TRANSFORMING PALM OIL CERTIFICATION IN INDONESIA: EMPOWERING SMALLHOLDERS THROUGH SOCIAL COMPETENCE AND SUSTAINABILITY

NURLIZA*

Doctoral Studies in Agricultural Sciences, Agriculture Faculty, University of Tanjungpura, Jl. Prof. Hadari Nawawi, 78124 Pontianak, West Kalimantan, Indonesia.

*Corresponding author: dnurliza.spmm@gmail.com

Abstract: Palm oil certification in Indonesia is a challenge due to the absence of a universal definition for social competence, as well as limited active information adoption by smallholders. This study introduces a novel interdisciplinary framework that integrates learning theory, diffusion of innovation and social competence to address the gap and promote social inclusion in rural development. Through a mixed-methods approach involving 150 smallholders, it uncovers how reliance on on-farm income heightens vulnerability to market risks, constraining the smallholders' capacity for investment. The study highlights how the enhancement of social competence—through trust, effective information processing, and a clear understanding of certification benefits—can significantly increase adoption rates. By positioning rational problem-solving, sustainable practices, and environmental stewardship at the core of certification efforts, this research offers innovative pathways for improving both productivity and sustainability in palm oil cultivation. The emphasis on aligning governance, cultural awareness, and collaborative problem-solving sets a new standard in fostering agricultural resilience and long-term growth.

Keywords: Certification, information processing, smallholders, social competence, sustainability.

Introduction

Indonesia's palm oil industry occupies a pivotal position in both the national economy and the global commodity market. With more than 14.6 million hectares of cultivated land producing over 46.98 million metric tonnes of Crude Palm Oil (CPO) annually, the industry contributes between 9% and 17% of the country's Gross Domestic Product (GDP) and sustains approximately 3.5% of the national workforce (Statistics-Indonesia, 2021; www.statista.com, 2023). Beneath these impressive macroeconomic figures, however, lies a more complex and uneven terrain, particularly when it comes to the inclusion of smallholders, who manage over 41% of the country's plantations and produce more than one-third of the total CPO output.

Many of these smallholders, who cultivate a plot of less than two hectares and rely almost entirely on on-farm income, face an intricate web of challenges that limits their ability to access sustainability certification schemes. Although the government has formalised the Indonesian Sustainable Palm Oil (ISPO) standard—anchored by Presidential Regulation No. 44/2020, which mandates certification for all producers its adoption among smallholders has been markedly slow. As Watts *et al*. (2021) observed, fewer than 10% of smallholder plantations have achieved ISPO certification in recent years, revealing a significant gap between policy intent and on-the-ground realities.

The reasons for this gap are multidimensional. Technical hurdles like inadequate extension services, lack of formal land tenure, and complex administrative requirements certainly play a role. But perhaps more insidiously, many smallholders find themselves navigating cognitive and informational barriers that are hard to quantify,

yet equally obstructive. Certification criteria are often conveyed in an abstract, top-down language that either fails to resonate with smallholders' lived experience, their indigenous knowledge systems or their everyday decision-making processes. This disconnect is further compounded by financial constraints, limited digital literacy, and fragmented access to formal markets, causing their perceived cost of certification to outweigh its unclear and delayed benefits (Apriani *et al*., 2020a; Putri *et al*., 2022).

Moreover, the prevailing assumption in many sustainability initiatives—that greater awareness will naturally lead to greater compliance—overlooks a critical reality: Awareness itself does not guarantee action. Smallholders are not merely lacking information; they are situated within layered and interdependent social, economic, and ecological systems that profoundly influence how they interpret risks, assign value to new information and navigate competing priorities.

Within these contexts, certification is often perceived not as an empowering instrument, but as yet another externally imposed demand—one that may feel disconnected from the practicalities and pressures of daily life. Understanding this disconnect requires moving beyond linear models of behaviour change towards a more nuanced appreciation of how people make sense of and respond to institutional expectations, in ways that are deeply contextual, adaptive, and often, quietly rational.

It is within this intricate human context that the inquiry of this study takes root. The challenge is approached with both conceptual curiosity and a grounded sense of urgency: How might smallholder engagement in sustainability initiatives be reimagined to better reflect the ways people think, relate, and act within their everyday realities? Specifically, questions like "how do smallholders interpret and respond to certification-related information?" and "how does this cognitive engagement shape their perceptions of trust, value, and decision-making?" are resolved to achieved the objectives.

Beyond information processing, how core social competencies like self-regulation, prosocial behaviour, communication, and problem-solving emerge or are activated through interactions with certification processes are explored. It is particularly interesting to observe how these competencies are not only expressions of individual capacity, but also shaped by broader social learning and institutional encounters.

