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Sustainability Learning and Cocoa Farmers' Readiness for EUDR Compliance: Insights from a Desk Study in Indonesia

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ABSTRACT

The European Union Deforestation Regulation (EUDR) introduces new sustainability requirements that significantly affect global cocoa supply chains. As one of the world's major cocoa-producing countries, Indonesia faces considerable challenges in ensuring that smallholder farmers comply with EUDR provisions related to traceability, geolocation, and deforestation-free production. In this context, sustainability learning has emerged as a critical factor in strengthening farmers' capacity to adapt to evolving environmental and market standards. This study examines the relationship between sustainability learning and cocoa farmers' readiness for EUDR compliance through a desk study approach. Data were collected from scientific journal articles, policy documents, reports from international organizations, and government publications related to agricultural extension, sustainability education, digital literacy, and cocoa governance. The data were analyzed using thematic content analysis. The findings indicate that farmers' readiness for EUDR compliance is strongly influenced by sustainability learning opportunities, the effectiveness of agricultural extension services, and the level of digital literacy required for traceability systems. Significant knowledge gaps regarding EUDR requirements remain, particularly among smallholders in remote areas. Strengthening sustainability-oriented extension programs, promoting digital learning platforms, and enhancing institutional support are essential for improving compliance readiness. This study contributes to the literature on sustainability education and offers policy insights for supporting cocoa farmers in meeting emerging global sustainability standards.

Keywords: *Sustainability Learning; Cocoa Farmers; EUDR; Agricultural Extension; Digital Literacy; Indonesia*

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INTRODUCTION

The increasing integration of environmental sustainability standards into global agricultural trade has transformed the governance landscape of commodity supply chains. One of the most significant recent developments is the implementation of the European Union Deforestation Regulation (EUDR), which requires imported commodities, including cocoa, to be demonstrably free from deforestation and fully traceable to their origins. The regulation introduces new obligations related to geolocation, supply chain transparency,

and due diligence, creating substantial challenges for producer countries that rely heavily on smallholder agriculture (European Commission, 2023).

Indonesia is among the world's major cocoa-producing countries, with the sector providing livelihoods for hundreds of thousands of smallholder farmers across Sulawesi, Sumatra, and other producing regions. Cocoa production contributes not only to rural incomes but also to national export earnings and local economic development. However, the predominance of small-scale farming systems presents structural challenges for compliance with increasingly complex sustainability requirements. Limited access to information, technological resources, and extension services often constrains farmers' ability to adapt to changing market regulations (Aji et al., 2024; Neilson, 2022).

The introduction of the EUDR has intensified concerns regarding the preparedness of cocoa farmers to meet international sustainability standards. Compliance requires farmers to possess adequate knowledge of environmental regulations, understand traceability mechanisms, maintain production records, and engage with digital technologies used in monitoring and verification systems. These requirements extend beyond conventional agricultural practices and demand new forms of learning and capacity development among farming communities (Auld et al., 2024; Schreiber et al., 2024).

In this context, sustainability learning has emerged as an increasingly important concept in agricultural transformation. Sustainability learning refers to processes through which individuals and communities acquire knowledge, skills, values, and competencies that enable them to respond effectively to environmental, social, and economic sustainability challenges (Wals, 2020). Unlike traditional knowledge transfer approaches, sustainability learning emphasizes continuous adaptation, critical reflection, collaborative problem-solving, and the integration of environmental considerations into decision-making processes. Within agricultural systems, sustainability learning can strengthen farmers' ability to adopt sustainable practices, respond to policy changes, and participate more effectively in evolving value chains (Bourn et al., 2023).

Recent scholarship has increasingly emphasized the importance of sustainability competencies in supporting transitions toward more sustainable agricultural systems. Sustainability competencies encompass a combination of knowledge, values, attitudes, and practical skills that enable individuals to address complex environmental and social challenges (Brundiers et al., 2021). Within farming communities, these competencies contribute to farmers' capacity to evaluate environmental risks, adopt sustainable production practices, and respond to changing policy environments. The development of sustainability competencies is therefore closely linked to the effectiveness of learning systems and educational interventions designed to support rural transformation.

