

## Bridging Skill Gaps in the Palm Oil Workforce: A Mixed-Methods Training Needs Assessment of Plantation Workers in Kampar Regency, Indonesia

Sri Endang Kornita<sup>1\*</sup>, Dahlan Tampubolon<sup>2</sup>, Misdawita<sup>3</sup>, Syapsan<sup>4</sup>, Marnis<sup>5</sup>

<sup>1,2,3,4,5</sup> Department of Economic, Faculty of Economy and Business, Universitas Riau.

\*Corresponding Author: [endang.kornita@gmail.com](mailto:endang.kornita@gmail.com)

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### ABSTRACT

The palm oil plantation sector remains a central pillar of Indonesia's agricultural economy, yet persistent gaps in worker competencies hinder productivity, safety, and sustainable practices. This study conducts a comprehensive Training Needs Assessment (TNA) for plantation workers in Kampar Regency one of the country's major palm oil-producing regions to identify both technical and non-technical skill deficiencies that limit workforce performance. Using a mixed-methods approach, data were collected from 20 respondents representing managerial, supervisory, administrative, and field-level roles across 10 companies. Quantitative findings reveal that the most urgent technical training needs include harvesting and processing skills (30%) and occupational safety (30%), while information technology literacy and heavy machinery operations remain secondary but emerging priorities. Non-technical needs are dominated by leadership and team management (35%), followed by problem-solving (25%) and effective communication (15%). Notably, 60% of respondents reported that existing training is insufficient, and 90% expressed the need for technology-based training as plantations shift toward digitalization. The findings highlight significant competency gaps that threaten productivity and the adoption of sustainable and technology-driven practices. This study argues that TNA should be an adaptive, multi-level process aligned with organizational strategy, especially as palm oil companies confront global sustainability standards (ISPO/RSPO). Recommendations include designing tiered training programs, strengthening digital literacy, and enhancing managerial soft skills to support long-term competitiveness in the plantation industry.

**Keywords:** Training Needs Assessment; Palm Oil Plantation; Workforce Competency; Technical Skills; Non-Technical Skills; Human Resource Development; Occupational Safety; Digital Agriculture

### INTRODUCTION

The palm oil plantation industry remains one of the most influential sectors in Southeast Asia, particularly in Indonesia and Malaysia, which collectively dominate global palm oil production. Despite its strategic economic importance, the industry is increasingly confronted with complex socio-environmental pressures, ranging from sustainability compliance to labor productivity demands. As noted by Suryani (2023), the cornerstone of organizational performance in labor-intensive sectors lies in the capability of its human resources, making workforce competency an urgent priority for industries striving to remain competitive and sustainable.

The technical demands of oil palm cultivation—spanning land preparation, crop maintenance, harvesting, and processing require specialized knowledge and skills. Without adequate training, workers risk making costly operational errors that reduce yields, damage crops, or negatively impact the environment. Lubis and Sinaga (2023) emphasize that technical deficiencies among plantation workers are a major barrier to improving production

efficiency, while also increasing exposure to workplace hazards such as chemical misuse, equipment accidents, and hazardous field conditions.

Beyond technical capability, the sector faces high levels of occupational risk, positioning occupational health and safety (K3) as a critical area of concern. Studies show that plantation workers are frequently exposed to chemical agents, extreme weather, uneven terrain, and heavy machinery (Arfansyah et al., 2025). Without structured and continuous safety training, these risks translate into lower productivity, increased medical costs, and reduced worker well-being a challenge that many companies have yet to effectively address.

At the same time, the global palm oil supply chain demands compliance with sustainability standards, including eco-friendly agricultural practices, reduced carbon footprints, and biodiversity protection. However, many plantation workers in regions such as Kampar Regency lack adequate understanding of sustainable agronomy techniques, leading to soil degradation, inefficient fertilizer use, and water mismanagement. Environmental criticisms of the palm oil industry highlight the urgency of equipping workers with competencies in sustainable land management and conservation-based farming practices (Wijayanti et al., 2022).

Kampar Regency, a major production hub in Riau Province, illustrates this competency gap. Although the agricultural sector continues to dominate the local economy (Kornita, 2015), the adoption of modern plantation technologies in the region remains uneven. Workers still rely heavily on traditional cultivation methods, with limited exposure to innovations such as drone-assisted monitoring, precision irrigation, and digital plantation management tools. This technological lag persists despite the increasing availability of agricultural digitalization solutions at the national level.

