Enhancing Sustainability in the Plantation Sector: Identifying and Addressing Technological Gaps through Survey-Based Analysis

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Abstract

The sustainability of the plantation sector is a serious challenge, involving the identification and closure of technology gaps that prevent the adoption of sustainable methods. This research investigates these gaps and their implications, to improve sectoral sustainability. A survey of 16 respondents from plantation workers who have varied backgrounds, including varying levels of experience and employment titles, was used to obtain insights into the technology infrastructure that supports sustainable practices. The findings reveal diverse perceptions: 43.8% of respondents believe their access to modern technology is adequate, while 18.8% disagree. 50% expressed confidence in the current system's capability to support sustainable practices. About 37.5% believe their organizations invest appropriately in technology, but 50% see room for improvement. Training appears to be another issue where 37.5% agree that employees receive adequate training but 25% disagree. These responses highlight the necessity for comprehensive strategies to address these barriers. The study highlights the significance of ongoing research, development, and the incorporation of practical solutions into the plantation sector. Collaboration among stakeholders, is critical for developing supportive policies, investing in technology, and increasing capacity for sustainable practices.

Keywords: *Infrastructure, Plantation Sector, Regulatory Barrier, Sustainability Technological Gaps*

1. Introduction

The sustainability of the plantation sector has become an increasingly pressing concern in recent years, driven by the urgent need to mitigate environmental degradation, ensure equitable resource management, and uphold socio-economic stability [1], [2]. Central to this endeavor is the identification and rectification of technological gaps that impede the adoption of sustainable practices within the sector. Implementing technologies such as precision agriculture, genetic engineering, and climate-smart agriculture can significantly enhance sustainability in plantations. These innovations help in efficient resource management, pest control, and improving crop yields, thereby reducing environmental impacts [3].

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The adoption of technologies such as the Internet of Things (IoT), unmanned aerial vehicles (UAVs), and various sensors can enhance precision agriculture practices [4], [5], [6]. These technologies enable better monitoring and management of plantations, leading to optimized resource use and improved crop yields. For instance, IoT can help in efficient water management, pest control, and real-time monitoring of plant health [7]. Thus, this paper delves into the intricate web of challenges and opportunities inherent in addressing these gaps, aiming to pave the way for enhanced sustainability in the plantation sector.

The pivotal research questions guiding this inquiry are multifaceted. Firstly, we seek to discern the key technological gaps that act as stumbling blocks to the widespread adoption of sustainable practices in the plantation sector. Through meticulous analysis and comprehensive investigation, we endeavor to unravel the underlying factors contributing to these gaps, shedding light on the intricate interplay of socio-economic, regulatory, and technological dynamics.

Secondly, our exploration extends to the comparative evaluation of existing technologies within the plantation sector against established best sustainability practices. By scrutinizing the efficacy and applicability of current technological frameworks, we aspire to pinpoint innovative solutions and advancements necessary to bridge the identified gaps. This comparative analysis serves as a compass guiding the trajectory toward more robust and sustainable management practices within the sector. Continuous research and development in technological innovations should be encouraged. This involves collaboration between research institutions, universities, and the agricultural sector to develop practical solutions that can be easily integrated into existing plantation systems [8].

Lastly, we delve into the multifaceted benefits that accrue from the closure of technological gaps in the plantation sector. Beyond mere economic dividends, we aspire to elucidate the broader environmental and social advantages that ensue from sustainable technological interventions. Furthermore, we propose strategies for stakeholder collaboration and engagement aimed at fostering the development and implementation of tailored solutions, thereby cultivating a more resilient and sustainable plantation industry. To effectively develop and implement these technologies, collaborative efforts among stakeholders are essential. Governments, Non-Governmental Organizations (NGOs), industry leaders, and local communities must work together to create supportive policies, invest in research and development, and build capacity for sustainable practices. This multi-stakeholder approach can facilitate the development of tailored solutions that enhance the resilience and sustainability of the plantation sector [9].

In essence, this study embarks on a journey of discovery and innovation, striving to unearth the technological underpinnings of sustainability in the plantation sector. By focusing on these areas, the plantation sector can bridge technological gaps and move towards more sustainable practices, ensuring long-term environmental and economic benefits [3]. The complexities of technological gaps and charting a course toward their resolution, we endeavor to catalyze transformative change, heralding a new era of sustainability and prosperity in plantation management.