Crucially, this study examines the dynamic interplay between how smallholders make sense of information and how they mobilise their social skills. Particular attention is given to how this interaction shapes their willingness to engage with, adopt, and sustain participation in the ISPO scheme. Through this process, the competencies most influential in enabling initial compliance—and in supporting long-term, meaningful participation in sustainability frameworks that work with, rather than around, smallholders' lived knowledge and agency—may be identified.

These questions stem from more than a scholarly inquiry; they reflect a deeper conviction shaped by firsthand engagement with the lived realities of smallholders. In Indonesia's palm oil landscape, smallholders are not marginal actors—they are foundational. Yet, too often, interventions treat them as passive recipients of policy rather than the complex, adaptive thinkers they are.

Supporting them effectively requires more than just mapping their practices; it demands an understanding of how they reason, learn, and connect within the intricate networks of their socio-economic and ecological environments. This study attempts to reposition smallholders not as subjects of change, but as agents—individuals whose cognitive frameworks and social relations are central to the legitimacy and success of sustainability certification. True inclusion, as contended, cannot be engineered solely through top-down mandates. It must be cultivated through genuine insight, empathetic engagement, and co-designed processes that

respect and amplify the smallholders' knowledge systems.

Literature Review

Oil palm cultivation in Indonesia has evolved into a complex intersection of economic promise and environmental tension. While its expansion has undeniably contributed to rural livelihoods and national GDP, it has also been shadowed by ecological concerns, social contestations and policy gaps. Within this landscape, the role of smallholders is particularly consequential. Representing nearly half of Indonesia's plantation areas, smallholders are not peripheral actors but central to the sector's sustainability and legitimacy. Yet, their participation in sustainability certification schemes remains disproportionately low—an issue that continues to draw both academic and policy attention.

A substantial body of work has explored the environmental and socio-economic impacts of oil palm expansion. Studies by Dermawan and Hospes (2018) and Ayompe *et al.* (2021) emphasised the loss of biodiversity and deforestation risks while Dou *et al.* (2020) highlighted the socio-economic integration of smallholders into global value chains. These perspectives establish the broader context but often leave the micro-level dynamics of smallholder agency underexplored. In particular, the nuanced, everyday decisions that farmers make—what they prioritise, how they process information, and what they value—are frequently overlooked.

Certification schemes such as the ISPO have been introduced to close the gap between economic development and ecological responsibility. However, as Pacheco *et al.* (2020) and Watts *et al.* (2021) pointed out, these frameworks often fail to resonate with smallholders, who struggle to navigate their bureaucratic complexity. Moreover, the dominant focus on compliance and enforcement tends to reduce smallholders to passive recipients of external mandates, rather than engaging with them as capable and strategic actors.

This disconnect invites a shift in perspective—one that considers not just institutional frameworks but also the human competencies that shape the smallholders' engagement with those frameworks. The diffusion of innovation theory (Rogers, 1983), long applied in agricultural studies, offers a useful entry point. It reminds us that adoption is rarely a linear or purely rational process. It unfolds through stages of knowledge, persuasion, decision, implementation, and confirmation, each shaped by the smallholders' context, values, and capacity to process information.

More recently, scholars have begun to recognise the importance of social competence, an umbrella term encompassing skills such as communication, empathy, self-regulation, and problem-solving, in shaping innovation adoption. While Rose-Krasnor's (1997) foundational work provided a multidimensional model for understanding social competence, applications within agricultural and rural development contexts remain limited. Baron and Markman (2003), for instance, argued that social competence underpins entrepreneurial success, yet this insight has rarely been extended to smallholder farming systems.

There is also growing attention to the cognitive and behavioural underpinnings of decision-making. Information processing, often studied in consumer behaviour or organisational learning (Matthews, 2008; Makkonen, 2021) has profound implications about how smallholders interpret and act on sustainability messages. Lord and Maher (1990) emphasised that individuals do not merely absorb information; they filter, evaluate, and internalise it based on prior knowledge and emotional cues. This perspective challenges the technocratic assumption that knowledge transfer alone is sufficient for behavioural change.

In this regard, smallholders can be reconceptualised as active processors of information, rather than passive recipients. This view aligns with Gruber's (2020) evolutionary reinterpretation of adoption-diffusion theory,

which emphasises learning, adaptation, and feedback. It also resonates with Gagné's (1984) taxonomy of learning outcomes, which identifies verbal information, intellectual skills, and attitudes as key domains of human performance. When situated in the context of palm oil certification, these domains intersect with the social, emotional, and ethical dimensions of farming decisions.

Another dimension that remains under-theorised is the relationship between social capital and social competence. While Adler and Kwon (2002) and Lans *et al.* (2015) underscored the role of social networks in rural innovation, the mechanisms through which interpersonal competence enhances trust, collaboration, and collective efficacy warrant deeper exploration. It is through these channels that certification norms may be internalised, not just as external requirements, but as shared community aspirations.

