the system as fair and supportive rather than punitive (Tomczak et al., 2021). Therefore, although EMS has the potential to enhance employee performance, its success is contingent on organisational culture, ethical design, and clear communication.

Employee Readiness

Employee readiness indicates the degree to which individuals are psychologically, emotionally, and behaviourally equipped to participate in and endorse organizational change. It is essential in influencing employee reactions to new initiatives, especially those related to technical breakthroughs like automation, digitization, or organizational restructuring. Employees are more inclined to adapt effectively when they comprehend the change, maintain favourable attitudes towards it, and engage actively in its execution, hence improving performance and diminishing resistance (Holt et al., 2023). In contrast, low readiness may present as tension, worry, or withdrawal, compromising the efficacy of change initiatives. Determinants of employee readiness include perceived organizational support, trust in leadership, previous experiences with change, and the accessibility of requisite training and resources (Choi & Ruona, 2021). Consequently, organizations aiming to implement change effectively must prioritize tactics that foster readiness, including clear and consistent communication, employee engagement, and access to pertinent training. By cultivating preparedness, organizations may preserve engagement and uphold high performance during transitional phases.

To Determine the Moderating Role of Employee Readiness in The Relationship Between Advance Robotics and Employee Performance

An increasing number of organisational and human factors shape the relationship between robotics and employee performance, with employee readiness emerging as a critical determinant. Properly implemented robotics can enhance performance by automating repetitive tasks, improving accuracy, and allowing employees to focus on more complex, strategic, and creative work (Colgate et al., 2020). However, the extent to which these benefits are realised largely depends on employees' readiness to adopt and adapt to new technologies. Employee readiness encompasses the ability, willingness, and psychological preparedness to engage with technological change, which strongly influences responses to robotic integration (Holt et al., 2019). Employees are more likely to respond positively to robotics when they believe they are capable of using the technology effectively and perceive it as supportive of their work, leading to improved task performance, flexibility, and engagement (Vakola, 2024). In contrast, low readiness can manifest as stress, disengagement, or resistance, reducing the potential advantages of robotic implementation (Choi & Ruona, 2021). Organisations that invest in change management, training programs, and inclusive implementation strategies are better positioned to cultivate a workforce prepared for robotics, maximising positive performance outcomes (Oreg et al., 2023). Consequently, employee readiness is a key factor that can either amplify or diminish the impact of robotics on employee performance.

To Determine the Moderating Role of Employee Readiness in The Relationship Between Artificial Intelligent and Employee Performance

Employee performance has been directly influenced by the substantial changes in work processes resulting from the increasing adoption of artificial intelligence (AI) in the workplace. Organisations are leveraging AI to support decision-making, automate routine tasks, and personalise workflows, which can enhance both individual performance and overall productivity (Davenport & Ronanki, 2021). However, the extent to which AI improves performance often depends on individual factors, particularly employee readiness. Employee readiness refers to an individual's mental, emotional, and behavioural preparedness to embrace change, especially technological change, in the workplace (Holt et al., 2021). Employees who are willing, motivated, and confident in using AI are more likely to engage effectively with the technology, resulting in improved task performance, flexibility, and creativity (Jarrahi, 2022). Conversely, employees who are unprepared exhibiting resistance, anxiety, or insufficient technical skills may experience reduced performance, errors, or disengagement, limiting the benefits of AI. Organisations that proactively foster readiness through clear communication, targeted training, and employee involvement in AI implementation are better positioned to maximise AI's performance-enhancing potential while mitigating risks associated with low adoption or resistance.

To Determine the Moderating Role of Employee Readiness in The Relationship Between Electronic Monitoring System and Employee Performance

