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Harnessing AI and Robotics to Drive Sustainable Project Outcomes in Clean Energy Development

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A B S T R A C T

The research focuses on analyzing the use of clean energy and the ways to develop it in a sustainable manner in the context of organizational premises. The thorough research on the effectiveness of incorporating advanced technology such as "AI and Robotics" has also been incorporated in the paper in order to gaining in the knowledge regarding the technology integration at sustainability management. As the need for clean energy grows, incorporating smart technology becomes critical to attaining sustainability goals effectively and economically. The aim of this study is to critically analyze the role of smart technologies like Robotics and AI for enhancing outcomes in installing solar grids. The current studies identify regulatory complexities and stakeholders' opposition as major roadblocks; the full-scale effect of smart technology can be observed with project aims tailored to environmental regulations. Therefore, organizations need to coordinate technology deployment with long-term sustainability objectives, guaranteeing scalability and system resilience for fully realizing the potential of these technologies.

1. INTRODUCTION

Smart technology, notably AI, robotics and automation play an increasingly important role in scaling up sustainable energy infrastructure. Smart technologies, like AI and robotics, are transforming solar farm construction and operation in the United States. In the US, the AI and robotics market is expected to reach $9.49bn in 2025, with an annual growth rate of 27.42% (Statista, 2025). This indicates that the US has a strong corporate environment and supporting government policies to support the use of smart technology for enhancing sustainable project outcomes.

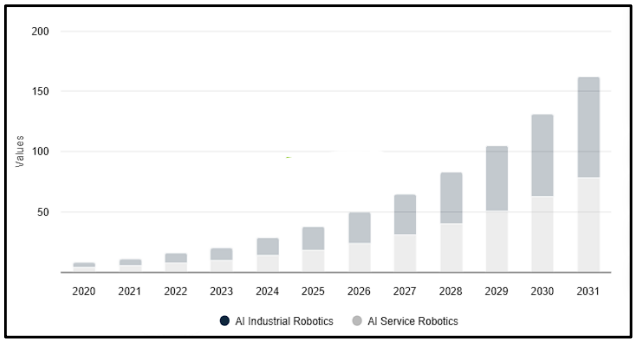

Figure 1: AI and Robotics Market in the US (Source: Statista, 2025)

As the need for clean energy grows, incorporating smart technology becomes critical to attaining sustainability goals effectively and economically. Terabase Energy funded $130 million in for its

smart technology integration in solar grids suggest smart automation for increased production, lower labour and operating expenses (ESG, 2025). The United States generated roughly 303.2 terawatt-hours (TWh) of solar energy, with utility-scale solar accounting for 218.5 TWh (EIA, 2024). This breakthrough emphasises the rising importance of AI and robotics in improving the efficiency and scalability of sustainable energy projects across the country.

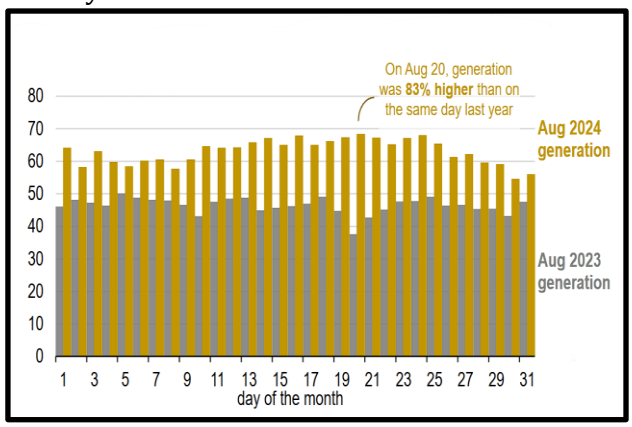

Figure 2: Solar Electricity generation and Demand in the U.S.

(Source: EIA, 2024)

1.1. Research aim

The aim of this study is to critically analyse the role of smart technologies like Robotics and AI for enhancing outcomes in installing solar grids.

1.2. Research Objectives

- To determine the main obstacles that green project management must overcome
- To examine the ways in which intelligent technology might minimize waste and maximize resource allocation
- To evaluate how AI and blockchain could increase efficiency and transparency.
- To evaluate the possible financial and ecological advantages of incorporating smart technology
- To offer suggestions for integrating smart technology into environmentally friendly initiatives

1.3. Problem statement

Problem Statement: Full potential of green projects are limited by inefficient resources allocation, fragmented data systems and outdated IT monitoring & infrastructure.

As per Sharma et al. (2023), higher operating costs cause implementation delays of innovative technologies in an organisation. Many sustainability programs continue to use manual or outdated methods that lack precision and flexibility, making it impossible to accurately monitor and manage their environmental impact. This research investigates the impact of AI and robots that can transform green project management by improving decision-making, real-time data analytics and automation for more sustainable and scalable solutions.

1.4. Hypothesis

H1. Smart technology integration greatly improves efficiency and reduces waste in green project management.