Thus, the literature reveals a critical gap. While considerable knowledge about the structural and institutional barriers to smallholder certification has been amassed, relatively little is known about the internal, relational, and psychological processes that mediate these barriers. What happens when a smallholder is faced with a new set of sustainability criteria? How does trust, past experiences, or communication skills affect their willingness to engage? These are deeply human questions—questions that this study seeks to bring to the foreground.

By integrating theories of learning, innovation diffusion, and social competence, this research aims to offer a more holistic framework. It moves beyond technical compliance to consider how smallholders make sense of certification in ways that are practical, emotional, and socially embedded. In doing so, it hopes to not only enrich academic debates, but also inform more empathetic and effective sustainability interventions.

Materials and Methods

This study adopted a mixed-methods approach, not merely as a combination of tools, but as a reflection of the complex, multi-layered nature of smallholder engagement with sustainability certification. Capturing this complexity required both the statistical power of quantitative analysis and contextual sensitivity afforded by qualitative insight. Certification behaviour is influenced not only by structural constraints, but also by how individuals process information, regulate behaviour, and navigate social dynamics (Rose-Krasnor, 1997; Matthews, 2008; Gruber, 2020).

The quantitative component was based on structured questionnaires administered to 150 purposively selected smallholders in Sambas, West Kalimantan—an area representing one of Indonesia's largest oil palm zones (Nurliza *et al.*, 2018; Statistics Indonesia, 2020). The sample size was determined using the two-step approach to Structural Equation Modeling (SEM) recommended by Anderson and Gerbing (1988). Analytical procedures included descriptive statistics, Multi-Dimensional Scaling (MDS) to identify key leverage dimensions of social competence (Rose-Krasnor, 1997; Rogers, 1983) and SEM using LISREL to test the structural relationship between information processing and social competence (Gagné, 1984; Matthews, 2008).

The qualitative dimension was embedded in the development and validation of the research instrument. Constructs such as trust, self-regulation, and perceived benefit required interpretation within local cultural and institutional contexts. To this end, the questionnaire was refined through pre-testing and field validation involving practitioners and smallholders, ensuring that questions were semantically clear and contextually resonant (Watts *et al.*, 2021; Putri *et al.*, 2022). This iterative process allowed the instrument to capture cognitive and behavioural dimensions that were often overlooked in top-down sustainability assessments (Lord & Maher, 1990; Makkonen, 2021).

The questionnaire was structured into three interconnected domains. First, smallholder characteristics: This section captured the socio-economic and smallholder variables including age, education, household size, income, land tenure, production volume, labour input, investment costs, and yield (Kuivanen *et al.*, 2016; Yanita & Ningsih, 2021). These data provided a structural backdrop to assess how resource constraints and demographic profiles could affect certification behaviour.

Second, information processing: This domain explored how smallholders acquired and evaluated certification-related information as summarised in Table 1. Drawing on Gagné's (1984) taxonomy, it measured verbal learning (e.g., memory, experience, and sensory preferences), intellectual skills (problem-solving), and attitudes (trust and perceived benefits). These indicators were aligned with Rogers' (1983) diffusion of innovations theory and reflected the smallholders' cognitive journey from exposure to internalisation (Lord & Maher, 1990; Makkonen, 2021).

The social competencies framework used self-regulation, social problem-solving, prosocial behaviour, social awareness, and communication abilities (Table 2). This

Table 1: The information processing framework: A guide to decision-making and innovation

The Information Processing	Indicators
Verbal information/FI (Gagné, 1984)	Knowledge, experience, remembering and processing, visual learning, auditory learning, and kinaesthetic learning
Intellectual skill/TS (Gagné, 1984)	Problem-solving ability
Attitude/AT (Gagné, 1984)	Trust and perceived benefits

Table 2: The social competencies framework

Social Competence	Indicators
Self-regulation (UNM, 1999)	Setting goals, persevering, making decisions, and making up for mistakes
Avoidance style/AS (Stemmet *et al.*, 2015)	Prevent issues, postpone payments, proceed rather slowly, experience obstacles, and remaining vigilant
Impulsiveness/carelessness style/ICS (Rodríguez-Fornells & Maydeu-Olivares, 2000)	Not rash, sentimental, idea, advantages, and disadvantages
Rational problem-solving/RPS (Meredith, 2009)	Cautious assessment, information collection, goal-setting, consequence prediction, solution, problem-solving, and constructive approach
Negative problem orientation/NPO (Gosselin *et al.*, 2005)	Irritated, fearful, insecure, agitated, and irresponsible
Social awareness (Zhou & Ee, 2012)	Expressions, comprehension, thought, response, and notions
Prosocial behaviour with prosocial tendencies measure/PTM (Baudinet, 2013)	Helping, contentment, simplicity, improved assistance, maximum assistance, on-target, conviction, financial support, mistakes, goods or money, silent assistance, stress, attention, complicated issue, time, appreciation, responsiveness, help without hesitation, personal information, emotional, donation, and repaying favours
Communication abilities (Mojtahedzadeh *et al.*, 2018)	A negative mindset, a positive mindset

framework underscored the critical role of these competencies in promoting constructive social interactions, particularly in the context of smallholder engagement in sustainable agricultural practices.