The use of electronic monitoring systems (EMS) in the workplace has gained attention due to their potential to enhance employee performance through increased accountability, efficiency, and data-driven management. Employers commonly implement EMS technologies such as computer surveillance, biometric tracking, and real-time productivity tools to improve transparency and performance oversight (Ravid et al., 2020). However, the impact of EMS on performance can be positive or negative, largely depending on how employees perceive and respond to monitoring. Employee readiness is a critical factor in this context, referring to the degree to which individuals are cognitively, emotionally, and behaviorally prepared to accept and adapt to organisational changes (Holt et al., 2022). Employees with high readiness—characterized by openness to technology, confidence in their abilities, and alignment with organisational goals—are more likely to respond positively to EMS, resulting in improved performance and collaboration (Choi & Ruona, 2021). Conversely, employees with low readiness may perceive monitoring as controlling or intrusive, which can trigger resistance, stress, or disengagement and reduce performance (Jeske & Santuzzi, 2025). Therefore, employee readiness is a key determinant of EMS outcomes, and organisations must prioritise change management, transparent communication, and training to foster readiness and maximise the benefits of monitoring systems.
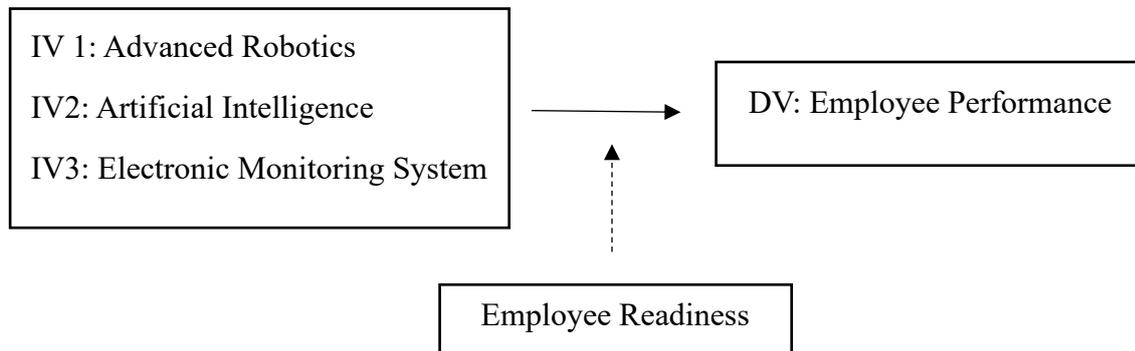
Research Framework

IV 1: Advanced Robotics

IV2: Artificial Intelligence

IV3: Electronic Monitoring System

DV: Employee Performance

Employee Readiness

Figure 1: Conceptual Framework of Research

Research Methodology

Research Design

Research design is a strategic plan that guides how researchers collect, organize, and analyse data to address research questions (Akhtar, 2020). It ensures that the research process aligns with the study's objectives while controlling for potential sources of variance. Broadly, research designs are categorized as qualitative or quantitative. While qualitative research explores subjective experiences, quantitative research focuses on numerical data to identify patterns, relationships, and trends. This study uses a quantitative research design because it aims to measure how technology innovations, like advanced robotics, artificial intelligence, and electronic monitoring systems, affect employee performance, while also considering employee readiness as a influencing factor, in the Malaysian manufacturing industry. The structured approach of quantitative research enables precise measurement and statistical analysis of these relationships.

Population And Sample Size

The population of interest comprises employees working in the Malaysian manufacturing sector. According to the Department of Statistics Malaysia, the manufacturing industry employed approximately 2.40 million workers in 2024. The workforce is divided into several sub-sectors, such as food, beverages, and tobacco; petroleum and chemical products; fabricated metal products; wood and furniture manufacturing; textiles and apparel; and transport equipment. The electrical and electronics industry has the most workers. Using the Krejcie and Morgan Table (1970), a sample size of 384 respondents was identified as sufficient for statistical reliability (Bukhari, 2021; Krejcie & Morgan, 1970). To account for potential non-responses and incomplete questionnaires, 400 questionnaires will be distributed.

Table 1: Numbers of Employees Under Manufacturing Industry Based on Sub-Sector

Manufacturing Sub-Sector	Employees	Share of Manufacturing Employment
Electrical, Electronic & Optical Products	670,000	28%
Petroleum, Chemical, Rubber & Plastic Products	450,000	19%
Food Products, Beverages & Tobacco	350,000	15%
Non-Metallic Mineral Products, Basic Metal & Fabricated Metal	300,000	12–13%
Wood Products, Furniture, Paper Products & Printing	220,000	9%
Textiles, Wearing Apparel & Leather Products	180,000	7–8%
Transport Equipment & Other Manufacturing / Repair	170,000	7%
Total Manufacturing Employment	**2,400,000**	**100%**

(Source: Department of Statistics Malaysia 2024)

Sampling Techniques

The study employs non-probability sampling, specifically convenience sampling, to select participants. Non-probability sampling enables the intentional selection of respondents, whereas convenience sampling emphasizes individuals who are readily accessible and willing to participate (Taherdoost, 2021). This approach is appropriate due to time and budget constraints and is particularly suitable for exploratory research, where the goal is to gain initial insights into employee performance in response to technology innovations rather than to make statistically generalizable claims. Convenience sampling also facilitates efficient pilot testing and preliminary data collection.