H2. When IoT and AI are applied to green initiatives, better real-time decision-making results in more sustainable outcomes.

2. LITERATURE REVIEW

2.1. Impact of developing Smart grid for energy efficacy

The development of smart grids can significantly help in enhancing the energy efficiency in the business organisations and long-term use in market premises. The research by Albogamy et al. (2022) has demonstrated that the smart grid for sustainability incorporation in energy consumption significantly reduces the environmental impact in the long-time frame. The smart grid development also maximises the system reliability, resilience and flexibility in the long-term executives which provides stability at the energy consumption in large organisations (Shehab et al., 2023; Alshurideh et al., 2024; Neyara Radwan et al., 2025; Alzoubi et al., 2024). The research by CODES (2022) has also identified that the “International Energy Agency (IEA)” has focused on highlighting the centralisation of energy production which can help in enhancing flexibility and energy distribution among the users (Alzoubi et al., 2025; Al-Qasem & A., 2021; Nazeer et al., 2025; Kukunuru et al., 2019). This can also help in enhancing the use of renewable energy sources in the organisational premises. The report by the “European Commission” has depicted that the energy consumption in the UK can increase by 10% to 12% by the year 2030 (Europea, 2025). This enhances the requirement for optimisation of energy distribution and reduces emissions in the long term.

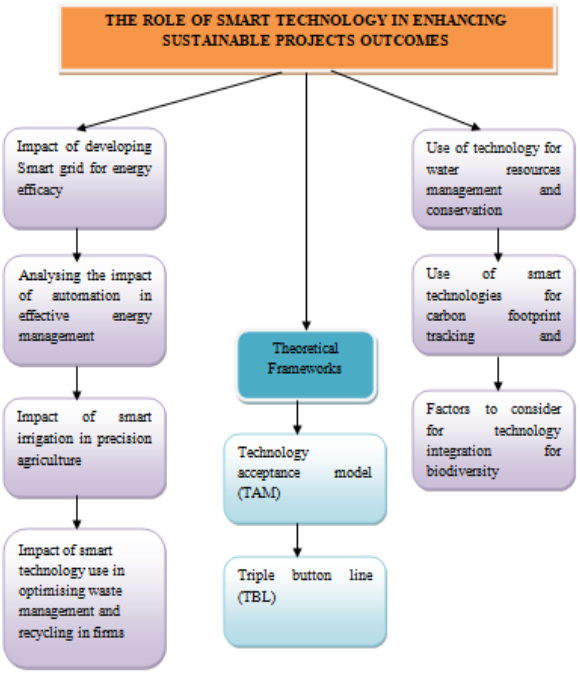

Figure 3: "Conceptual framework"
(Source: Self-Developed)

2.2. Analysing the impact of automation in effective energy management

The development of effective energy management and automation integration in the large business organisations faces the impact of automation technology at the energy consumption management (Ilyas et al., 2023). The research by Papinutto et al. (2022) has found that the encompassment of automation technology helps in reducing the energy consumption through the optimisation of lighting and HVAC systems (Alqassem et al., 2022; Sakkthivel et al., 2025; Al Kurdi et al., 2024; Nuseir et al., 2021). This also focuses on reduction in greenhouse gas emission that improves the operation of efficiency. The article by He & Chen (2024) has depicted that the encompassment of green technology can help in sustainable urban development. Therefore, it can be portrayed that automation technology has a prolonged impact on energy efficiency management in the long-term perspective (Rana et al., 2025; Khan et al., 2023; El Khatib et al., 2023; Yas et al., 2024; Karthika et al., 2024).

2.3. Impact of smart irrigation in precision agriculture

The encompassments of smart grid systems are also effective for describing precision agriculture, which can significantly contribute to the sustainability perspective at the organisational level (Treacy et al., 2025; Shwedeh et al., 2024; Almidfa et al., 2024; Zeeshan et al., 2025; Anifa et al., 2022). The paper by Hassan et al. (2021) has identified that the enhancement of automation uses at the agricultural firms can significantly help in soil monitoring and reduce the water uses. The automation in business perspective implementation can help in cutting down the need for using additional technological supports to enhance quality of operations in the long-time pass practice (El Khatib et al., 2023; Alshurideh et al., 2022; Radwan et al., 2025; AlShawabkeh et al., 2023). The research by Subeesh & Mehta (2021) has focused on demonstrating the use of automation for monitoring the agriculture operations. Therefore, it can be portrayed that the implementation of smart technology can help in maintaining sustainability at the business premises in long time perspectives.

2.4. Impact of smart technology use in optimising waste management and recycling in firms

The use of smart technology is effective in maintaining the waste management in firms (Alshurideh et al., 2025; Samer Hamadneh et al., 2023; Tanveer et al., 2025; Khatib et al., 2024; Som et al., 2023). The research by Lakhouit (2025) has found that the automation in waste management helps in enhancing sustainability in the businesses. The report by "UN Environment Programme (UNEP)" has demonstrated that the AI technology can improve recycling efficiency by approximately 50% (UNCP, 2025; Kharbat et al., 2024; Kabiraj et al., 2009; Kharabsheh et al., 2024; Rosmadi et al., 2025; Naim et al., 2024). This also contributes to the effective collection of data to optimise the waste management in industries.