2. Research Objective

Sustainable plantation methods are increasingly recognized as crucial for reducing environmental damage and promoting long-term economic sustainability. However, the move to more sustainable management techniques is frequently hindered by a variety of technological and operational issues. This research tries to explore these problems with a focus on three main objectives:

1. To identify key technological gaps hindering the adoption of sustainable practices in the plantation sector and elucidate the underlying factors contributing to these gaps.
2. To compare existing technologies in the plantation sector with best practices in sustainability, pinpointing innovations necessary to bridge the identified gaps and promote more effective sustainable management practices.
3. To evaluate the role of employee training and expertise in the adoption of sustainable technologies in the plantation sector and propose improvements to training programs to better support sustainability goals.

3. Literature Review

There is a wide range of literature on sustainability and technology developments in the forestry sector, including studies on technical acceptance, production efficiency, and socioeconomic impact of these practices. The current research on factors affecting productivity and efficiency of plantation management, the role played by technology in dealing with these challenges as well as the socioeconomic dimension of plantation operations is set out in this review.

a. Technological Adoption and Production Efficiency in Plantations

The impact of adopting recommended technologies by the government on production efficiency, in particular for smallholder oil palm plantations, has been studied through a large body of research. The impact of technology adoption on the productivity and technical efficiency of small oil palm farmers in Riau and West Kalimantan has been assessed in a study carried out in Riau and West Kalimantan [10]. The results showed that farmers who had selected the entire package of suggested technologies, e.g. improved planting material, proper setting up and integrated pest management, and effective use of fertilizers, succeeded in increasing their production efficiency compared to those who did not choose this option. The study also highlighted the importance of farmers' associations with extension workers and their experience in improving the efficiency of production. It underlines the critical role of comprehensive technology adoption and support networks in improving operational results for smallholder' plantations.

b. Impact of Specific Technological Innovations on Yield and Sustainability

Technological innovations serve a significant part in increasing production, resource efficiency, and environmental sustainability. The success of oil palm agriculture is dependent on many fundamental agronomic methods that work together to increase productivity and sustainability. Utilizing high-quality planting materials, such as chosen seedlings or clones, provides strong development, improved disease resistance, and increased yield potential due to desired features

such as higher oil content and disease tolerance [3] . Another important component is proper tree spacing, which improves solar exposure, nutrient uptake, and air circulation, resulting in healthier plants and significantly higher yields, as supported by numerous studies [7]. Implementing integrated pest management methods is critical for pest and disease control through monitoring, early detection, and targeted treatments, which reduces pest damage and supports long-term high yields [8]. Furthermore, proper fertilizer use, which includes applying the right type and amount at the right time, assures balanced nutrition, promotes optimal plant growth, and increases oil output [9]. Collectively, these advances improve plantation production and sustainability by addressing core plant health and resource management issues. Technological innovations offer a critical part in increasing production, resource efficiency, and environmental sustainability.

c. Socio-Economic Challenges in Sustainable Plantation Management

The interaction of local communities and plantation corporations in Indonesia creates a complicated dynamic that affects the implementation of socially sustainable community development initiatives. Unresolved land conflicts, the selection of relevant community programs, the requirement for effective capacity training, a lack of firm and government facilitators, and managing community expectations are examples of practical obstacles in socially sustainable community development. Projects such as Desa Makmur Peduli Api (integrated fire management) and Pertanian Ekologi Terpadu (ecological farming) in West Kalimantan demonstrate the challenges of linking corporate social responsibility programs with community needs [11]. Effective socially sustainable community development governance can reduce tensions and improve relationships between communities and businesses, thereby promoting a long-term social license to operate. These initiatives highlight the significance of strategic social investments and shared value techniques for promoting social sustainability in plantation operations [8].

d. Historical Context and Challenges in Plantation Forestry

The growth of plantation forestry in Malaysia provides a microcosm of the sector's global concerns. Since the early 1970s, a considerable shift from natural forests to plantation forestry has been driven by a scarcity of logs from sustainably managed forests [12]. Despite large-scale plantation projects launched in the 1970s, 1980s, and 2000s, results have varied, owing to several ongoing difficulties. Insufficient quality planting stock has regularly hampered growth and yield, and poor species-site matching has frequently resulted in inferior growth and yield outcomes. Soil quality concerns, particularly degraded or inappropriate soils, have hampered the successful establishment and expansion of plantation forests [13]. On top of that, ongoing insect and disease concerns have harmed plantation health and output [14]. Inadequate silvicultural and management practices have also contributed significantly to the poor performance of these plantation initiatives. However, there is still great room for improvement through the use of intensive, research-based silvicultural and management approaches. This method could greatly improve the performance and production of maturing planted forests in the future [3].