A compounding challenge is the relatively low educational attainment among plantation workers. Most workers in Kampar Regency possess only secondary-level education or lower, limiting their ability to understand technical instructions, interpret data, or engage with digital farming systems. As highlighted by Gustiana et al. (2022), training must be designed to accommodate workers' cognitive readiness, ensuring that learning materials are accessible while still enhancing professional competence.

Managerial and supervisory competencies also require significant improvement. Weak leadership, limited communication skills, and inadequate problem-solving capabilities among supervisors often result in poor team coordination and reduced operational coherence. Wijayanti et al. (2022) emphasize that strong managerial skills are crucial for aligning organizational strategy with field-level implementation, particularly in sectors facing the dual pressures of globalization and sustainability certification requirements such as ISPO and RSPO.

Despite various training initiatives offered by companies, access to high-quality training remains limited, especially for workers in small and medium-sized plantations with minimal investment in human resource development. Several programs are often generic, outdated, or misaligned with the real needs of plantation workers. As noted by Arifin and Rahman (2021), training programs tend to fail when not supported by a proper Training Needs Assessment (TNA), resulting in low transfer of learning and minimal workplace impact.

These challenges underscore the critical need for a systematic and context-specific Training Needs Assessment (TNA) within the palm oil industry. As argued by Rahmana (2024), TNA serves as a strategic tool to identify competency gaps at the organizational, job, and individual levels, enabling companies to design effective training interventions. In the context of Kampar Regency, conducting a rigorous TNA is not merely an administrative requirement but a strategic necessity to enhance productivity, reduce occupational risks, improve sustainability compliance, and ensure the long-term competitiveness of the palm oil sector.

## LITERATURE REVIEW

Human resources (HR) are widely acknowledged as the central driver of organizational performance, particularly in labor-intensive sectors such as palm oil plantations. As highlighted by Suryani (2023), human capital determines an organization's ability to achieve productivity, maintain competitiveness, and ensure operational continuity. In the plantation industry, where daily operations rely heavily on manual skills and precision-based fieldwork, the importance of skilled labor becomes even more pronounced. Without structured development efforts, companies risk inefficiencies, operational failures, and persistent environmental and social challenges.

Training represents a fundamental component of Human Resource Development (HRD). It serves not only to enhance employee competence but also to prepare workers for evolving job demands. Gustiana et al. (2022) emphasize that training is a structured intervention designed to modify knowledge, skills, and behavior to improve individual performance. Within palm oil plantations, training is crucial for safeguarding product quality, increasing harvesting efficiency, reducing material waste, and preventing technical errors that may result in crop damage or financial loss. However, training effectiveness is highly dependent on its alignment with actual competency gaps an alignment ensured through a systematic Training Needs Assessment (TNA).

The concept of TNA is essential in determining the relevance and effectiveness of training programs. According to Rahmana (2024), TNA involves identifying discrepancies between current and required competencies at the organizational, job, and individual levels. Organizational analysis ensures that training initiatives support strategic goals, such as productivity targets or sustainability certification. Job-level analysis identifies the specific skills required to perform tasks effectively, while individual analysis pinpoints personal skill gaps that require targeted interventions. When implemented comprehensively, TNA prevents training misalignment, reduces resource waste, and improves learning transfer a major concern in the industry, as reported by Arifin and Rahman (2021).

Sustainability Theory reinforces the need for structured competency development by highlighting the environmental, social, and economic responsibilities embedded in modern plantation management. Compliance with Indonesian Sustainable Palm Oil (ISPO) and Roundtable on Sustainable Palm Oil (RSPO) standards requires workers to possess knowledge of environmentally responsible practices such as soil conservation, integrated pest management, proper waste handling, and biodiversity protection. Research by Wijayanti et al. (2022) reveals that gaps in sustainability-related skills among plantation workers are a major contributor to non-compliance risks and environmental degradation. Thus, integrating sustainability competencies into TNA has become imperative for companies seeking global market access and reputational legitimacy.

On the operational side, technical competencies remain foundational. Plantation workers must master skills related to harvesting, fertilization, pruning, pesticide application, and equipment operation. Lubis and Sinaga (2023) stress that lacking these skills leads to productivity decline, safety risks, and inconsistent product quality. Furthermore, occupational hazards such as chemical exposure, extreme weather, and interaction with heavy machinery highlight the critical need for structured occupational health and safety (K3) training. Arfansyah et al. (2025) argue that K3 training significantly reduces accident rates and improves worker well-being, thereby supporting long-term organizational resilience.