Environmental literacy represents another important dimension of sustainability learning. Environmental literacy refers to an individual's ability to understand environmental issues, assess their implications, and make informed decisions that support sustainability objectives (Jordan et al., 2022). Studies conducted in agricultural contexts suggest that environmentally literate farmers are more likely to adopt conservation-oriented practices, participate in sustainability initiatives, and engage in responsible

resource management. Such capabilities are increasingly relevant in the context of EUDR implementation, where environmental performance has become a critical determinant of market access.

The growing digitalization of agricultural systems has also transformed the nature of farmer learning. Digital technologies provide farmers with access to information, market intelligence, extension services, and sustainability-related resources that were previously difficult to obtain (Klerkx et al., 2024). Mobile applications, online training platforms, geographic information systems, and digital traceability tools are becoming important instruments for supporting sustainable commodity production. Consequently, digital learning environments are emerging as complementary mechanisms that enhance conventional extension approaches and facilitate knowledge dissemination among rural communities.

Furthermore, the literature highlights the increasing importance of adaptive capacity in responding to sustainability transitions. Adaptive capacity refers to the ability of individuals and communities to anticipate, respond to, and adjust to environmental, economic, and institutional changes (Folke et al., 2021). In agricultural systems, adaptive capacity is strongly influenced by access to knowledge, learning opportunities, institutional support, and social networks. Farmers possessing higher adaptive capacities are generally more capable of responding to emerging sustainability regulations and maintaining their competitiveness in changing market environments.

Recent studies focusing on global commodity governance indicate that sustainability regulations are increasingly shaping market participation and value chain inclusion (Lambin et al., 2023). Compliance with these regulations requires producers to engage with new monitoring systems, certification schemes, and reporting requirements. Consequently, sustainability learning should be viewed not only as an educational process but also as a strategic mechanism that enables farmers to navigate evolving governance frameworks and maintain access to international markets.

Agricultural extension services play a crucial role in facilitating sustainability learning among farmers. Extension programs have traditionally focused on disseminating technical knowledge related to crop management and productivity enhancement. However, contemporary sustainability challenges require extension systems to expand their functions by promoting environmental literacy, digital competencies, and market-oriented knowledge. Recent studies suggest that effective extension services can significantly improve farmers' awareness of sustainability standards and enhance their readiness to comply with emerging regulatory frameworks (Davis & Sulaiman, 2022; Knook et al., 2023).

Another important dimension of EUDR preparedness is digital literacy. The implementation of traceability systems increasingly depends on digital tools, including geospatial mapping, mobile applications, electronic record-keeping, and online reporting platforms. Farmers with limited digital capabilities may encounter difficulties in meeting compliance requirements, thereby increasing their vulnerability to exclusion from international markets. Consequently, digital literacy has become an essential component of

sustainability learning in modern agricultural systems (Rotz et al., 2022; Trendov et al., 2021).

Although growing attention has been devoted to EUDR implementation and sustainable cocoa governance, existing studies have predominantly focused on regulatory impacts, supply chain adjustments, and institutional challenges. Comparatively limited attention has been given to the educational dimensions of compliance, particularly the role of sustainability learning in shaping farmers' readiness to respond to new sustainability regulations. This gap is particularly evident in the Indonesian context, where smallholder cocoa farmers remain central actors in national cocoa production and export systems.

Addressing this gap, the present study examines how sustainability learning contributes to cocoa farmers' readiness for EUDR compliance in Indonesia. Using a desk study approach, the research synthesizes findings from academic literature, policy documents, and institutional reports related to agricultural extension, sustainability education, digital literacy, and cocoa governance. The study seeks to identify key factors influencing compliance readiness and to develop insights that can inform educational and policy interventions aimed at strengthening the adaptive capacity of cocoa farmers in an increasingly sustainability-oriented global market.

Sustainability learning has gained increasing attention as a framework for understanding how individuals and communities adapt to complex environmental challenges. The concept extends beyond the acquisition of technical knowledge and emphasizes the development of critical thinking, problem-solving abilities, collaborative learning, and adaptive capacities that support sustainable decision-making (Wals, 2020). In agricultural contexts, sustainability learning enables farmers to integrate environmental considerations into production practices while responding to changing regulatory, economic, and ecological conditions. Such learning processes are particularly important for smallholder farmers who face increasing pressure to comply with global sustainability standards while maintaining their livelihoods (Bourn et al., 2023).