Third, social competence: This section assessed individual and interpersonal capacities crucial to sustainability engagement, including self-regulation (UNM, 1999), rational problem-solving (Meredith, 2009), impulsiveness/carelessness (Rodríguez-Fornells & Maydeu-Olivares, 2000), avoidance styles (Stemmet *et al.*, 2015), prosocial behaviour (Baudinet, 2013), social awareness (Zhou & Ee, 2012), and communication ability (Mojtahedzadeh *et al.*, 2018). These constructs were critical to understand how social and emotional skills could enable or hinder collective action and compliance with ISPO certification (Baron & Markman, 2003; Lans *et al.*, 2015; Astleitner & Ortner, 2017).

By combining these approaches, the study could move beyond conventional compliance metrics to interrogate how smallholders learn, adapt, and relate to certification frameworks. The mixed-methods design was not simply a dual-track approach, but it was a deliberate strategy to align empirical robustness with contextual fidelity. In a governance landscape where institutional expectations often clashed with rural realities, this methodological stance

allowed for a more empathetic and actionable understanding of smallholder behaviour.

Results and Discussion

Key Aspects of Smallholders: Characteristics, Information Processing, and Social Competencies

Smallholder characteristics included socio-economic (Figure 1) and smallholding factors (Figure 2). In Figure 1, the predominant socio-economic characteristics of smallholders indicated that most were aged between 38 and 46 with two household members and received six to eight years of formal education. Their on-farm income ranges from Rp2,200,000 to Rp4,000,000 (approximately US$139 to US$252) per month while off-farm and non-farm incomes were generally below Rp2,200,000 per month. Monthly food expenses ranged from Rp850,000 to Rp1,200,000 while non-food expenses were less than Rp600,000. This structured overview highlighted the economic challenges faced by smallholders and their reliance on on-farm income.