Data Collection

Data will be collected using online questionnaires distributed via Google Forms and email. According to Taherdoost (2021), a well-organized data collection process includes clearly planning the distribution method, response timelines, and follow-up procedures. The estimated data collection period is four weeks, during which responses from approximately 450 participants are expected. The questionnaires aim to measure the impact of advanced robotics, artificial intelligence, and electronic monitoring systems on employee performance, while considering the moderating role of employee readiness in the manufacturing industry.

Instrument and Measurement

The questionnaire was used as the primary instrument for data collection due to its cost-effectiveness, scalability, and suitability for collecting data from large populations (Katz, 2020). Questionnaires are widely used in social science research because they enable

researchers to gather standardized responses efficiently from a large number of participants. The questionnaire consists of two main sections. The first section collects demographic information, including respondents' age, gender, level of education, and job position, to describe the characteristics of the participants. The second section measures the key constructs of the study, including the independent variables (advanced robotics, artificial intelligence, and electronic monitoring systems), the dependent variable (employee performance), and the moderating variable (employee readiness). All items are measured using a five-point Likert scale ranging from 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. This scale is commonly used in behavioural and management research, as it allows respondents to indicate their level of agreement with each statement while enabling the researcher to quantify attitudes and perceptions for statistical analysis.

Sample of Original Questionnaire

Table 2: Original Questionnaire Statement with Operational Definition and Sources.

Variables	Operational Definition	Statements	Sources
Employee Performance (DV)	Employee performance is the extent to which an employee successfully fulfills job responsibilities and contributes to organizational goals, measured by goal achievement, work quality, efficiency, adaptability, and team contribution.	1. I consistently achieve my work targets. 2. My work quality meets the standards expected by my organization. 3. I complete tasks efficiently and on time. 4. I am able to adapt to changes in work processes effectively. 5. My overall contribution positively impacts the team's performance.	Adopted from Noe (2020)
Advanced Robotics (IV1)	Advanced robotics is the use of intelligent robotic systems with AI, sensors, and automation to perform complex tasks, measured by task accuracy, efficiency, adaptability, and level of automation	1. Robotics technology in my workplace helps reduce repetitive and manual tasks. 2. The use of robotics improves the efficiency of production processes. 3. Robotics has positively impacted the quality of output in my department. 4. I am able to operate or interact with robotic systems effectively.	Adopted from Sharkey (2024)

		5. Robotics technology has improved overall productivity in my team.	
Artificial Intelligence (AI) (IV2)	Artificial Intelligence is the capability of machines to perform tasks requiring human-like intelligence, measured by data processing accuracy, pattern recognition, prediction ability, and adaptability to new information	1. AI-based systems support decision-making in my daily tasks. 2. AI helps to predict and prevent errors in the production process. 3. I feel confident using AI technologies in my work. 4. AI contributes to increased efficiency in performing my tasks. 5. AI systems have positively impacted the overall performance of my department.	Adopted from Floridi et al. (2021)
Electronic Monitoring System (IV3)	. An Electronic Monitoring System is a technological system that tracks and supervises activities using devices like sensors, cameras, or GPS, measured by accuracy, real-time monitoring, reliability, and effectiveness in decision-making.	1. Electronic monitoring systems help track my work performance accurately. 2. Monitoring systems provide useful feedback for improving my performance. 3. I feel more accountable due to the presence of monitoring systems. 4. Electronic monitoring motivates me to perform better. 5. The monitoring systems have improved overall productivity in my workplace.	Adopted from Tomczak et al. (2021)
	Employee readiness is the extent to which employees are prepared to perform their job roles and adapt to changes,	1. I am open and willing to adopt new technology in my workplace. 2. I feel confident in my ability to learn new systems or tools.	Adopted from

Employee Readiness (Moderator)	measured by their skills, confidence, adaptability, and motivation.	3. I have received sufficient training to handle technological innovations. 4. I actively seek opportunities to improve my technical skills. 5. I am motivated to adapt to changes introduced by technology in my work	Jeske and Santuzzi (2025)