The effectiveness of sustainability learning largely depends on the availability of educational support systems that facilitate knowledge transfer and capacity building. Agricultural extension services remain among the most important institutional mechanisms for promoting farmer learning and innovation adoption. Traditionally, extension programs focused on increasing productivity through the dissemination of technical information. However, contemporary agricultural challenges require extension systems to address broader sustainability issues, including environmental stewardship, climate adaptation, certification requirements, and responsible land management. As sustainability regulations become more prominent in international markets, extension services are expected to function as key intermediaries connecting farmers with new knowledge and compliance requirements (Davis & Sulaiman, 2022).

In addition to extension services, social learning processes play a significant role in strengthening farmers' adaptive capacities. Social learning occurs when individuals acquire knowledge through interactions with peers, farmer groups, cooperatives, and community networks. Such collective learning environments facilitate the exchange of experiences and

encourage the diffusion of sustainable agricultural practices. Previous studies have shown that social learning can improve environmental awareness and enhance the adoption of sustainability-oriented innovations among smallholder farmers (Knook et al., 2023). Consequently, sustainability learning should be understood not merely as an individual process but also as a collective mechanism that supports community-wide adaptation.

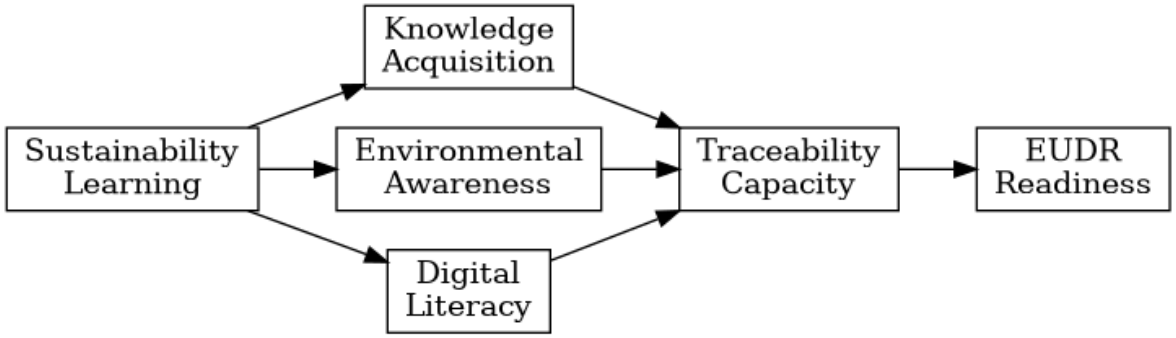
Digital literacy has emerged as another critical dimension of sustainability learning in modern agricultural systems. The increasing use of digital technologies in agriculture has transformed the way information is generated, communicated, and utilized. Traceability systems, geolocation mapping, mobile applications, and digital monitoring platforms are becoming essential components of sustainable commodity governance. Farmers who possess adequate digital competencies are generally better positioned to access information, comply with reporting requirements, and participate in increasingly transparent value chains (Trendov et al., 2021). Conversely, limited digital literacy can create barriers that hinder participation in sustainability certification schemes and international markets.

These challenges are particularly relevant in the context of EUDR implementation. The regulation requires comprehensive traceability mechanisms that enable the verification of commodity origins and ensure that production activities are not associated with deforestation. For cocoa farmers, compliance involves not only changes in production and documentation practices but also the acquisition of new knowledge and skills related to geospatial information, record-keeping, and environmental monitoring. As a result, readiness for EUDR compliance cannot be viewed solely as a regulatory issue; it is also an educational and learning challenge that requires substantial investments in farmer capacity development (Auld et al., 2024; Schreiber et al., 2024).

Despite growing scholarly interest in sustainable commodity governance, limited attention has been devoted to understanding how sustainability learning contributes to farmers' preparedness for emerging environmental regulations. Existing studies have largely focused on policy implementation, certification mechanisms, and supply chain governance, while the educational dimensions of compliance remain underexplored. This gap is particularly important in Indonesia, where smallholder cocoa farmers continue to dominate production systems and are expected to adapt to increasingly demanding sustainability standards.