Figure 2 reveals key characteristics of the smallholdings, showing that most owners possessed land rights and utilised fewer than 200 trees in one hectare. They typically harvest between 800 kilograms and 1,000 kilograms of Fresh Fruit Bunches (FFB) per year, conducting
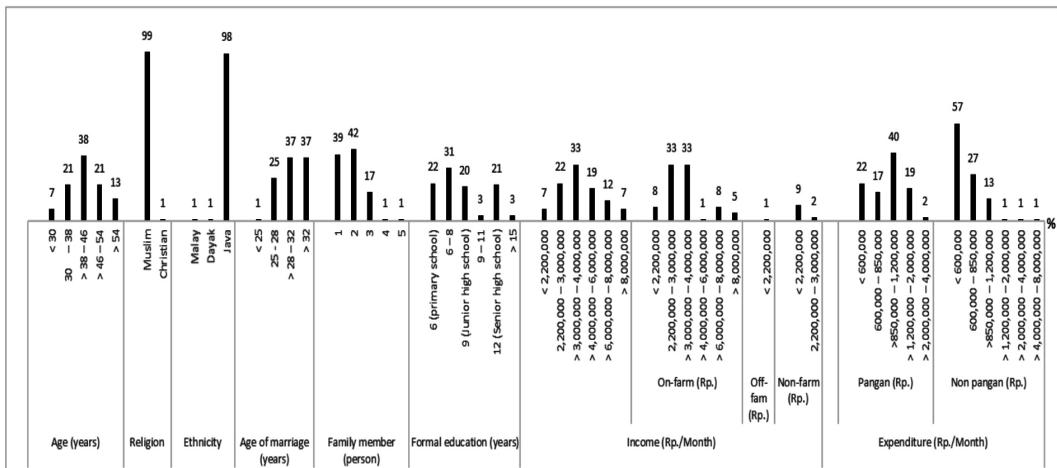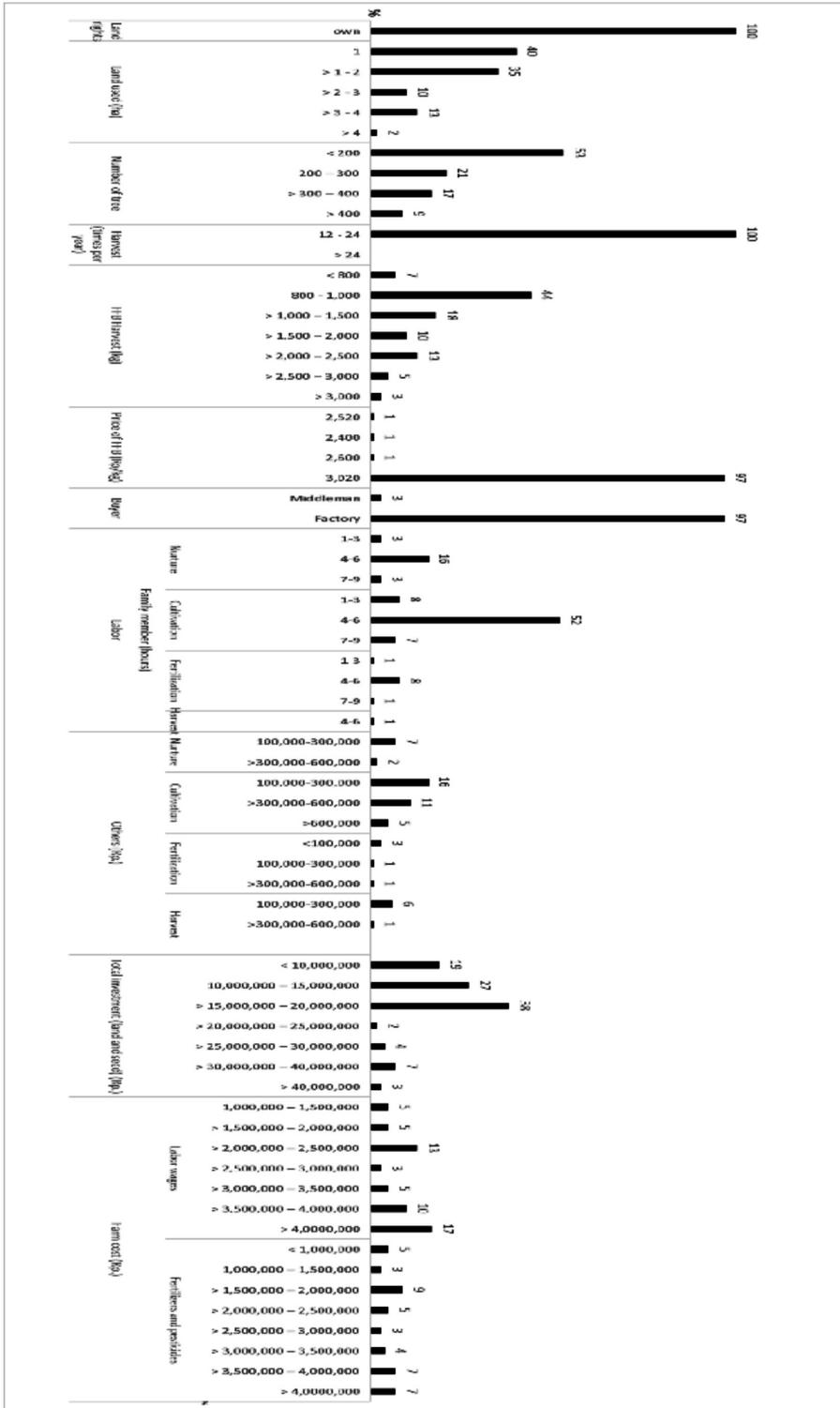

Figure 1: Social-economic factors (%)

Figure 2: Farm factors of smallholders (%)

more than 24 harvests. The average FFB price was Rp3,020 (about 19 US cents) per kilogram, with factories serving as primary buyers.

Tree-planting such as nurturing, cultivating, fertilising, and harvesting requires four to six hours of family labour. Associated costs for these activities ranged from Rp100,000 to Rp300,000. Total investment in land and seeds was between Rp15,000,000 and Rp20,000,000. Additionally, farm labour costs had exceeded Rp4,000,000, with fertiliser costing Rp1,500,000 and pesticides costing Rp2,000,000. This overview highlighted the economic pressures and resource allocation challenges faced by smallholders.

Figures 1 and 2 illustrate the considerable economic challenges encountered by smallholders, which were largely due to their dependence on on-farm income that exposed them to market volatility. They also faced resource constraints and economic pressures that restricted their capacity to invest in essential improvements. Together, these factors could jeopardise their financial stability and long-term sustainability in agriculture.

Table 3 presents the key characteristics of information processing in certification. It highlighted that the primary aspects of information processing in certification were the attitude towards data accuracy and information that could influence farming practices. The most significant attitude within certification principles emphasised sustainable business improvement and the management of environmental resources, natural habitats, and biodiversity. This underscored the importance of fostering trust and accountability in information to drive positive changes in farming methods.

Table 4 presents the goodness-of-fit test for sensitive attributes of social competencies under specific conditions while Figure 3 illustrates the critical aspects of leveraging social competencies. The goodness-of-fit for social competencies evaluated the alignment between the proposed model and observed data. A strong fit indicated that the model could accurately represent the relationships among variables, confirming that the measures effectively captured the intended constructs. Together, these findings provided a comprehensive understanding of the nuanced elements that influenced social competence in the context of smallholders, highlighting their relevance in fostering effective community engagement and sustainable practices.