Pilot Test

A pilot test was performed by distributing the questionnaire to the respondents. The pilot test is vital because it reveals errors in the questionnaire when given to respondents. The pilot test collected 35 data points to test the reliability of all the questionnaire's questions. According to Murugan and Govindarajen (2023), the data of the pilot test is using the Statistical Package of Social Sciences (SPSS) to analyse for the result. In the pilot test, Cronbach's alpha will be tested. According to George and Mallery (2020), reliability is the degree to which measures are free of error and thus produce reliable results. According to Renuse (2024), one of the most significant and prevalent statistics in research has been identified as Cronbach's alpha. The author categorizes the result of the Cronbach's alpha into several categories: excellent, good, acceptable, and questionable. For the excellent, the Cronbach's alpha result is more than 0.9. For the goods, it is more than 0.8, and the acceptable is more than 0.7.

Table 3: The Reliability Statistics on Pilot Test

Variable	No. of Item	Cronbach's Alpha
Employee Performance	5	0.771
Advance Robotics	5	0.802
Artificial Intelligence	5	0.886
Electronic Monitoring System	5	0.834
Employee Readiness	5	0.721

Table 1 shows the result of Cronbach's alpha, with the highest reliability score ($\alpha = 0.886$), the Artificial Intelligence scale showed strong internal consistency among its items. The Electronic Monitoring System ($\alpha = 0.834$) and Advanced Robotics ($\alpha = 0.802$), both of which demonstrated strong dependability, came next. Acceptable reliability levels were found for the Employee Performance ($\alpha = 0.771$) and Employee Readiness ($\alpha = 0.721$) scales, indicating that the items in these constructs measure their respective concepts fairly consistently.

Data Analysis Procedure

After data collection, the responses will be analysed using IBM SPSS Statistics. Several statistical techniques will be employed to analyse the data. Frequency analysis will be conducted to summarize the demographic characteristics of the respondents. Descriptive

analysis will be used to examine the central tendencies and variability of the responses. Reliability analysis will be performed to assess the internal consistency of the questionnaire items using Cronbach's alpha. In addition, Pearson Correlation Analysis will be applied to determine the strength and direction of the relationships among the variables. Finally, Multiple Regression Analysis will be conducted to evaluate the impact of technological innovations, namely advanced robotics, artificial intelligence, and electronic monitoring systems, on employee performance, while considering employee readiness as a moderating variable. This structured analytical approach helps ensure that the research findings are reliable and valid for addressing the objectives of the study.

Results and Discussion

To analysis results, this study uses the Statistic Package for Social Science (SPSS) student version. In addition, five studies such as frequency analysis, descriptive analysis, reliability analysis, Pearson correlation analysis, and multiple regression analysis, will address data analysis.

Frequency Analysis

The study of frequencies would examine the number of respondents and percentage of gender, age, highest academic attainment, position and sub-sectors of manufacturing.

Reliability Analysis

Table 4: Reliability Analysis

Variable	Number of Item	Cronbach's Alpha
Employee Performance	5	0.880
Advanced Robotics	5	0.737
Artificial Intelligence	5	0.881
Electronic Monitoring System	5	0.785
Employee Readiness	5	0.724

The reliability study of five variables using Cronbach's Alpha, a metric for internal consistency, is shown in Table 2. There are five items in each variable. With Cronbach's Alpha of 0.880, the Employee Performance scale has outstanding internal consistency. With an alpha of 0.881, the Artificial Intelligence variable also exhibits excellent reliability. With alpha values of 0.737 and 0.785 respectively, the Advanced Robotics and Electronic Monitoring System scales demonstrate acceptable reliability. Lastly, the Employee Readiness variable has an adequate Cronbach's Alpha of 0.724. All of the study's constructs exhibit satisfactory levels of reliability overall. This indicates that the measurement instruments are reliable and appropriate for more research.