In addition to technical demands, non-technical or soft skills have gained increasing importance in plantation management. Supervisors and middle managers, in particular, require competencies in leadership, communication, performance evaluation, and conflict resolution. Weak managerial capacity has been identified as a major contributor to coordination failures and low worker motivation (Wijayanti et al., 2022). These findings reinforce the HRD perspective that soft skills are as important as technical skills for ensuring effective team management and operational coherence.

Digital transformation is reshaping the plantation sector, introducing new competency requirements. The rise of Digital Agriculture and Smart Farming such as drone-based monitoring, precision irrigation, GPS mapping, and digital record-keeping demands that workers develop basic digital literacy and technological readiness. Kusumastuti et al. (2025) explain that technological innovations fail when the workforce lacks the capacity to adopt them. The Technology Acceptance Model (TAM) also underscores that perceived usefulness and ease of use influence workers' willingness to adapt digital tools. This theoretical lens positions TNA as a critical instrument for assessing digital readiness and bridging competency gaps in technology adoption across plantation roles.

Integrating HRD, Sustainability, and Digital Agriculture theories produces a multidimensional understanding of training requirements in the palm oil sector. HRD theory ensures structured learning; Sustainability theory aligns training with environmental and certification demands; while Digital Agriculture theory highlights the emerging need for digital competencies. Together, these frameworks reinforce the notion that TNA must extend beyond traditional technical skill identification to encompass sustainability literacy and digital capability assessment. As industries evolve toward sustainable and technology-driven models, a comprehensive and adaptive TNA becomes essential for ensuring workforce competence, operational efficiency, and long-term competitiveness.

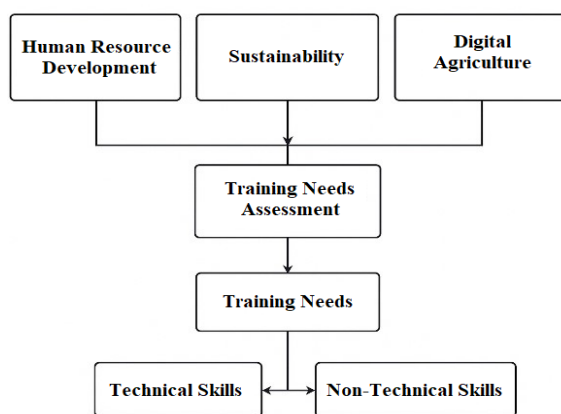


Figure 1. Conceptual Framework

## METHODOLOGY

### Research Design

This study employed a **mixed-methods approach**, integrating quantitative and qualitative techniques to obtain a comprehensive understanding of the training needs of palm oil plantation workers in Kampar Regency. A mixed-methods design was chosen to address the complexity of workforce competency issues, as quantitative data alone may overlook contextual factors, while qualitative data alone may not adequately represent broader competency patterns. The methodological orientation follows the perspective of Judijanto et al. (2024) and Kusumastuti et al. (2025), who emphasize that mixed methods provide stronger explanatory power when assessing human resource-related phenomena.

### Quantitative Component

The quantitative phase focused on capturing measurable indicators of training needs through structured surveys. The questionnaire was designed to assess respondents' existing competencies, perceptions of current training adequacy, and priorities for future training. Items were developed based on theoretical foundations from HRD Theory, Sustainability Theory, and Digital Agriculture Theory, ensuring alignment with organizational, job-level, and individual competencies.

### Sampling Technique

A purposive sampling strategy was implemented to target respondents representing various hierarchical levels within plantation companies, ensuring a balanced representation of technical and managerial perspectives. A total of **20 respondents** from **10 palm oil plantation companies** participated in the survey, consisting of managers (15%), supervisors (20%), administrative staff (25%), and field workers (40%).

### Data Analysis

Quantitative data were analyzed using **descriptive statistics**, including frequency distributions and percentages. This approach allowed identification of skill gaps and priority training areas across different job roles. The use of descriptive analysis is appropriate for TNA studies, which typically aim to map needs rather than test hypotheses.

### Qualitative Component

The qualitative phase aimed to obtain deeper insights into worker experiences, competency challenges, and workplace realities that may not be fully captured through surveys.