Based on the reviewed literature, this study proposes that sustainability learning constitutes a foundational mechanism through which cocoa farmers develop the competencies necessary for EUDR compliance. Sustainability learning facilitates knowledge acquisition, strengthens environmental awareness, improves digital literacy, and enhances farmers' capacity to implement traceability requirements. These interrelated processes ultimately contribute to greater readiness for compliance with international sustainability regulations. Accordingly, the conceptual framework guiding this study is presented in Figure 1.

Figure 1. Conceptual Framework of Sustainability Learning and Cocoa Farmers' Readiness for EUDR Compliance.



Source: Developed by the authors based on sustainability learning, agricultural extension, digital literacy, and EUDR readiness literature.

METHOD

Research Design

This study employed a desk study approach to examine the relationship between sustainability learning and cocoa farmers' readiness for compliance with the European Union Deforestation Regulation (EUDR) in Indonesia. A desk study was considered appropriate because it enables the systematic examination and synthesis of existing knowledge derived from academic publications, policy documents, institutional reports, and relevant secondary sources. This approach is widely used to generate conceptual insights, identify knowledge gaps, and develop analytical frameworks for emerging policy issues (Johnston, 2017).

Data Sources

The study utilized secondary data obtained from multiple sources. Academic literature was collected from peer-reviewed journal articles focusing on sustainability learning, agricultural extension, digital literacy, sustainable agriculture, cocoa governance, traceability systems, and EUDR implementation. In addition, policy documents and technical reports were gathered from international organizations and government institutions, including the European Commission, Food and Agriculture Organization (FAO), International Cocoa Organization (ICCO), World Bank, United Nations Development Programme (UNDP), and the Ministry of Agriculture of Indonesia.

To ensure the relevance of the reviewed materials, the study prioritized publications issued between 2020 and 2026. Earlier publications were included selectively when they provided important theoretical foundations related to sustainability learning and agricultural education.

Inclusion and Exclusion Criteria

The selection of literature followed several inclusion criteria. First, publications had to address at least one of the following themes: sustainability learning, agricultural extension, farmer education, digital literacy, cocoa production, traceability systems, or EUDR compliance. Second, the sources had to be published in reputable academic journals, institutional reports, or official policy documents. Third, the materials had to provide conceptual, empirical, or policy-related insights relevant to smallholder farmers and sustainability governance.

Publications unrelated to agriculture, sustainability education, or cocoa supply chains were excluded from the review. Similarly, non-academic sources lacking sufficient methodological transparency were not included in the analysis.

Data Collection Procedures

The literature collection process was conducted through systematic searches of academic databases and institutional repositories. Keywords used during the search process included “sustainability learning,” “agricultural extension,” “digital literacy,” “cocoa farmers,” “traceability,” “deforestation-free supply chains,” “EUDR,” and “sustainable agriculture.” Relevant documents were screened based on titles, abstracts, and full-text reviews to ensure their alignment with the objectives of the study.

The selected literature was subsequently organized according to thematic categories that reflected the analytical focus of the research, namely sustainability learning, extension services, digital literacy, traceability capacity, and EUDR readiness.

Data Analysis

The collected data were analyzed using thematic content analysis. This method allows researchers to identify recurring patterns, concepts, and relationships across diverse sources of information (Braun & Clarke, 2022). The analysis was conducted through several stages.

First, all selected documents were reviewed to obtain a comprehensive understanding of their content. Second, key concepts and findings related to sustainability learning and EUDR compliance were coded and categorized. Third, similar codes were grouped into broader themes representing major factors influencing cocoa farmers’ readiness for compliance. Finally, the identified themes were synthesized to develop an integrated conceptual framework explaining how sustainability learning contributes to knowledge acquisition, environmental awareness, digital literacy, traceability capacity, and ultimately EUDR readiness among cocoa farmers.

Trustworthiness of the Study

To enhance the credibility of the findings, the study applied source triangulation by comparing information obtained from academic publications, policy documents, and institutional reports. This process helped reduce potential biases associated with relying on a single source of information. Furthermore, the use of multiple data sources enabled a

more comprehensive understanding of the educational and institutional dimensions of cocoa farmers' preparedness for emerging sustainability regulations.

The analytical process focused on identifying converging evidence across different sources, thereby strengthening the reliability and validity of the conclusions drawn from the study.