Descriptive Analysis

Table 5: Descriptive Statistics

Variable	N	Mean	Standard Deviation
Employee Performance	398	4.2437	0.63938
Advanced Robotics	398	4.4121	0.46635
Artificial Intelligence	398	4.5799	0.46086
Electronic Monitoring System	398	4.4503	0.49040
Employee Readiness	398	4.5095	0.43483

Table 3 illustrates the descriptive statistics for the study are derived from 398 participants. All factors have comparatively high mean values, indicating that respondents' opinions are largely favorable. At 4.5799 (SD = 0.46086), Artificial Intelligence gets the highest mean score. The Electronic Monitoring System scores 4.4503 (SD = 0.49040), while Employee Readiness comes in second with a mean of 4.5095 (SD = 0.43483). Additionally, Advanced Robotics did well, with a mean score of 4.4121 (SD = 0.46635). Despite showing a good trend, Employee Performance has the lowest mean at 4.2437 (SD = 0.63938). All of the variables' standard deviations are modest, suggesting that the responses are mostly clustered around the mean. This implies that participants have a high degree of agreement.

Pearson Correlation Analysis

Table 6: The Correlation Between Advanced Robotics, Artificial Intelligence, Electronic Monitoring System, Employee Readiness and Employee Performance.

		EP	AR	AI	EMS	ER
EP	Pearson correlation	1				
	Sig. (2-tailed)					
	N	398				
AR	Pearson correlation	0.645**	1			
	Sig. (2-tailed)	0.000		0.000	0.000	0.000
	N	398	398			
AI	Pearson correlation	0.412**	0.539	1		
	Sig. (2-tailed)	0.000	0.000		0.000	0.000
	N	398	398	398		
EMS	Pearson correlation	0.609**	0.647	0.580	1	
	Sig. (2-tailed)	0.000	0.000	0.000		0.000
	N	398	398	398	398	
ER	Pearson correlation	0.608**	0.737	0.779	0.864	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	
	N	398	398	398	398	398

**Correlation is significant at the 0.01 level (2-tailed)

According to Table 4, a sample of 398 participants was used for the Pearson correlation study, which looked at the correlations between five variables, which are Employee Performance (EP), Advanced Robotics (AR), Artificial Intelligence (AI), Electronic Monitoring System (EMS), and Employee Readiness (ER). Strong evidence of a relationship between the variables was indicated by the statistical significance of all correlations at the 0.01 level. There was a positive and substantial correlation between employee performance and each of the four predictors, which are EMS (r = 0.609), AI (r = 0.412), AR (r = 0.645), and ER (r = 0.608). This implies that enhanced employee performance is correlated with technological innovation and employee readiness aspects.

Multiple Regression Analysis

Table 7: Relationship Between Advanced Robotics, Artificial Intelligence And Electronic Monitoring System with Employee Performance

Dependent Variable	Independent Variable	Std. Beta	Sig.
Employee Performance	Advanced Robotics	0.459	0.000**
	Artificial Intelligence	0.002	0.974
	Electronic Monitoring System	0.346	0.000**
R^2		0.480	
Adjusted R^2		0.474	
F Change		90.554	

P< 0.01**, P<0.05*

Table 5 show that, the effects of advanced robotics, artificial intelligence, and the electronic monitoring system on employee performance were investigated using multiple regression analysis. With a p-value of less than 0.01 and an F-change of 90.554, the entire model was statistically significant. This suggests that a sizable portion of the variation in employee performance may be explained by the independent variables taken together. A decent model fit was shown by the model's adjusted R² of 0.474 and its 48.0% variance explanation (R² = 0.480). The Electronic Monitoring System (β = 0.346, p < 0.01) and Advanced Robotics (β = 0.459, p < 0.01) were the predictors that significantly improved employee performance. Artificial Intelligence, on the other hand, had no significant impact (β = 0.002, p = 0.974), indicating that AI had no direct effect on employee performance in this situation. These results demonstrate the significance of advanced robotics and electronic monitoring systems in enhancing employee performance. AI's impact could be less immediate and impacted by other variables.

Table 8: Relationship Between Advanced Robotics, Artificial Intelligence And Electronic Monitoring System With Employee Readiness And Employee Performance

Dependent Variable	Independent Variable	Std. Beta	Sig.
Employee Performance	Advanced Robotics with Employee Readiness	0.575	0.000**
	Artificial Intelligence with Employee Readiness	-0.321	0.005**

Electronic Monitoring System with Employee Readiness	0.282	0.003**
R^2		0.472
Adjusted R^2		0.466
F Change		87.672