2.5. Use of technology for water resources management and conservation

The technology integration for wastewater management is also a part of organisational activities. The article by Preite & Vignali (2024) demonstrates that the uses of AI algorithms are effective in managing the water use optimization in firms (Joghee et al., 2023; Alkatheeri et al., 2025; Alzoubi et al., 2024; Joghee et al., 2013; Tangri et al., 2023; Yas et al., 2024; Shao et al., 2025). The AI integration helps in managing water use in the organisational premises. The development of urban water efficiency can be done through real time monitoring (Fu et al. 2022; Shwedeh et al.,

2024; Alzoubi et al., 2024; Alhashmi et al., 2025; AI-Nakeeb et al., 2024; Al-Shawabkeh et al., 2011). This depends on the smart system integration in organisations.

2.6. Use of smart technologies for carbon footprint tracking and sustainability reporting

The tracking of carbon footprint is essential for maintaining sustainability in the firms. The research by Huang & Mao (2024) has depicted that the use of artificial intelligence is efficient to track the carbon footprint (Hanaysha et al., 2021; Al-Shawabkeh et al., 2016; Kabiraj et al., 2011**;** Nazeer et al., 2025). This improves the engagement of the organisation to address the risks that are faced during the development of solar power projects to maintain sustainability (AlShawabkeh et al., 2018; Al Najdawi et al., 2024; Al-Qassem et al., 2021; Alzoubi et al., 2024). In contrast, the lack of experience at the large organisation perspective has created poor growth of the business operation (Adamik & Sikora-Fernandez, 2021). This largely impacts the sustainability reporting in the firms and hampers the carbon footprint tracking of businesses such as solar power grid manufacturers (El Khatib et al., 2024; Al-Qassem & A. H., 2024; El Khatib et al., 2023; Alhashmi et al., 2025; Ahmed et al., 2024; Al-Qassem et al., 2025).

2.7. Factors to consider for technology integration for biodiversity monitoring and conservation

The key factors that are required to form effective biodiversity monitoring include the accessibility to the real time data and encompassment of image recognition (Alblooshi et al., 2025; Yas et al., 2024; Anifa et al., 2024; Razmak et al., 2018; Shwedeh et al., 2023). The article by Müller et al. (2023) has demonstrated that "Nature Communications" portrays that the use of drones can help in monitoring biodiversity. The encompassing of the data security and sustainability perspectives are also identified as the crucial aspects for enhancing the efficiency of biodiversity conservation (Singh & Vallarasu, 2023; El Khatib et al., 2023; Al-Shawabkeh et al., 2013). The use of automated drone also contributes to better data gathering for sustainability management in the long-time frame.

3. THEORETICAL IMPLICATIONS

"Technology acceptance model (TAM)"

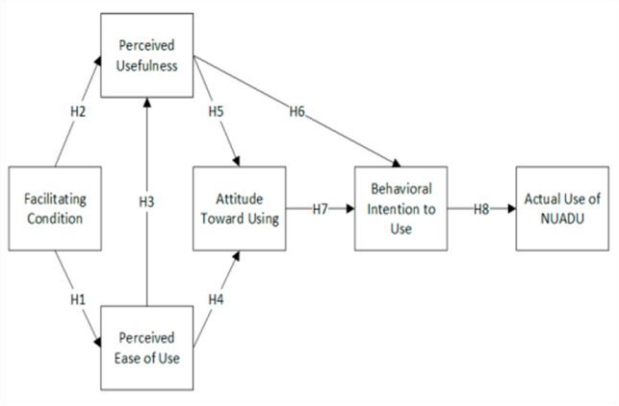

Figure 4: "Technology acceptance model (TAM)" (Source: Natasia et al. 2022)

The application of the TAM model finds that the technology integration in the business premises is highly dependent on the perceived usefulness of the technology (Habbal et al., 2019; Ma'asor et al., 2023; Maydybura et al., 2024; Joghee et al., 2023; Al Kurdi et al., 2025). The use of AI technology is highly effective in the context of solar grid installation for automating the process of power generation (Natasia et al. 2022). However, the technology integration rates challenges related to the requirement of high adaptability (Razmak et al., 2018; Al Hamadi et al., 2024; El Khatib et al., 2023; Al Najdawi et al., 2024; Shwedeh & F., 2022). Thus, the application of TAM is effective for encompassing smart technologies in organisations to foster sustainability through technology integration.