Figure 3 (d) indicates that rational problem-solving was the primary competency among smallholders. Self-regulation and negative problem orientation were linked to decision-making difficulties and frustration with complex issues. Conversely, positive problem orientation was closely associated with effective problem-solving. Additionally, avoidance styles and pro-social behaviours reflected tendencies to evade challenges and support others, respectively. Social awareness and communication skills were founded on understanding others and fostering a positive attitude, which was crucial for collaborative efforts and effective engagement within the community.

Thus, palm oil certification among smallholders required collaboration, discretionary authority, resources, effective governance and socio-cultural relevance in funding, culture, structure, and knowledge (Phulkerd *et al*., 2017; Teddy *et al*., 2019). Additionally, successful certification also needed effective financial management, social networking support, and personal motivation (Hayden *et al*., 2021; Lin *et al*., 2021). These elements were crucial in enabling smallholders to adopt sustainable practices and successfully navigate the certification process.

Impact of Information Processing in Certification on Enhancing Social Competence

Table 5 demonstrates consistent convergent validity, indicating that the measures used effectively capture the intended constructs. This consistency reinforced the reliability of the findings and supported the robustness of the study measurement framework.

Table 6 presents the goodness-of-fit test results for the model used in problem analysis. This assessment evaluated the model's appropriateness and effectiveness in capturing

Table 3: Information processing in certification

Information Processing Legal and Plant Management		Certification Principles (%)				
		Implementation of Good Plantation Practices	Management of Environment, Natural Resources, and Biodiversity	Application of Transparency	Sustainable Business Improvement	Mean
Verbal information	Knowledge	75	100	100	0	75
	Experience	38.85	59.6	50	0	49.69
	Remembering and processing	54.68	100	100	100	90.94
	Visual learning	75	90	100	0	73
	Auditory learning	32.03	58.39	52	51.3	38.74
	Kinesthetics learning	0	10	50	0	12
	Mean	**45.93**	**69.67**	**75.33**	**16.67**	**67.87**
Intellectual skills	Problem-solving ability	69.33	100	0	0	33.87
	Mean	**69.33**	**100**	**0**	**0**	**33.87**
Attitudes	The truth regarding the provision of data and information can change farming patterns	100	100	100	100	100
	Perceived benefits of information regarding the provision of data and information	75	94.4	100	0	73.88
	Mean	**87.5**	**97.2**	**100**	**50**	**86.94**

Table 4: The goodness-of-fit for social competencies

| Dimension	Stress	R^2	MDS	Monte-Carlo	Deviation (MDS-Monte-Carlo)
Self-regulation	0.19	0.92	50.58	50.02	0.56
Negative problem orientation	0.15	0.94	0.47	4.75	4.28
Positive problem orientation	0.20	0.91	61.78	61.39	0.39
Rational problem solving	0.15	0.94	64.37	64,77	0.40
Avoidance style	0.14	0.94	2.24	4.22	1.98
Impulsiveness-carelessness	0.16	0.92	39.94	41.20	1.26
Prosocial behaviour	0.15	0.92	48.83	50.51	1.68
Social awareness	0.16	0.89	11.43	11.76	0.33
Communication abilities	0.21	0.91	34.53	34.82	0.29
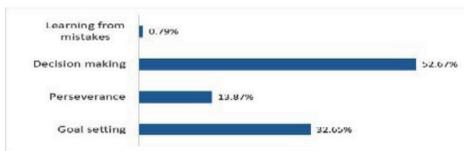
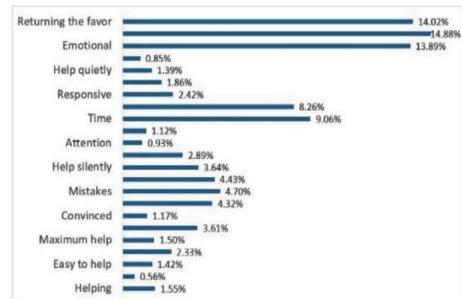(a) Self-regulation
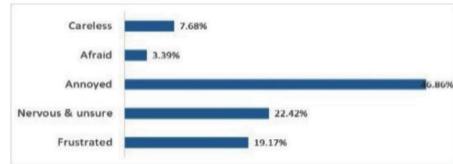
(b) Negative problem orientation
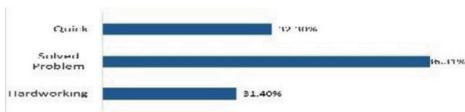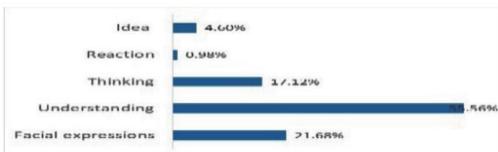
(c) Positive problem orientation
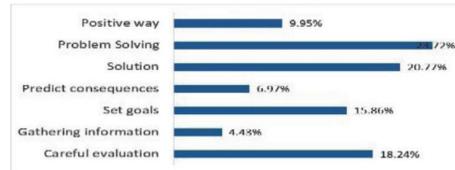
(d) Rational problem-solving
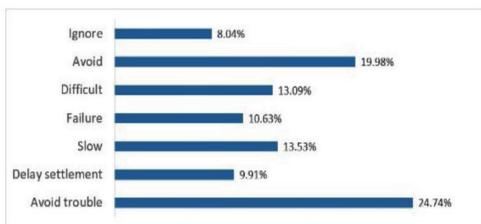
(e) Avoidance style