$P < 0.01$**, $P < 0.05$*

From Table 6, regression analysis was used to examine the effects of employee readiness on employee performance in relation to advanced robotics, artificial intelligence, and electronic monitoring systems. With a p-value of less than 0.01 and an F-change of 87.672, the model demonstrated excellent explanatory power and was statistically significant. The adjusted R² was 0.466, indicating a decent fit, and the model explained 47.2% of the variance in employee performance (R² = 0.472). Employee performance was strongly and significantly improved by the interaction between Advanced Robotics and Employee Readiness (β = 0.575, p < 0.01). This demonstrates how robotics improves performance when employees are prepared and able to do so. It's interesting to note that there was a substantial negative impact (β = -0.321, p = 0.005) in the interaction between AI and employee readiness. This implies that greater preparedness might lessen AI's performance impact, either as a result of resistance or dependence. In contrast, there was a significant beneficial impact from the interaction between employee readiness and electronic monitoring systems (β = 0.282, p = 0.003). This suggests that employees are more likely to perform better if they are more ready or receptive to monitoring technologies. These results highlight the critical role that employee readiness plays in the ways that technology systems affect workplace productivity.

Results of Hypotheses Testing Summary

Table 9: Hypothesis Result

Hypothesis	Statement	Remarks
H1	There is relationship between advanced robotics and employee performance in manufacturing industry,	Accepted
H2	There is relationship between artificial intelligence and employee performance in manufacturing industry	Rejected
H3	There is relationship between electronic monitoring system and employee performance in manufacturing industry.	Accepted
H4	The relationship between advanced robotics and employee performance in manufacturing industry can be moderated by employee readiness	Accepted
H5	The relationship between artificial intelligence and employee performance in manufacturing industry can be moderated by employee readiness.	Rejected

H6	The relationship between electronic monitoring systems and employee performance in manufacturing industry can be moderated by employee readiness.	Accepted

Conclusion

This study emphasizes the pivotal role of employee readiness including skills, attitudes, and willingness to adopt new technologies in translating technological innovation into improved performance within the manufacturing industry. Unlike prior research that often treats technology as an independent driver of performance, this study integrates human and technological factors, showing that employee preparedness mediates the effectiveness of innovation. By providing practical guidance on aligning technology projects with employee training programs, the research offers actionable insights for companies seeking to maximize the benefits of technological change. Additionally, by identifying gaps in cause-and-effect relationships, industry-wide applicability, and factors such as leadership and organizational culture, the study lays the groundwork for future cross-industry research.

The findings indicate that improved performance is not solely a result of technological advancements; instead, employee readiness and willingness to embrace new technologies play a critical role in translating innovation into organizational success. Skills, attitudes, and openness to change serve as important indicators of readiness. For technology to be effectively integrated into operations, such preparedness is essential. Therefore, organizations must ensure that technological initiatives are complemented by programs designed to enhance employee capabilities, fostering successful adoption and sustainable performance improvements.

However, research has several limitations. The cross-sectional design limits the ability to draw causal inferences or evaluate long-term effects. Reliance on self-reported data may introduce bias and affect the accuracy of the findings. The study focused solely on the manufacturing industry within a single region, which restricts the generalizability of results to other industries or international contexts. Moreover, the analysis did not consider other potentially influential factors, such as market dynamics, organizational culture, and leadership style.

Future research should address these limitations by employing longitudinal designs to track changes over time and better assess causality. Incorporating qualitative methods, such as case studies or interviews, may provide deeper insights into the dynamics of employee performance and technology adoption. Expanding the study to additional sectors and geographic regions would help validate the findings, while investigating variables such as organizational readiness, leadership commitment, and technological complexity could contribute to a more comprehensive understanding of the conditions under which technology adoption enhances performance. Overall, this study highlights the importance of human factors in technological change, demonstrating that employee readiness is essential for maximizing the benefits of innovation in the manufacturing sector.

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Ethics Statement:	This study did not involve any human participants, animals, or sensitive data requiring ethical approval. The authors confirm that the research was conducted in accordance with accepted academic integrity and ethical publishing standards.
Author Contribution Statement:	All authors made substantial contributions to the development of this manuscript. Mehela Subramaniam was responsible for the literature review, conceptualization, methodology, data collection, data analysis, interpretation of results, manuscript drafting, and critical revision of the manuscript. Sri Sarah Maznah Mohd Salleh and Dayang Hasliza Muhd Yusuf provided overall supervision and guidance throughout the development of the manuscript. All authors reviewed and approved the final version of the manuscript prior to submission and agreed to be accountable for all aspects of the work.

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