### Data Collection

Three qualitative techniques were used:

1. ***In-depth Interviews*** – conducted with selected supervisors and managers to explore leadership challenges, digital readiness, and sustainability-related skill gaps.
2. ***Focus Group Discussions (FGDs)*** – involving field workers to capture collective perspectives on training limitations, operational barriers, and occupational safety issues.
3. ***Non-participant Observation*** – carried out at plantation sites to document daily work processes, behavioral patterns, and gaps between SOPs and actual field practices.

This triangulated approach strengthens the reliability and contextual richness of the qualitative findings.

### Qualitative Analysis

Qualitative data were analyzed through **thematic analysis**, identifying recurring patterns connected to three theoretical domains:

1. HRD (training, leadership, performance),
2. Sustainability compliance (environmental practices, K3),
3. Digital agriculture (technology use and barriers).

Themes were coded manually and refined iteratively to ensure consistency and interpretive accuracy.

### Integration of Mixed Methods

Following the mixed-methods design, quantitative and qualitative findings were integrated during the interpretation phase. Quantitative results provided measurable evidence of skill gaps, while qualitative insights explained the underlying reasons for these gaps and contextualized them within plantation realities. This integration enabled a more nuanced TNA, consistent with best practices in HRD studies (Noe, 2020).

## Validity and Reliability

Several steps were taken to enhance methodological rigor:

1. **Instrument Validation:** The survey instrument was reviewed by three HRD experts and plantation supervisors to ensure content validity.
2. **Pilot Testing:** A small pilot test (n=5) was conducted to refine item clarity and structure.
3. **Triangulation:** Combining surveys, interviews, FGDs, and observations strengthened data reliability.
4. **Researcher Reflexivity:** Field notes were used to minimize bias during observation and interpretation.

These measures enhance the credibility and trustworthiness of the findings.

## Ethical Considerations

Ethical procedures were applied throughout the study. Participation was voluntary, and respondents were informed of the research objectives, their right to withdraw, and confidentiality measures. All data were anonymized to protect the identities of workers and companies involved. Permission to conduct data collection was obtained from company management, ensuring institutional compliance.

## RESULTS AND ANALYSIS

### Respondent Profile

A total of 20 respondents from 10 palm oil plantation companies in Kampar Regency participated in this study. The sample represented multiple organizational levels, including managers (15%), supervisors (20%), administrative staff (25%), and field workers (40%). The age distribution shows that the majority of respondents were between **36–45 years old (35%)**, reflecting a productive workforce with substantial industry experience.

**Table 1.** Respondent Demographics

Variable	Category	n	%
Age	26–35 years	2	10.0
	36–45 years	7	35.0
	> 45 years	3	15.0
Position	Manager	3	15.0
	Supervisor	4	20.0
	Administrative Staff	5	25.0
	Field Worker	8	40.0

The diversity of job roles in the sample strengthens the representativeness of the findings, demonstrating that training needs exist across both operational and managerial layers. This aligns with Asrini et al. (2024), who argue that a holistic TNA must incorporate organizational, job-level, and individual perspectives to ensure accurate competency mapping.

### Technical Training Needs

The analysis reveals that technical competencies remain the highest priority for plantation workers. As shown in Table 2, **oil palm harvesting and processing skills (30%)** and **occupational health and safety (K3) (30%)** emerged as the most urgent needs. These findings are consistent with Lubis & Sinaga (2023), who highlight that low technical proficiency frequently leads to production inefficiencies and elevated workplace risks.

**Table 2.** Technical Training Needs

Technical Skills	Companies in Need	Respondents	%
Oil palm processing (harvesting, processing)	6	6	30.0
Occupational safety and health (K3)	5	6	30.0
IT for plantation management	3	3	15.0
Heavy equipment operation	2	2	10.0

Additional technical needs identified include **information technology utilization in plantation management (15%)** and **operation of heavy equipment (10%)**. Although these needs show lower percentages, they signal an emerging shift toward digitalization and mechanization, reflecting broader industry trends toward precision agriculture.

### Non-Technical Training Needs

Non-technical competencies also surfaced as critical, particularly among supervisory and managerial roles. **Leadership and team management** dominated the category at **35%**, followed by **problem-solving and decision-making** (25%) and **effective communication** (15%).