e. Technological Gaps and Challenges in the Plantation Sector

Several technology gaps continue to hinder optimal productivity and sustainability in the plantation industry. The adoption of mechanisation and automation technologies in oil palm plantations faces significant constraints due to complex processes, high capital requirements, and limited local fabrication capabilities, necessitating collaboration with manufacturing powerhouses to align research and development with operational needs [7]. Yield gaps are another major issue that frequently results from farmers' failure to follow suggested methods, such as insufficient use of high-yielding cultivars, poor spacing, and a lack of plant protection measures [8]. More importantly, global competition, price instability, and rapid technical advancements all impose pressure on the plantation sector, demanding the use of new technology and management approaches to remain competitive [9]. Furthermore, identifying and implementing appropriate technologies for various crops such as coconut, arecanut, and cocoa remains a significant challenge, with research institutions playing an important role in developing and disseminating relevant technologies to improve productivity and sustainability [3].

Exploring the impact of technological adoption and specific breakthroughs allows us to discover important gaps and chances for development in sustainability practices. The findings of [10] on the positive impact of comprehensive technology adoption highlight the need for the plantation sector to connect existing technologies with best sustainability practices where which is related to our first research question and objectives. Similarly, investigating specific innovations like as improved planting materials, integrated pest management, and efficient fertilizer use directly contributes to our understanding of the technological gaps that prevent the implementation of sustainable practices where which is in line with our second research question and objective. Addressing these gaps is critical to connecting current operations with sustainability objectives. [7], [8] identify substantial technology gaps that must be solved to support sustainable practices. [11] emphasizes the need for strong training programs and competence to address socio-economic concerns and promote successful capacity building. Besides, [11] emphasis on socioeconomic difficulties and the critical role of effective capacity building highlights the necessity of strong training programs and expertise in supporting the adoption of sustainable technology as mentioned in the third research question and objective. Thus, connecting the literature findings with our research aims and questions not only supports the study's focus but also lays the groundwork for creating actionable insights that can promote long-term developments in the plantation industry.

4. Methodology

The methodology section is an important part of any study since it outlines the systematic strategy taken to answer the research questions and achieve the study's objectives. This section offers a full outline of the research design, participants, data collection methods, and analytical methodologies used in the study. It ensures that the research method is transparent and replicable, allowing other researchers to understand and assess the study's validity and reliability.

To provide a visual summary of these methodological stages, Figure 1 illustrates a flowchart of how the study was carried out. This flowchart summarizes the complete process, from designing the research design to analyzing and reporting the results, providing a simple yet effective representation of the research journey.