"Triple button line (TBL)" theory

The implementation of "Triple button line (TBL)" theory finds that the integration of smart technologies is helpful in optimising the sustainability perspectives in the organisational activities (Naim et al., 2025; Sun et al., 2016; Nuseir et al., 2019; Pande et al., 2024**;** Khatib et al., 2024). The technology integration for automating the waste management and monitoring power generation aligns with the people and planet management aspects of the theory (Olawade et al. 2024; Kharbat et al., 2021; Al-Kassem, 2022; El Khatib et al., 2024). Thus, the application of the theory is helpful to foster effective technological integration in organisational premises to foster innovation for maintaining sustainability.

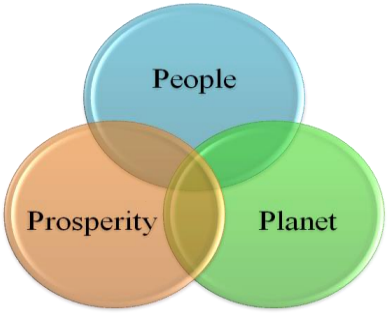

Figure 5: "Triple button line (TBL)" theory
(Source: Self Developed)

3.1. Literature gap

The key gap in the literature includes the lack of insights regarding the implementation of technology for the process of installing the technology for sustainability practices. The practical applicability related information is missing in the literature, which creates a gap in the research.

4. METHODOLOGY

4.1. Research Philosophy

This research is going to use "***Interpretivism Research Philosophy"*** for connecting employees' options on AI and robotics with academic evidence studying its impact on green practices within solar grids. Interpretivism philosophy can further help the study to integrate social viewpoints on the subject and its implication, offering an in-depth observation (Bianchi, 2021; Alzoubi et al., 2025). Therefore, using interpretivism can allow the study to define employee opinion with established theories to observe anomalies.

4.2. Research Approaches

The research is going to use "***Deductive Research Approach"*** for deducing the impact of smart technologies on improving efficiency, lowering waste and real-time decision making. According to Casula, Rangarajan & Shields (2021), "deductive research approach" helps studies test hypotheses using organised surveys, aligning with market information to draw insights. Thus, this study chose a "deductive approach" for ensuring to collect recent data supported by studies and public opinion.

4.3. Research Strategy

The research uses a "***Descriptive Research Design"*** for ensuring that the research can capture the underlying issues and opportunities that can influence the direct role of smart technology on enhancing sustainable project outcomes. According to Taherdoost (2021), "descriptive research design" can improve the reliability of a study by obtaining comprehensive information from diverse sources of high-quality data, making conclusions on a broader population. This research adopts both "***Primary and Secondary strategy"*** for gathering high quality data that sheds light on internal factors, as well as the external environment of an organisation. This "Mixed research strategy" can help the study determine innovations introduced by AI, robotics, IoT and Blockchain in enhancing operations of green projects by considering the market influences as well.

4.4. Data Collection Techniques

The research has focused on collecting ***both "Primary quantitative" and "Secondary qualitative"*** data collection techniques. The selection of effective data collection methods is highly crucial for gathering relevant information related to technology in project management and meet the research objectives (Ganesha & Aithal, 2022; Murtaza et al., 2024). The "Primary quantitative" data collection includes the survey method where 51 responses are collected for 10 relative questions. The "Secondary qualitative" data collection has focused on developing 2 themes based on the hypothesis of the research and existing literature is used for analysing those themes using "thematic analysis". Each theme is focused on to be analysed using 3 peer-reviewed articles to gather relevant information in relation to use of smart technologies in sustainable project outcomes.

4.5. Case studies

The key case studies are related to the use of technology for developing green projects for maintaining sustainability outcomes. The research focuses on demonstrating the case study of "Terabase Energy" that focuses on using "robotics and AI" for installing solar grids. The research on the use of "robotics and AI" for green technology development project management related to solar power generation is crucial for enhancing the sustainability practices at the organisational level (Islam et al. 2025; Al-Qassem et al., 2022; Khan et al., 2024). Thus, the study focuses on identifying the application of "robotics and AI" technology for power grid instalment at a large level.

4.6. Best Practices & Improvements

The best practice for improving the methodological section includes the use of mixed methods where

the primary qualitative and secondary quantitative methods can also be incorporated. The mixed method is effective for conducting research as the method helps in gathering information from all kinds of relevant sources (Taherdoost, 2022; AlShawabkeh et al., 2023; Alzoubi et al., 2024; AlNaoimi et al., 2024). This enhances the credibility of the research related to the green practices and use of technological advances such as "robotics and AI" in developing power grids.

4.7. Analysis Method

The ***"Secondary qualitative"*** data is analysed using the ***"thematic analysis method"*** that has incorporated peer reviewed articles and journals to gather relevant information regarding the use of AI and robotics for power grid development. The different forms of data require adapting different analysis methods to forecast effective outcomes in research (Jaramillo et al. 2024). The research has focused on implementing the ***"Descriptive Statistical Methods"*** to analyse the ***"Primary quantitative"*** information.