**Table 3.** Non-Technical Training Needs

Non-Technical Skills	Companies in Need	Respondents	%
Team leadership & management	7	7	35.0
Problem solving & decision making	5	5	25.0
Effective communication	3	3	15.0

The prominence of leadership skills indicates gaps in supervisory effectiveness, especially in coordinating field teams and ensuring adherence to standard operating procedures (SOPs). These findings reinforce the insights of Wijayanti et al. (2022), who emphasize that managerial competence is central to maintaining productivity, fostering team cohesion, and facilitating change within plantation settings.

### Perception of Training Adequacy

Table 4 shows that **60% of respondents** perceived existing training programs as inadequate for meeting operational and managerial demands. Moreover, **90% expressed the need for technology-based training**, reflecting workers' recognition that digital tools are becoming increasingly integral to plantation operations. This perception highlights a significant competency gap that threatens productivity and digital readiness. It also supports the argument of Arifin & Rahman (2021), who found that misalignment between training design and actual worker needs contributes to low training transfer and limited organizational impact.

**Table 4.** Training Adequacy and Technology Needs

Aspect	Category	Respondents	%
Adequacy of Existing Training	Adequate	8	40.0
	Not adequate	12	60.0
Need for New Technology Training	Yes	18	90.0
	No	2	10.0

### Integrated Analysis

Synthesizing all findings, the results reveal two overarching themes:

#### ***Dual Skill Gap: Technical + Non-Technical***

Workers face simultaneous deficits in technical competencies (harvesting, processing, K3) and non-technical competencies (leadership, communication). This dual gap suggests that TNA must be multidimensional, addressing both practical field skills and managerial skill sets. Such an integrated approach aligns with HRD Theory, which emphasizes competency development across multiple domains to improve overall organizational performance.

#### ***Emerging Digital and Sustainability Demands***

The strong demand for IT-related training (90%) signals that the workforce is undergoing a structural transition toward digital agriculture. However, gaps in digital literacy risk hindering technological adoption. Similarly, the lack of sustainability-related skills—although not explicitly quantified was evident in qualitative findings (e.g., limited understanding of environmentally friendly practices, inefficient fertilizer use).

This supports the principles of Sustainability Theory and Digital Agriculture Theory, strengthening the argument that future training programs must incorporate environmental stewardship and digital competence.

## DISCUSSION

The findings of this study highlight several critical implications for human resource development in the palm oil plantation sector. First, the dominant need for technical competencies particularly in harvesting, processing, and occupational safety reinforces the notion that productivity and safety challenges remain central concerns in plantation operations. This supports the argument by Lubis & Sinaga (2023) that insufficient technical mastery significantly limits production efficiency and increases exposure to workplace hazards. The fact that more than half of respondents perceive existing training as inadequate further demonstrates a persistent gap between organizational expectations and actual worker capabilities.

Second, the emergence of non-technical competencies, especially leadership and problem-solving, indicates that managerial gaps are equally influential in shaping operational outcomes. Supervisors serve as a vital link between strategic directives and field implementation; thus, weaknesses in leadership directly affect team motivation, workflow coordination, and adherence to SOPs. These findings align with the insights of Wijayanti et al. (2022), who argue that managerial competence is an indispensable component of sustainable plantation management. The need for stronger communication and decision-making skills also suggests that organizational hierarchies in plantations may suffer from limited information flow, affecting both efficiency and responsiveness to field-level challenges.

Third, the strong demand for technology-based training (90%) underscores the accelerating digitalization of plantation management. The adoption of precision agriculture tools, such as drone-assisted monitoring and digital reporting systems, requires digital literacy and adaptability among workers. However, as Kusumastuti et al. (2025) note, the success of digital transformation is highly dependent on workforce competence and readiness. The findings indicate that while workers recognize the importance of technology, many still lack foundational digital skills, posing a significant risk to the effective integration of smart farming practices. This gap reflects the broader national challenge of increasing digital proficiency in rural labor markets.

Fourth, the results also point to inadequate mastery of sustainability-related competencies. Although these aspects were more prominent in qualitative findings, they align with Sustainability Theory, which asserts that environmental stewardship and social responsibility must form the foundation of modern plantation management. Workers' limited understanding of environmentally friendly practices such as integrated pest management, responsible fertilizer use, and waste reduction suggests that sustainability goals cannot be achieved without targeted training interventions. This is especially relevant as companies seek to comply with ISPO and RSPO requirements, where many compliance indicators depend on worker-level practices rather than managerial-level policy alone.