(f) Prosocial behaviour

(g) Social awareness

(h) Communication abilities

Figure 3: Leveraging social competencies

the complexities of the analysed issues, providing crucial insights into its reliability and validity in understanding the underlying problems.

Figure 4 illustrates the structural model while Table 7 presents the measurement model, both reflecting the impact of information processing in certification on social competence. These models collectively demonstrated how effective information processing could enhance social competencies among smallholders, providing a framework for understanding the dynamics of certification and its implications for sustainable practices.

Figure 4 demonstrates that information processing in certification significantly enhances the social competencies of oil palm smallholders. This improvement underscored the vital role of effective information management in fostering community engagement and promoting sustainable agricultural practices.

Thus, smallholders' adaptability and behaviour were significantly influenced by information processing, which were related to cognitive and behavioural constructs as well as overall well-being (Şenol & Metin, 2021; Gál *et al*., 2022). In uncertain conditions, the need for information processing tended to increase (Costa *et al*., 2022). Furthermore, self-regulation was shaped by individual traits and the effectiveness of information processing, including perceived memory functions (Ruttan & Nordgren, 2015; Torrens-Burton *et al*., 2017). This memory function supported the smallholders' self-regulation, which could compensate for slower information processing (Meijs *et al*., 2021).

Successful certification adjustment required strong social problem-solving skills (Kaur, 2018). Smallholders' prosocial behaviour was shaped by their environment and past experiences (Huynh, 2018). Key factors such as empathy, moral judgment, and elevation could enhance this behaviour (Ding *et al*., 2018). Additionally, social awareness also fostered a conducive learning environment and was essential for effective decision-making (Huynh, 2018). High levels of social awareness correlated with increased flexibility and

Table 5: Composite Reliability (CR) and Variance Extracted (VE)

| Criteria	Social Competence									Information Processing in Certification		
	SR	NPO	PPO	RPS	AS	ICS	PTM	SA	CA	FI	TS	AT
Std. Loading Factor VE	0.54	0.73	0.74	0.95	0.48	0.80	0.87	0.87	0.94	0.99	0.9	0.70
Error VE	0.70	0.47	0.45	0.10	0.77	0.36	0.24	0.24	0.12	0.02	0.19	0.51
VE	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.76	0.76	0.76
Overall VE > 0.50												
Std. Loading Factor CR	0.54	0.73	0.74	0.95	0.48	0.80	0.87	0.87	0.94	0.99	0.90	0.70
Error CR	0.70	0.47	0.45	0.10	0.77	0.36	0.24	0.24	0.12	0.02	0.19	0.51
CR	0,93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.90	0.90	0.90
Overall CR > 0.70												

Note: SR=Self-Regulation, NPO=Negative Problem Orientation, PPO=Positive Problem Orientation, RPS=Rational Problem Solving, AS=Avoidance Style, ICS=Impulsiveness/Carelessness Style, PTM=Prosocial behaviour with Prosocial Tendencies Measure, SA=Social Awareness, CA=Communication Abilities, FI=Verbal information, TS=Intellectual skill, AT=Attitude