FINDING AND DISCUSSION

RESEARCH RESULT

Sustainability Learning as a Foundation for EUDR Readiness

The reviewed literature consistently indicates that sustainability learning constitutes a fundamental prerequisite for farmers' adaptation to emerging environmental regulations. Sustainability learning enables farmers to acquire knowledge and competencies necessary to understand sustainability standards, environmental responsibilities, and market requirements. Rather than focusing solely on technical agricultural practices, sustainability learning promotes broader capacities related to environmental awareness, critical thinking, and adaptive decision-making (Wals, 2020; Bourn et al., 2023).

The findings reveal that sustainability learning plays an increasingly important role in the context of global commodity governance. As sustainability requirements become more complex, farmers are expected to understand not only production-related issues but also environmental regulations, supply chain transparency, and traceability mechanisms. Consequently, learning processes become essential for facilitating farmers' adaptation to changing institutional environments.

Several studies emphasize that sustainability-oriented learning contributes to improved awareness of environmental conservation, responsible land-use practices, and sustainable resource management. These competencies are particularly relevant for cocoa farmers who are required to demonstrate compliance with deforestation-free production standards under the EUDR framework (Auld et al., 2024).

Agricultural Extension and Capacity Development

The literature further highlights the importance of agricultural extension services in strengthening farmers' preparedness for sustainability compliance. Extension programs serve as key channels through which farmers gain access to information, training opportunities, and technical guidance. Contemporary extension systems increasingly integrate sustainability-related topics, including environmental stewardship, climate adaptation, certification requirements, and digital technologies (Davis & Sulaiman, 2022).

The reviewed studies indicate that extension services contribute significantly to farmers' knowledge acquisition and innovation adoption. Farmers who regularly participate in extension activities tend to possess greater awareness of sustainability standards and demonstrate higher levels of readiness to adopt new agricultural practices. Extension agents also play an important role in translating complex regulatory requirements into practical guidance that can be implemented at the farm level.

However, the literature identifies several limitations affecting extension effectiveness. These include insufficient institutional capacity, limited coverage in remote areas, inadequate training resources, and weak coordination among stakeholders. Such challenges can constrain the dissemination of sustainability-related knowledge and reduce farmers' preparedness for compliance with emerging regulations.

Digital Literacy and Traceability Challenges

Another major finding concerns the growing significance of digital literacy in sustainable agricultural governance. The implementation of traceability systems increasingly relies on digital technologies that facilitate data collection, monitoring, reporting, and verification processes. As a result, digital competencies have become important determinants of farmers' ability to participate in sustainable supply chains (Trendov et al., 2021; Rotz et al., 2022).

The reviewed literature indicates that many smallholder farmers continue to face substantial barriers related to digital technology adoption. Limited access to digital infrastructure, inadequate technological skills, and insufficient training opportunities frequently hinder the effective use of traceability systems. These constraints are particularly evident among farmers operating in geographically isolated areas where internet connectivity and digital support services remain limited.

The findings also suggest that digital literacy directly influences farmers' capacity to comply with EUDR requirements. Geolocation mapping, electronic record-keeping, and digital reporting systems require a minimum level of technological competence. Farmers lacking these competencies may encounter significant difficulties in meeting compliance obligations and maintaining access to international markets.

Cocoa Farmers' Readiness for EUDR Compliance

The reviewed evidence suggests that readiness for EUDR compliance varies considerably across cocoa-producing regions and farmer groups. Several studies indicate that many smallholder cocoa farmers possess limited knowledge of EUDR requirements and remain unfamiliar with traceability procedures and deforestation-free verification mechanisms (Neilson, 2022; Schreiber et al., 2024).

The literature identifies several factors influencing readiness levels, including access to information, participation in extension programs, institutional support, technological capacity, and market integration. Farmers engaged in organized producer groups or certification schemes generally demonstrate higher levels of preparedness compared with independent smallholders.

Furthermore, the findings indicate that compliance readiness should not be understood solely as a technical issue. Instead, readiness reflects a broader combination of knowledge, awareness, skills, institutional support, and learning opportunities. This suggests that educational interventions may play a critical role in strengthening farmers' adaptive capacity and facilitating compliance with sustainability regulations.