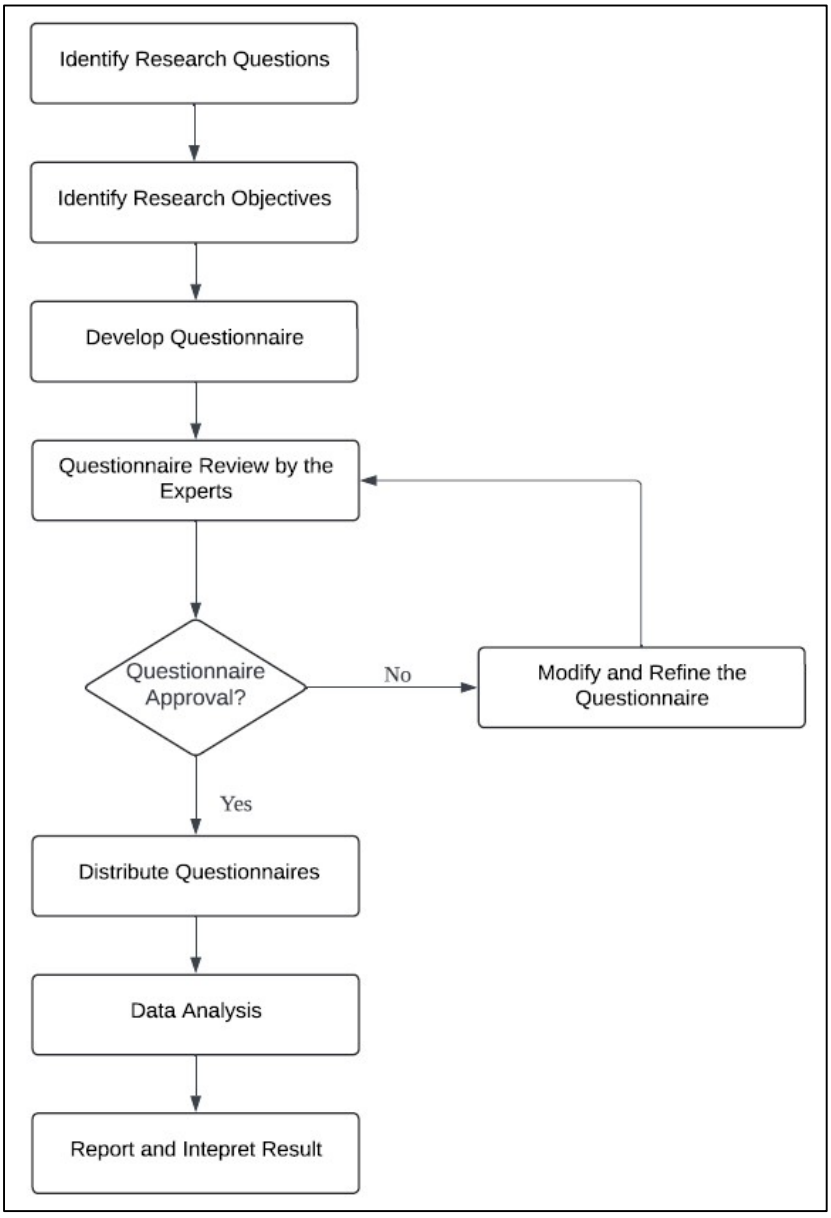

Figure 1: Flowchart of the Study Methodology

4.1. Participants

A total of 16 respondents participated in this survey. The feedback varied widely across different questions. Respondents provided a range of ratings for statements on access to advanced technology, technological limitations, investment in technology, employee training, funding issues, access to advanced technology, training or expertise, resistance to change, and regulatory barriers. The diverse

responses reflect mixed perceptions and experiences regarding the company's technological infrastructure and its support for sustainable practices.

There was the majority of respondents have significant experience in the plantation sector. Specifically, 41.2% of respondents have worked in the sector for 6-10 years, and 35.3% of respondents have more than 10 years of experience. These groups likely provide well-informed insights based on their extensive familiarity with the industry and its technological infrastructure. Meanwhile, 11.8% of respondents have less than 1 year of experience, offering fresh perspectives and possibly highlighting initial challenges or gaps in the current systems. Another 11.8% of respondents have one to five years of experience, balancing between newcomers and more seasoned professionals. This distribution of experience levels allows for a comprehensive understanding of the adequacy of the current technological infrastructure in supporting sustainable practices, reflecting both long-term observations and fresh viewpoints.

Among the respondents, there is a diverse range of job titles. Executives and administrative managers represent the largest groups, each accounting for 12.5% of the total respondents. Data-focused roles, including Data Management Executives and Data Engineers, make up 6.3% of the respondents. Mid-level management roles, such as Senior Executives and Executive Assistants, also account for 6.3%. Finance and account positions contribute another 6.3%. The remaining 6.3% includes a variety of other roles, such as officers, Plantation, and Administrative Assistants. This varied representation across different levels and functions within the company provides a comprehensive perspective on the technological infrastructure's support for sustainable practices.

4.2. Questionnaire

The questionnaire has been distributed to employees in the plantation sector via Google Forms[1]. Sections in this survey have been divided into three. Section A is about years of working experience and the role of the respondents. Section B focused on technological gap identification in sustainable practices within the company’s plantation operation. All questions were in the form of a Likert scale from one to five where (1) Strongly Disagree; (2) Disagree; (3) Neither Agree nor Disagree; (4) Agree; (5) Strongly Agree. Section C focused on perceived contribution to technological gaps hindering the adoption of sustainable practices within a company’s plantation operation. The format for this section is a Likert scale from one to five where 1) Most Significant; (2) Significant; (3) Neither Significant nor Insignificant (Neutral); (4) Insignificant; (5) Least Significance. The questionnaire’s sections can be simplified as follows:

- Section A: Experience and Role
- Section B: Technological Gap Identification
- Section C: Factors Contributing to Technological Gaps

[1] https://docs.google.com/forms/d/e/1FAIpQLScfCD3kiChVqdGszY1HKQobMkqtJwSY6kavUz6ADoBqNdUGxQ/viewform

5. Result and Discussion

This section provides an extensive discussion of the findings from the questionnaire issued to participants. It includes an in-depth analysis of several areas of technological gaps that exist among the examined population. This analysis is further divided into two independent sections for clarity and focused exploration. The first subsection, named "Technological Gap Identification," examines the specific gaps and inadequacies discovered through survey responses, putting light on areas that need to be addressed and improved within the technology environment. Meanwhile, the second subsection, "Factors Contributing to Technological Gaps" investigates the underlying causes and variables that contribute to the presence of the detected gaps. In addition, one extra section is presented in this section to give an overview of the summary of the survey results.

5.1. Technological Gap Identification

The study results provide light on the complicated landscape of ideas about how the current technical infrastructure aligns with plantation sustainability goals. While a sizable proportion of respondents about 50% expressed confidence in the existing system's ability to support sustainable practices, with 31.3% indicating moderate adequacy and 12.5% indicating room for improvement, the nuanced range of perceptions highlights the importance of a comprehensive approach to assessment and strategic planning. These findings are consistent with scholarly research by [3], [7] which emphasizes the significance of critically examining the technical environment to suggest areas for improvement. Furthermore, the respondents' different perspectives emphasize the importance of inclusive decision-making procedures and collaborative efforts to successfully resolve identified shortcomings. By integrating information from both positive and critical viewpoints, stakeholders can inform strategic investments and efforts aimed at increasing technical support for sustainability, ultimately driving continual development in the plantation sector's sustainability practices.

The findings of the survey reveal a diverse range of viewpoints on the accessibility and use of new technologies to advance sustainability goals in the plantation sector. A significant portion, 43.8% of respondents, agree that their access to contemporary technology is appropriate. This finding aligns with the opinions expressed in the study by [8], which emphasizes the critical importance of advanced technology in promoting sustainable agriculture practices. In contrast, 18.8% of respondents reported disagreeing, echoing issues stated in research by [7], [9] underlining the necessity of overcoming barriers to technology adoption and diffusion. The 31.3% who remain neutral or uncertain indicate a degree of ambiguity or variety in judgments, prompting further investigation into the variables influencing people's attitudes about technological accessibility. Furthermore, 6.3% of respondents strongly agree broad access to sophisticated technology demonstrates the potential for technological innovation to generate revolutionary change in sustainable practices. These different perspectives highlight the complexity of technology ecosystems in the plantation sector, as well as the significance of extensive assessments and focused actions to alleviate inequities and maximize new technologies' potential for sustainable development.

In addition, the survey results offer insight into the perceived influence of technological limitations hindering the effective implementation of sustainable practices in the plantation industry. 43.8% of respondents agree some level of difficulty is due to technical restrictions and this issue matches stated in research by [7], [8] which highlights the challenges faced by inadequate technology infrastructure and support mechanisms. In contrast, 6.3% of respondents disagree that technological limitations hinder the effective implementation of sustainable practices in the plantation industry. 25% of respondents who had a neutral view or expressed uncertainty highlight the complexity and nuanced nature of technology limits, indicating the need for deeper investigation into the unique issues faced by various stakeholders. Another group of 25% of respondents who strongly believe that technical constraints significantly impede the adoption of sustainable practices emphasizes the critical importance of overcoming these barriers to promote sustainable development in the plantation sector. These findings focus attention on the importance of tackling technology constraints and supporting innovation to allow wider adoption of sustainable practices, as noted in the literature by [3], [9].