4.8. Ethical Considerations

The research focuses on following the guidelines of ***"Data Protection Act 2018"*** which provides information regarding "data privacy and security". The "Data Protection Act 2018" is imposed by the government to ensure data privacy which also helps in avoiding the changes of data vulnerabilities for conducting research (Legislation, 2025; Al-Qassem et al., 2024; Alshurideh et al., 2024; Alzoubi et al., 2024; Alblooshi et al., 2025; Ismail et al., 2024). The study focuses on gaining consent from the participants and does not collect personal information while providing the freedom to withdraw the responses voluntarily. The used journals and articles are properly cited to give credit to the researcher which ensures ethical use of data in the research.

4.9. Rationale for Methodology

The reason for choosing ***the "Primary quantitative" and "Secondary qualitative"*** methods for the research is to gather relevant information regarding the use of robotics and AI in developing solar grids projects. The "Primary quantitative" method is chosen to collect the data from the industry professionals which help in getting insights in a more accurate manner (Maida et al. 2022; Sihag et al., 2024). The "Secondary qualitative" methods are used for gathering information from the relevant research and identify the findings from those studies to enhance the credibility of knowledge in the study. Thus, the use of "Primary quantitative" and "Secondary qualitative" methods are justified for collecting the most recent and relevant information that contributes to the reliability of the research outcomes.

4.10. Limitations

The key limitation of the methodology includes the lack of data accessibility in the form of secondary quantitative and qualitative assets. This restricts the information gathering in the context of statistical analysis which could contribute to the effective finding for using advanced technologies in terms of developing solar projects. The applications of the technologies for developing sustainable projects are also missing from the research outcome which creates limitations of the study.

5. FINDINGS & ANALYSIS

5.1. Findings

Primary Quantitative Findings

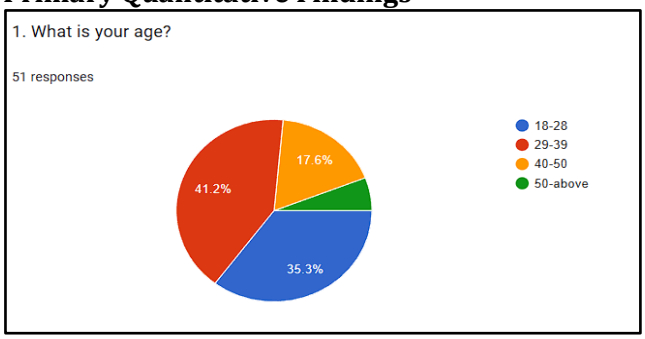

Figure 6: Age of Respondents
(Source: Self-Developed)

Based on the above figure, most of the respondents are aged between 29 and 30, indicating a considerable younger workforce that is capable of influencing survey results. Given Terabase's innovation strategies and its less than 6% older workforce can give an in-depth insight on the behavioural aspects of technology acceptance.

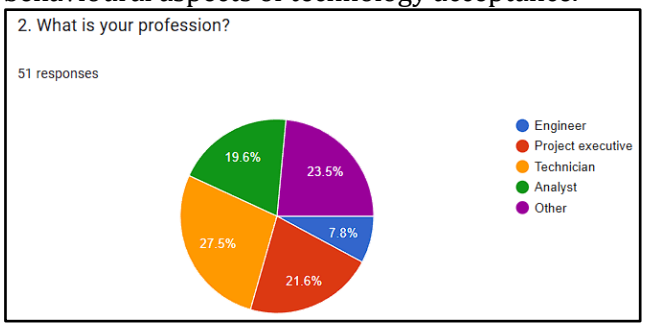

Figure 7: Professional Job Role of Respondents
(Source: Self-Developed)

Based on the above figure 27.5% respondents are technician, 21.6% work as project executives, 19.6% works as an Analyst, 7.8% are engineers, while 23.5% belongs to various other profession in the field.

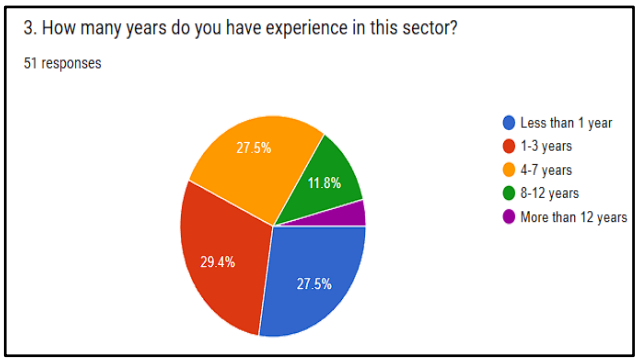

Figure 8: Experience of Respondents
(Source: Self Developed)

The survey results show that 29.4% of employees have been with the company for 1 to 3 years, while 27.5% have been with the company for more than 4 years, suggesting a fairly young workforce.