Overall, the reviewed literature demonstrates that sustainability learning, agricultural extension, digital literacy, and traceability capacity constitute interconnected factors that collectively shape cocoa farmers' readiness for EUDR compliance. These findings provide the foundation for the subsequent discussion regarding educational strategies and policy implications for strengthening sustainability-oriented learning systems in Indonesia's cocoa sector.

DISCUSSION

The findings of this study demonstrate that sustainability learning plays a central role in shaping cocoa farmers' readiness to comply with EUDR requirements. While previous discussions on EUDR have largely focused on regulatory frameworks, supply chain governance, and institutional adjustments, the present study highlights the importance of educational processes in enabling farmers to respond effectively to increasingly demanding sustainability standards. Compliance with EUDR requires more than technical adaptation; it requires farmers to acquire new knowledge, develop environmental awareness, strengthen digital competencies, and improve their ability to manage traceability systems. These capacities are fundamentally linked to learning processes that occur through extension services, farmer organizations, community networks, and digital platforms.

The conceptual framework proposed in Figure 1 suggests that sustainability learning functions as the foundation of compliance readiness. Learning processes facilitate knowledge acquisition regarding environmental regulations, sustainable production practices, and market requirements. Consistent with the work of Wals (2020), sustainability learning enables individuals to develop adaptive capacities necessary for responding to complex sustainability challenges. In the context of cocoa farming, these learning processes help farmers understand the implications of deforestation-free supply chains and the practical requirements associated with EUDR implementation.

Knowledge acquisition alone, however, is insufficient to ensure compliance. The findings indicate that environmental awareness represents an important intermediary mechanism connecting knowledge to behavioral change. Farmers who understand the environmental consequences of deforestation and land degradation are more likely to recognize the importance of sustainable land management practices. Environmental awareness encourages a shift from compliance driven solely by market incentives toward a broader commitment to sustainability principles. This observation supports previous studies emphasizing that environmental literacy constitutes a key component of sustainable agricultural transformation.

The results further reveal the growing significance of digital literacy in contemporary agricultural governance. EUDR implementation relies heavily on digital technologies that support traceability, monitoring, and reporting systems. Consequently, digital competencies have become essential for participation in international commodity markets. Farmers must increasingly interact with geospatial mapping tools, electronic record-keeping systems, and digital verification platforms. Those lacking digital literacy may face significant barriers to compliance, even when they possess adequate knowledge of

sustainability principles. This finding reinforces arguments that digital inclusion should be considered a critical component of agricultural education and rural development strategies.

The findings can also be interpreted through the lens of sustainability competencies. Brundiers et al. (2021) argue that sustainability transitions require individuals to develop integrated competencies that combine systems thinking, anticipatory capacities, strategic action, and collaborative problem-solving. The present study suggests that EUDR readiness reflects a similar process in which cocoa farmers must combine environmental knowledge, technological skills, and practical management capabilities. Consequently, compliance should be understood not merely as adherence to regulations but as the manifestation of broader sustainability competencies developed through continuous learning.

The role of adaptive capacity is equally important in explaining variations in readiness among cocoa farmers. Consistent with Folke et al. (2021), farmers who have greater access to information, institutional support, and learning opportunities tend to demonstrate stronger adaptive responses to changing policy environments. Sustainability learning therefore contributes not only to knowledge acquisition but also to the development of resilience and flexibility required for long-term adaptation. This perspective is particularly relevant for smallholder cocoa farmers facing uncertainty associated with global sustainability transitions and evolving market standards.

The increasing integration of digital technologies into agricultural governance further reinforces the need for more inclusive educational strategies. Klerkx et al. (2024) note that digital transformation has the potential to improve agricultural sustainability while simultaneously creating new inequalities related to technology access and digital skills. In the context of EUDR implementation, efforts to strengthen digital literacy should therefore be accompanied by targeted support for marginalized and geographically isolated farming communities. Without such interventions, digital requirements may inadvertently increase exclusion from global value chains.

Finally, the findings support broader arguments concerning the relationship between sustainability governance and learning-based approaches to rural development. Rather than relying solely on compliance enforcement, effective sustainability governance requires investments in human capital, knowledge systems, and learning infrastructures (Lambin et al., 2023). Strengthening sustainability learning ecosystems may therefore represent one of the most effective pathways for improving EUDR readiness while simultaneously promoting inclusive and sustainable agricultural development.