The study results provide useful insights into firms' investment strategies for improving Information Technology (IT) systems for sustainability. The 37.5% of respondents who agree their organizations are appropriately investing in upgrading technical systems for sustainability support the literature's argument that adequate investment in technology is critical for promoting sustainable practices [8]. In contrast, the 50% of respondents who are neutral and uncertain with the current level of investment but see room for improvement indicate that, while organizations recognize the importance of investing in technology for sustainability, there is still untapped potential for further improvement. 6.3% of respondents who are dissatisfied with the level of investment highlight the importance of reevaluating and maybe boosting investment in technical improvements to successfully support sustainability goals. In contrast, 6.3% who strongly agree with the sufficiency of the investment may represent exemplary cases where organizations have successfully prioritized and allocated resources to technological innovations for sustainability, as discussed in literature emphasizing the critical role of strategic investments in driving sustainability efforts [11]. These findings highlight the significance of strategic investment in technology as a catalyst for promoting sustainable practices within organizations, necessitating a shift toward more proactive and forward-thinking investment strategies to support technological breakthroughs that advance sustainability goals.

Findings on employees' adequate training on utilizing technology for sustainable practices found that 37.5% of respondents rated this statement as agree, indicating they believe that employees receive adequate training on utilizing technology for sustainable practices. Conversely, 25% rated it as disagree, expressing a stronger belief that employees do not receive sufficient training in this area. Another 31.3% rated it as neutral, suggesting a more neutral stance or some uncertainty regarding the adequacy of employee training. Additionally, 6.3% of respondents rated it as strongly agree, indicating a strong belief that employees do receive adequate training in utilizing technology for sustainable practices. Differing reactions to adequate employee training on using technology for sustainable practices highlight several critical factors in the plantation industry. [7]found that skill development

and capacity-building activities have an important role in increasing technology adoption and supporting sustainable agriculture practices. Effective training programs can provide staff with the skills needed to manage complicated technology systems and use them to address sustainability issues. Companies that invest in comprehensive and focused training initiatives can better prepare their employees to use technology for sustainable practices, resulting in beneficial environmental and socioeconomic effects.

6.2. Factors Contributing to Technological Gaps

The responses to the adequacy of investment in updating technology systems for sustainability provide a mixed picture. 37.5% of respondents scored this statement as neutral, reflecting employees may not be directly involved in technology upgrade decision-making processes and may lack the information required to reliably assess investment adequacy. In contrast, 25% of respondents ranked it as significant, indicating a higher belief in the insufficient funding for technical advances and highlighting a more critical perspective on the topic. Another 6.3% scored it as one, suggesting a considerable projected shortage of financing for technology advances, which could impede progress toward sustainability targets. However, 25% of respondents evaluated it as insignificant, indicating a relatively appropriate level of money for technical developments within companies. This study suggests that a minority of companies may be committing adequate resources to support technical developments for sustainability, which is consistent with the concept of strategic investment in driving sustainability efforts [11]. Finally, 6.3% of respondents ranked it as least significant indicating a belief in enough funding for technology investments, which could indicate example cases where companies prioritize and allocate resources efficiently to generate long-term technological advancements. These findings highlight the need for proper financial resources and strategic investment in driving technical improvements for organizational sustainability, as well as the need for proactive funding methods to effectively support sustainable practices.

The responses referring to limited access to modern technology provide a complex picture. An insignificant 25% of respondents indicated a view of limited access to modern technology which some respondents may have had limited exposure to advances in technology in their current roles If they do not rely extensively on technology for their work activities or have access to alternate ways, they may consider limited access insignificant. Furthermore, 6.3% of respondents scored it as most significant, indicating that they see a major lack of access to modern technology, potentially reflecting serious obstacles in obtaining critical technological resources. This finding is consistent with previous research emphasizing the importance of widespread access to contemporary technologies for encouraging sustainability measures [3]. Another 6.3% of respondents ranked it as the least significant, indicating a belief in widespread access to advanced technology, which could indicate examples where companies effectively overcame hurdles to technology adoption, resulting in more effective sustainability policies. However, 56.3% of respondents answered the questionnaire as neutral. This may cause some respondents may have had limited exposure to modern technology in their current roles or environments. Without actual knowledge, individuals may feel

unable to deliver an accurate viewpoint and choose a neutral option instead. Thus, these findings highlight the need to remove access obstacles and increase the widespread availability of modern technology to support sustainability initiatives in the plantation sector.