The combination of technical, managerial, sustainability, and digital skill gaps supports the integrated conceptual framework of this study, where Training Needs Assessment (TNA) serves as the central mechanism to align organizational goals with workforce development. HRD Theory emphasizes the importance of structured learning and continuous development, and the findings affirm that TNA must be adaptive, multidimensional, and evidence-based. Meanwhile, Sustainability Theory and Digital Agriculture Theory expand the scope of TNA beyond traditional skill assessments to include environmental literacy and technological readiness competencies that are increasingly essential for organizational competitiveness.

Furthermore, the dual nature of the identified skill gaps technical and non-technical suggests that training programs cannot adopt a one-size-fits-all approach. Field workers require hands-on, practice-oriented training focused on operational accuracy and safety, whereas supervisors and managers require soft skills and strategic training to execute effective leadership. This distinction emphasizes the need for tiered training frameworks that reflect job-specific responsibilities and learning capacities.

Overall, the findings affirm that palm oil companies in Kampar Regency must shift from reactive, ad hoc training practices to strategic training systems grounded in rigorous TNA. This transition is critical not only for improving productivity and reducing workplace risks but also for preparing the workforce to meet sustainability standards and take advantage of emerging digital technologies. By integrating HRD, Sustainability, and Digital Agriculture theories, this study provides a comprehensive lens to guide future training policies and strengthen the long-term resilience of the palm oil plantation sector.

## CONCLUSION

This study provides a comprehensive analysis of the training needs of palm oil plantation workers in Kampar Regency through an integrated mixed-methods approach. The findings reveal that competency gaps exist across multiple dimensions technical, managerial, sustainability-related, and digital. Technical skills such as harvesting, processing, and occupational safety remain the most urgent priorities, underscoring persistent challenges in productivity and workplace risk management. Meanwhile, non-technical competencies including leadership, communication, and problem-solving emerge as critical for strengthening supervisory effectiveness and improving overall coordination in plantation operations.

The study also demonstrates that the workforce is increasingly aware of the importance of digital transformation, with 90% of respondents expressing the need for technology-based training. This reflects broader sectoral trends toward smart farming and precision agriculture but also highlights a significant readiness gap in digital literacy. Furthermore, sustainability-related training remains insufficient, posing challenges for companies seeking to meet ISPO/RSPO certification standards and global market demands for environmentally responsible production.

Taken together, the findings confirm that Training Needs Assessment (TNA) must be treated as a strategic organizational function rather than a procedural formality. When guided by HRD Theory, Sustainability Theory, and Digital Agriculture Theory, TNA can serve as a powerful tool to align workforce competencies with organizational goals, sustainability requirements, and technological advancements. The study concludes that implementing structured, multi-level, and adaptive training programs is essential for enhancing productivity, improving worker safety, strengthening sustainability compliance, and preparing the workforce for digital transformation. Strengthening the capacity of plantation workers through well-designed training interventions will not only improve organizational performance but also support the long-term resilience and competitiveness of the palm oil industry in Kampar Regency.

## RECOMMENDATIONS

Based on the findings and conclusions of this study, several recommendations are proposed to enhance the effectiveness of workforce development in the palm oil plantation sector in Kampar Regency:

### 1. Develop Tiered and Job-Specific Training Programs

Companies should design training programs that reflect the distinct competency needs of different job levels:

- **Field workers:** technical skills (harvesting, processing, K3).
- **Supervisors:** leadership, communication, and problem-solving.
- **Managers:** strategic decision-making, sustainability governance, and digital oversight.

A tiered approach ensures that training interventions are targeted, relevant, and aligned with organizational structure.

### 2. Integrate Digital Literacy and Smart Farming Competencies

Given the growing reliance on digital tools in plantation management, companies should:

- Provide digital literacy training for all employee levels.
- Introduce workers to digital agriculture tools (e.g., drone monitoring, mobile-based reporting, GIS mapping).
- Prepare supervisors and managers for data-driven decision-making.

These initiatives will improve technology adoption and support the industry's transition toward precision agriculture.

### 3. Strengthen Sustainability and Environmental Management Training

To ensure compliance with ISPO/RSPO standards, training programs must incorporate:

- Integrated pest management (IPM).
- Balanced fertilization techniques.
- Water resource management.
- Biodiversity conservation and waste reduction practices.

Embedding sustainability competencies will reduce environmental risks and enhance certification readiness.

### 4. Expand Occupational Safety and Health (K3) Programs

Given the high-risk nature of plantation work, companies should:

- Increase the frequency of K3 training and field-based demonstrations.
- Ensure availability of personal protective equipment (PPE).
- Strengthen monitoring and enforcement of safety SOPs.
- Develop incident reporting and learning systems.