Traceability capacity emerges as a direct outcome of sustainability learning, environmental awareness, and digital literacy. The reviewed literature indicates that traceability is no longer merely a technical requirement imposed by buyers or regulators. Instead, it has become a strategic capability that determines farmers' access to global markets. Effective traceability systems require accurate documentation, geolocation data, transparent production records, and the ability to communicate information throughout the supply chain. Farmers who possess these capacities are more likely to comply

successfully with EUDR requirements and maintain their participation in international cocoa markets.

The discussion also highlights the continuing importance of agricultural extension services. Extension systems represent one of the most influential institutional mechanisms through which sustainability learning can be promoted among smallholder farmers. However, traditional extension approaches that focus primarily on productivity enhancement may no longer be sufficient. Emerging sustainability regulations require extension programs to integrate environmental education, digital literacy training, traceability management, and sustainability governance into their activities. Such a transformation would enable extension services to function not only as channels for technology transfer but also as platforms for sustainability-oriented learning.

From a policy perspective, the findings suggest that improving EUDR readiness requires investments in educational and institutional capacities rather than relying solely on regulatory enforcement. Government agencies, producer organizations, private companies, and development partners should collaborate to strengthen sustainability learning ecosystems within cocoa-producing regions. These efforts may include the development of farmer training programs, digital learning platforms, traceability support systems, and community-based learning initiatives. Particular attention should be directed toward smallholder farmers in remote areas, who often face the greatest barriers to accessing information and technological resources.

The Indonesian cocoa sector is currently undergoing a period of transition as international markets increasingly demand higher levels of sustainability assurance. In this context, sustainability learning should be viewed as a strategic investment that enhances farmers' adaptive capacity and long-term competitiveness. By strengthening knowledge acquisition, environmental awareness, digital literacy, and traceability capacity, sustainability learning can contribute significantly to improving cocoa farmers' readiness for EUDR compliance while simultaneously supporting broader goals of sustainable rural development.

Overall, this study proposes that EUDR readiness is not merely the result of regulatory compliance mechanisms but rather the outcome of an integrated learning process. Sustainability learning provides the foundation through which farmers acquire the competencies necessary to navigate evolving sustainability requirements and participate effectively in global agricultural markets. The conceptual framework developed in this study therefore offers a useful perspective for understanding the educational dimensions of sustainability governance and for designing interventions that support farmer adaptation to emerging environmental regulations.

CONCLUSION

This study examined the role of sustainability learning in enhancing cocoa farmers' readiness for compliance with the European Union Deforestation Regulation (EUDR) in Indonesia. Drawing on a desk study approach, the findings demonstrate that EUDR readiness extends beyond technical and regulatory requirements and is strongly influenced

by educational and learning processes. Sustainability learning enables farmers to acquire the knowledge, skills, and competencies necessary to understand sustainability standards and adapt to evolving global market demands.

The study identifies knowledge acquisition, environmental awareness, digital literacy, and traceability capacity as key dimensions linking sustainability learning to compliance readiness. Farmers who have access to learning opportunities, extension services, and digital support systems are generally better positioned to understand regulatory requirements and participate in sustainable supply chains. Conversely, limited access to information, training, and digital technologies may hinder farmers' ability to comply with EUDR obligations.

The findings further emphasize the strategic role of agricultural extension services in facilitating sustainability-oriented learning. Extension programs should move beyond conventional productivity-focused approaches by integrating environmental education, digital competency development, and traceability management into their activities. Such efforts are essential for strengthening farmers' adaptive capacities and ensuring their continued participation in international cocoa markets.

From a policy perspective, improving cocoa farmers' readiness for EUDR compliance requires collaborative investments in sustainability learning ecosystems involving government agencies, educational institutions, producer organizations, private sector actors, and development partners. Strengthening these learning systems will not only support regulatory compliance but also contribute to the broader goals of sustainable agricultural development and rural resilience.

Finally, this study proposes a conceptual framework that positions sustainability learning as the foundation of EUDR readiness through its influence on knowledge acquisition, environmental awareness, digital literacy, and traceability capacity. Future research may validate and refine this framework through empirical investigations involving cocoa-producing communities in different regions of Indonesia and other cocoa-producing countries.

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