The concept of insufficient training or expertise among employees shows a wide range of responses. Based on the analysis, 50% ranked this statement as neutral, indicating that assessing the level of training and knowledge among employees can be difficult, especially if respondents are not directly involved in training. So, they may struggle to appropriately evaluate this element and ultimately choose a neutral option. Another 12.5% answered as significant, showing a higher conviction about the lack of training or experience, and raising concerns about the workforce's readiness to embrace sustainable technologies effectively. This viewpoint emphasizes the need for companies to invest in strong training activities to strengthen employees' abilities to drive sustainability efforts. This finding is consistent with comments in the literature that emphasize the necessity of comprehensive training programs to improve employees' abilities to use technology for sustainable practices [8]. About 25% respondents answered that insufficient training or expertise among employee is insignificant. It may because of respondents' personal experiences and views can influence how they perceive employee training and expertise levels. If they have not encountered instances of insufficient training or a lack of expertise in their contacts, they may dismiss the problem as insignificant due to their restricted perspective.Another 6.3% of respondents evaluated it as the most significant, indicating a substantial lack of knowledge or experience among staff, which could pose significant obstacles in implementing sustainable practices. Finally, 6.3% of respondents rated it as the least significance, suggesting that they believed employees had adequate training or knowledge, presumably reflecting examples where companies successfully emphasized employee development to achieve sustainable goals. These findings highlight the need to resolve training gaps and cultivate a culture of continuous learning to empower staff to use technology for sustainable practices in the plantation sector.

The results of the survey reveal a variety of perspectives on the prevalence of resistance to change within the organization, with 37.5% of respondents rating this statement as neutral, indicating some level of opposition. In contrast, 25% gave it a rating of significant, indicating respondents' thoughts, beliefs, and attitudes toward change may influence their judgment of its significance. If they have a positive attitude toward change and innovation, they may see opposition as an important obstacle that must be overcome to promote organizational advancement and success. Another 12.5% evaluated it as the most significant, suggesting a high level of opposition within their organizations. Furthermore, 18.8% rated it as insignificant, indicating a view of relatively little resistance, which could indicate successful change management tactics. The lowest rating, 6.3%, came from respondents who rated it as the least significance, indicating minimal resistance to change, which is consistent with organizational cultures that encourage adaptation and creativity. These findings highlight the necessity of overcoming resistance to change as a critical aspect of implementing successful sustainability initiatives within companies.

The survey results reflect diverse viewpoints on the prevalence of regulatory hurdles or restraints within enterprises. Specifically, 31.3% of respondents ranked this statement as neutral. In contrast, an identical amount of respondents (31.3%) scored it as significant, indicating a stronger conviction in the presence of such hurdles or limits. Another 6.3% evaluated it as the most significant, indicating a significant amount of regulatory hurdles within their companies. Furthermore, 18.8% of respondents gave it a rating of insignificant, indicating that they saw fewer regulatory barriers or restraints, potentially due to effective compliance efforts. The remaining 12.5% of respondents answered as the least significant indicating minor perceived regulatory hurdles or restraints, which could be due to favorable regulatory environments or proactive regulatory compliance initiatives. These findings highlight the need to know and address regulatory issues to promote sustainable practices within enterprises.

7. Conclusion

In conclusion, the methodology employed in this study has provided valuable insights into the technological infrastructure supporting sustainable practices within the plantation sector. Through a comprehensive survey distributed to a diverse group of participants, including individuals with varying levels of experience and job roles, this research has shed light on the complex landscape of perceptions and experiences regarding technology adoption and support for sustainability. There exists a diverse range of perspectives on the current technological infrastructure's alignment with sustainability goals. While a significant proportion of respondents express confidence in the existing systems, there are also notable concerns and areas for improvement identified. Other than that, investment in technology emerges as a critical factor influencing the adoption of sustainable practices. While some respondents perceive adequate investment, others highlight the need for increased financial resources to support technological advancements. Furthermore, access to modern technology and training and expertise among employees are identified as significant factors affecting the adoption of sustainable practices. Addressing barriers to technology access and investing in comprehensive training programs are essential steps for enhancing sustainability efforts within organizations. Overcoming resistance to change and navigating regulatory hurdles are crucial challenges that must be addressed to promote sustainable practices effectively also one of the findings in this study.

In summary, these findings highlight the importance of targeted interventions and collaborative efforts to address technological gaps and promote sustainability in the plantation sector. By considering diverse perspectives and addressing the identified gaps and challenges, organizations can pave the way for more effective and sustainable practices, driving positive environmental and socioeconomic outcomes. Additionally, the outcomes of the study reveal the necessity for targeted interventions and collaborative efforts to address technological gaps and promote sustainability within the sector, emphasizing the need for proactive strategies and inclusive decision-making processes to drive continual development and progress.

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