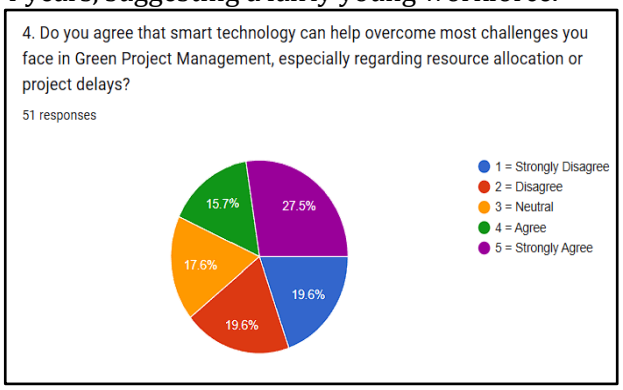

Figure 9: Smart technology to overcome resource allocation or project delays challenges
(Source: Self-Developed)

Based on the survey results, 43.2% showed a positive response when asked if Smart technology helps overcoming resource and project risks.

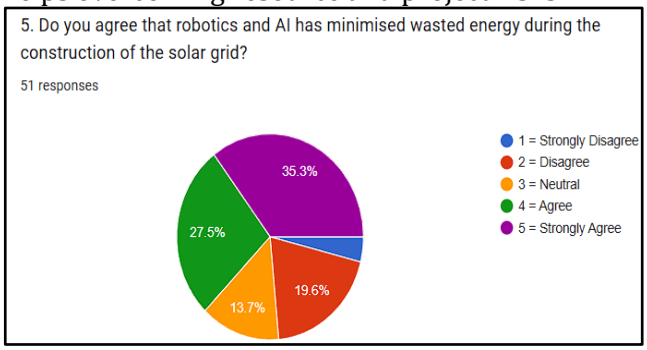

Figure 10: Robotics and AI has minimised wasted energy during the construction of the solar grid
(Source: Self-Developed)

Based on the survey results over 50% responding agreed that robotics and AI has been effective for minimizing waste generation during the construction of solar grids.

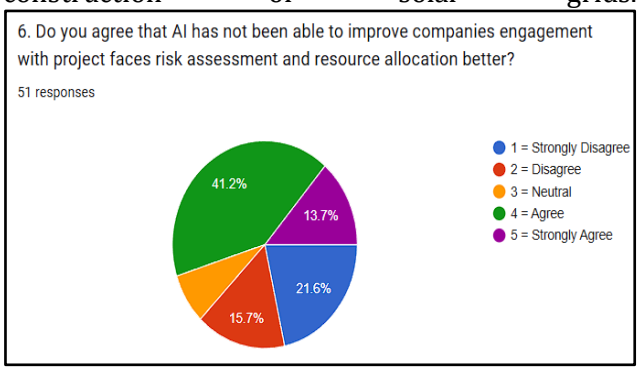

Figure 11: AI inability to improve leadership engagement with project
(Source: Self-Developed)

As per figure, 7 41.2% employees agreed and 13.7% responding strongly felt that AI has not been much effective for increasing leadership engagement and project management.

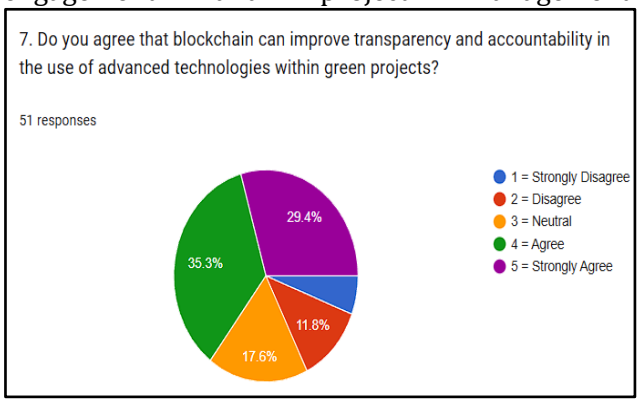

Figure 12: Blockchain for improved transparency and accountability within green project
(Source: Self Developed)

The survey recorded more than 60% who felt blockchain could improve transparency and accountability for the use of advanced technology such as AI that is well known for data privacy risk.

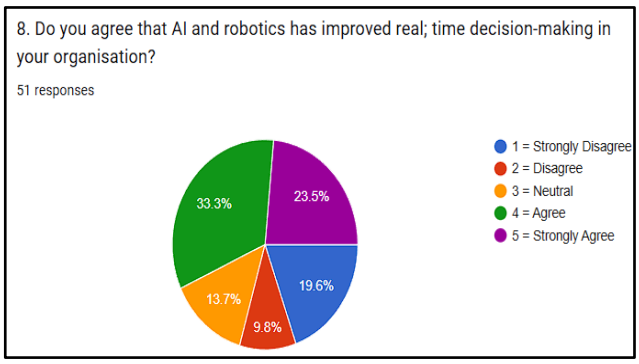

Figure 13: AI and robotics has improved real time decision-making in your organisation
(Source: Self Developed)

Based on the above figure it can be confirmed that over 50% of the respondents agrees on the effectiveness of AI and Robotics for better decision making in real time.