Enhanced K3 implementation will improve worker well-being and reduce operational disruptions.

### 5. Enhance Collaboration Between Industry, Government, and Training Institutions

Local governments and industry associations should play a more proactive role by:

- Developing standardized training modules for plantation competencies.
  - Facilitating access to accredited training centers and certification programs.
  - Providing incentives for small and medium-sized plantation companies to invest in HRD.
- Stronger multi-stakeholder collaboration will ensure consistent and scalable training practices.

### 6. Establish Continuous and Adaptive TNA Mechanisms

Companies are advised to conduct TNA regularly to adapt training programs to changing operational, technological, and sustainability demands.

Continuous TNA will enable companies to:

- Detect emerging skill gaps,

- Respond to technological innovations,
- Support workforce mobility and career development,
- Strengthen long-term organizational resilience.

#### **7. Encourage Worker Participation in Lifelong Learning**

Employees should be encouraged to engage in self-development by:

- Participating in online learning platforms related to agriculture.
- Improving digital skills independently.
- Seeking internal mentorship opportunities.

A culture of continuous learning will improve individual readiness for organizational changes.

## **REFERENCES**

- Arfansyah, D., Ginting, J. I., Pastika, M. A., Azha, K., & Situmorang, S. D. (2025). The effect of occupational health & safety programs and the work environment on the performance of oil palm plantation employees. *Agrienvi: Journal of Agricultural Sciences*, 19(1), 62–67.
- Arifin, M., & Rahman, T. (2021). The effectiveness of training programs in palm oil plantation companies in Indonesia. *Journal of Human Resource Development*, 15(2), 85–98.
- Asrini, N., Putu, A. T. S. N. L., Ayundha, D., & Veranita, M. (2024). Identify training and human resource development needs. *Journal of Education, Humanities, Linguistics and Social (Jagaddhita)*, 2(2), 40–53.
- Gustiana, R., Hidayat, T., Fauzi, A., & Penulis, K. (2022). Human resource training and development: A literature review of human resource management science. *Journal of Information Systems Management Economics*, 3(6), 657–666.
- Judijanto, L., Wibowo, G. A., Karimuddin, K., Samsuddin, H., Patahuddin, A., Anggraeni, A. F., ... & Simorangkir, F. M. A. (2024). *Research design: Pendekatan kualitatif dan kuantitatif*. PT Sonpedia Publishing Indonesia.
- Kornita, S. E. (2015). Economic analysis of the basis and potential synergies of development in Kampar Regency and Pekanbaru City. *Jurnal Ekonomi Universitas Riau*, 18(4), 8816.
- Kusumastuti, S. Y., Anggraeni, A. F., Rustam, A., Desi, D. E., & Waseso, B. (2025). *Research methodology: Qualitative and quantitative approaches*. PT Sonpedia Publishing Indonesia.
- Lubis, A., & Sinaga, R. (2023). Improving occupational safety and productivity through training in palm oil plantations. *International Journal of Agribusiness Studies*, 12(1), 44–57.
- Lubis, R., & Sinaga, P. (2023). Occupational safety challenges in palm oil plantations. *International Journal of Agricultural Management*, 12(1), 67–78.
- Rafly, M., Yatimah, D., & Sutisna, A. (2025). Implementation of Training Needs Analysis in employee development at the Collection & Recovery Unit, Permata Bank. *Ganaya: Jurnal Ilmu Sosial dan Humaniora*, 8(3), 142–151.
- Rahmana, A., & Suyono, A. M. (2024). Conceptual model of Training Need Analysis for regional public companies. *Jurnal Penelitian dan Aplikasi Sistem dan Teknik Industri (PASTI)*, 18(1).
- Suryani, R. I., & Hidayatulloh. (2023). Systematic literature review (SLR): Human resource training and development. *Jurnal Pendidikan dan Riset Ilmu Sains*, 2(3), 363–370.
- Wijayanti, D., Nugroho, A., & Setiawan, R. (2022). Leadership competence in sustainable plantation management. *Asian Journal of Business and Management*, 14(3), 112–124.
- Wijayanti, E., Hidayat, R., & Prasetyo, A. (2022). Leadership and managerial skills development in the plantation sector: Evidence from Indonesia. *Journal of Management and Agribusiness*, 19(3), 203–216.