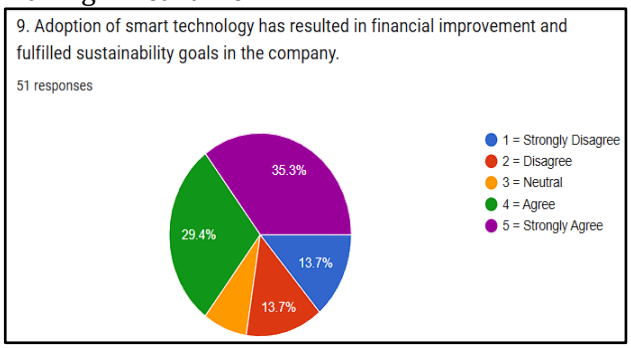

Figure 14: Adoption of smart technology for financial improvement and sustainability goals
(Source: Self Developed)

Around 64% respondents strongly believe that adopting smart technologies, such as AI and robotics, can improve financial health within the organisation.

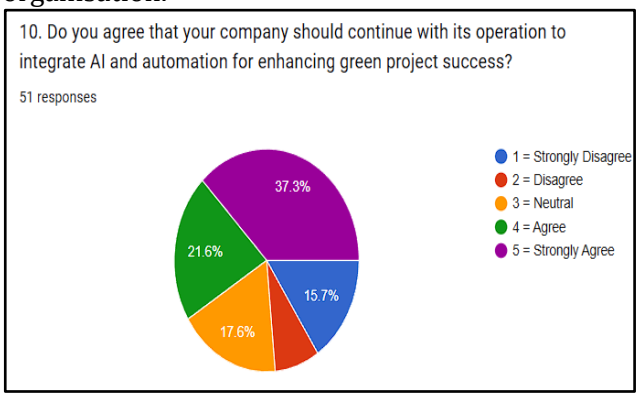

Figure 15: Continued AI and automation integration for enhancing green project success
(Source: Self Developed)

Based on the above figure over 30% respondents strongly agree that the database should continue with its operation for integrating AI and automation within its green projects given the record of remarkable success.

5.2. Secondary Qualitative Findings

Theme 1: Impact of Smart technology integration for improved efficiency and reduced waste in green project management.

Smart technology integration has a revolutionary impact on green project management by increasing efficiency and reducing resource waste. It provides real-time data, automation, and informed decision-making throughout all project phases in a sustainable operation (AlShawabkeh et al., 2021). According to Ghansah et al. (2021), the integration process of smart technologies is hampered by procedural and organisational impediments. The study further identifies a deficiency in traditional project management frameworks that limits technological adoption. On the other hand, Franchina et al. (2021) examine the way smart technologies alter urban garbage and supply chain flows. The research demonstrates the impact of digital technologies for minimising inefficiencies by providing predictive analytics and real-time monitoring (Alshurideh et al., 2022; Joghee et al., 2024; Alzoubi et al., 2024; Aldawsari et al., 2024). Finally, Lawal et al. (2024) conducts a case study analysis of green construction projects adopting smart technology. The study findings suggest that smart technologies, such as AI, IoT and robotics can improve sustainability performance and reduce waste. Therefore, while the current studies identify regulatory complexities and stakeholders' opposition as major roadblocks, the full-scale effect of smart technology can be observed with project aims tailored to environmental regulations (El Khatib et al., 2023; Yas et al., 2024; Halder et al., 2024; Som et al., 2023; Al-Qassem et al., 2024).

Theme 2: Application of IoT and AI to green initiatives for better real-time decision-making results

IoT and AI integration greatly improves real-time decision-making in green efforts, promoting operational agility and sustainability. These technologies promote effective resource utilisation by enabling real-time data gathering, analysis, and reaction (Alshurideh et al., 2025; Lee et al., 2024; Kofinas et al., 2016; Kanwal et al., 2023). According to Malik (2024), IoT technologies enable businesses to make data-driven choices that support environmental objectives. The study had further analysed internal forces and highlighted

that real-time monitoring is an advantage gained by smart technology that contributes in sustainable project operations (Al-Shawabkeh et al., 2014; Al-Kassem et al., 2022; Pande et al., 2024). Chinta (2024) investigates the impact of Edge AI for helping IoT networks to make informed decisions. In time-sensitive settings, this decentralisation improves sustainability by lowering latency and energy consumption. Lazaroiu et al. (2022) talk about IoT sensors and AI algorithms in cognitive manufacturing (Al Kurdi et al., 2023). The results further concluded that include improved system flexibility, less material waste, and predictive insights that optimise energy use (Al-Kassem & A. H., 2021; Salloum et al., 2024). The above-mentioned discussion supports the role of IoT and AI-powered real-time decision-making for increasing the efficacy of green programs (AlShawabkeh et al., 2021). However, data security, integration complexity, and infrastructure needs remain major challenges for the application and adoption of IoT and AI (Tanveer et al., 2024). Therefore, organisations need to coordinate technology deployment with long-term sustainability objectives, guaranteeing scalability and system resilience for fully realising the potential of these technologies (Joghee et al., 2020).

6. ANALYSIS

"Primary Quantitative" Analysis

The research on the use of automated technologies such as "robotics and artificial intelligence" has been focused on to be analysed in order to enhance the efficiency of the solar power project in an organisational context . The "primary data collection and analysis" perspective has found that the incorporation of "robotics and AI" is highly effective for minimising the generation of waste during the construction procedure of solar grids (Alzoubi et al., 2024). The reduction in waste generation is directly aligned with the sustainability prospers in the organisation premises (Albogamy et al. 2022; Al-Nakeeb et al., 2023; Al Najdawi et al., 2024). The identification of risk is also not efficient by incorporating automation technology, which also contributes to the poor allocation of resources in the long-term perspective (Papinutto et al. 2022; Khadragy et al., 2022; Alkatheeri et al., 2025). However, the business of "Terabase Energy" has been able to reduce the cost for implementing smart technology that has resulted in reducing the construction cost. The research has also demonstrated the fact that the improvement of transparency and accountability for technology uses can significantly more than through the incorporation of blockchain under the AI integration (Kurdi et al., 2025; Kumar et al., 2024; Vij et al., 2025; Kharbat et al., 2017). The literature review section deploys the fact that the use of blockchain for incorporating AI integration in the solar project can significantly help in enhancing the security prospectus during the development of smart solar systems at the organisational premises (He & Chen, 2024; Alzoubi et al., 2024; AlShawabkeh et al., 2023). The business of database energy has focused on installing solar panels dramatically and they have started the process with acquiring small firms. The literature review section of the study has also found that the integration of AI and robotics helps in enhancing the energy efficiency at the organisational premises (Hassan et al. 2021; Shawabkeh et al., 2017; Joghee et al., 2021; El Khatib et al., 2022). This helps in the enhancement of sustainability and reduction of energy consumption at the business organisations (Al Amiri et al., 2024). This has helped the business to enhance the experience for solar panel development and mitigate risk at a large level in the future.

"Secondary Qualitative" Analysis

The incorporation of technology largely contributes to the tracking of real time data and automation to make sustainable operation at the power management perspective in green project activities. The use of smart technology has affected the procedural and organisational perspective in the "Green Project Management" (Ghansah et al. 2021; Yasir et al., 2024; Khatib et al., 2024; El Khatib et al., 2023; Shwedeh & F., 2022). The business of "Terabase Energy" faced challenges in relation to installing solar power grids in the US. The thorough examination of the use of smart technologies for urban garbage and supply chain management also need to be analysed by the researchers (Franchina et al. 2021; El Khatib et al., 2023; Joghee et al., 2021). The study has also demonstrated that the developments of green construction projects are highly effective for a long-term sustainable perspective (Lawal et al. 2024; Al-Qassem, 2022). Therefore, the uses of AI robotics and blockchain have been identified as the

most significant technology to improve the performance of organisations (Alzoubi et al., 2024; Shwedeh & F., 2021; Al-Qassem & A. H., 2024).

The research has also identified that the adaptation of smart technology has significantly helped in meeting the financial improvement and sustainability goals at the organisation premises. The IoT and AI adaptation are crucial for developing real time scion making in advance systems (Malik, 2024; Martinez et al., 2022). The literature review action has demonstrated that the real time monitoring of required resources is effective in terms of managing the sensitive setting (Subeesh & Mehta, 2021). The use of Edge AI is helpful for better management of solar systems in the organisational premises (Chinta, 2024; Khatib et al., 2024). The tracking of energy consumption is essential for cognitive manufacturing of solar grids. The IoT and AI technology is effective in analysing the power use at the organisational premises (Lazaroiu et al. 2022; Shwedeh et al., 2024). Thus, it can be portrayed that the effective resources allocation largely impacts the efficiency of the organisational work progress which impacts the time management and sustainability activities at the firm.

7. CONCLUSION & RECOMMENDATIONS

The research concludes that the technology integration can be highly effective in terms of enhancing sustainability in businesses through automating the processes. The business of "Terabase Energy" can focus on integrating AI and robotics technology to foster innovation in developing power grids. This can contribute to reduction in cost for energy and enhanced sustainability in the long-time frame.

- *Recommendations*

Recommendation 1: Use automation for waste management

The large organisations can focus on using the "Lewin's change model" to foster innovation at the business for effective waste management. The integration of technology requires continuous monitoring which can be done through implementing the "Lewin's change model" by unfreezing operation and refreeze process (Memon, 2021). Thus, automation technology such as AI can help in effective waste handling in firms for sustainability.

Recommendation 2: Training employees at firms to foster technology adaptation

The businesses can focus on incorporating "blended learning" for fostering employee training for effective technology adaptation. The "Blended learning" can encompass both theoretical and practical learning methods for effective technology adaptation (Anthony et al. 2022). The employee learning strategy is recommended to reduce the chances of human error in business organisations for technology adaptation.

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