Table 6: The goodness of fit

GOF	Standard Value	Estimate	Conclusion
Chi-Square/χ^2	$\rho \geq 0.05$	2.52	Fit
χ^2/DF	$1.0 \geq X \leq 5.0$	64.16 (37.57; 8.44)	Fit
NCP	Small value with narrow intervals	0,42	Fit
SNCP (NCP/n)	Small value	0.00044	Fit
RMSEA	≤ 0.80	M = 250.42 S = 396.70 I = 2789.53	Fit
ECVI	Small value and close to Saturated ECVI	0.96	Fit
AIC	Small value and close to Saturated AIC	0.96	Fit
CAIC	Small value and close to Saturated CAIC	0.97	Fit
NFI	≥ 0.90	0.97	Fit
NNFI	≥ 0.90	0.94	Fit
CFI	≥ 0.90	0.94	Fit
IFI	≥ 0.90	0.56	Fit
RFI	≥ 0.90	0.045	Fit
GFI	≥ 0.90	2.52	Fit
PGFI	0 - 1	64.16 (37.57; 98.44)	Fit
RMR	≤ 0.50	0,42	Fit
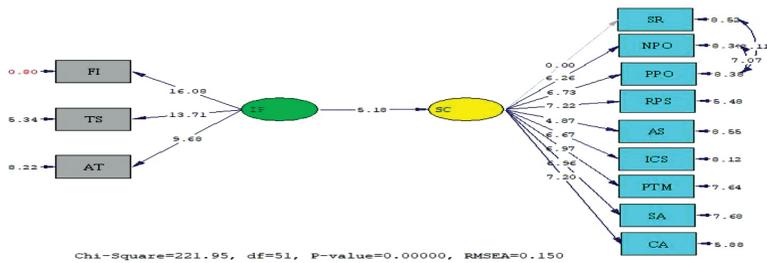
(a) t-value
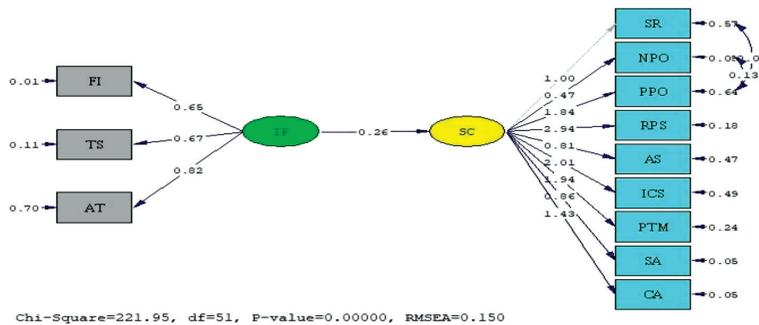
(b) Coefficient estimate

Figure 4: Structural model

participation in constructive dispute resolution (TransformEd, 2019). Furthermore, improved information processing was observed to enhance communication skills, which in turn, would positively impact smallholding performance (Maulia *et al*., 2020; Rachmawati *et al*., 2021).

Table 7 illustrates the causal relationships between latent variables and their indicators in the confirmatory factor analysis model. Meanwhile, Table 8 presents the direct effects of information processing in certification on social competency indicators, which demonstrates how effective information handling can enhance social skills and competencies.

According to Table 7, rational problem-solving had been identified as the key social competency, encompassing cautious assessment, information collection, goal-setting, consequence prediction, solution formulation, and a constructive approach. This finding aligned with the results stated in Table 8. Additionally, the critical aspect of information processing in certification was the attitude towards truthful data provision, which had the

potential to transform farming practices, as supported by Table 3.

Interpersonal competence and social problem-solving shared specific skills and functions (Astleitner & Ortner, 2017). In the context of certification, social problem-solving could influence adaptive functioning and motivation (Günaydın, 2022). Consequently, effective decision-making and problem-solving skills necessitated practical and creative thinking processes.

Conclusions

Smallholders navigate a web of structural and behavioural challenges that profoundly shape their ability to engage meaningfully with sustainability certification. Their deep reliance on on-farm income renders them acutely sensitive to price volatility while limited access to capital, information, and technical support narrows the space for long-term investment. This study suggests that, beyond these material constraints, it is the capacity to process certification-

Table 7: The measurement models

Latent Variable Indicators	Coef. Estimated	R²
Social competence/SC:		
Self-regulation/SR	0.48	0.29
Negative problem orientation/NPO	0.22	0.53
Positive problem-solving/PPO	0.88	0.55
Rational problem solving/RPS	1.36	0.91
Avoidance style/AS	0.37	0.23
Impulsiveness/carelessness style/ICS	0.93	0.63
Prosocial behaviour/PTM	0.89	0.76
Social awareness/SA	0.40	0.76
Communication abilities/CA	0.65	0.88
Information processing in certification/IP:		
Verbal information/FI	0.65	0.97
Intellectual skill/TS	0.67	0.80
Attitude/AT	0.82	0.49

Table 8: The direct effects of information processing in certification on social competency indicators

The Direct Effects	Value
Information processing/IP → Self-regulation/SR	0.29
Information processing/IP → Negative problem orientation/NPO	0.40
Information processing/IP → Positive problem solving/PPO	0.41
Information processing/IP → Rational problem solving/RPS	1.54
Information processing/IP → Avoidance style/AS	0.27
Information processing/IP → Impulsiveness/carelessness style/ICS	0.45
Information processing/IP → Prosocial behaviour/PTM	0.49
Information processing/IP → Social awareness/SA	0.49
Information processing/IP → Communication abilities/CA	0.53

related information—and to draw on key social competencies such as rational problem-solving, self-regulation and communication — that plays a defining role in how smallholders relate to the ISPO scheme. Information processing, in this setting, is rarely linear. It is filtered through layers of lived experience, trust, and emotional resonance. What is understood and internalised is shaped not only by the clarity of the message but by who conveys it, in what context, and with what perceived consequences. When such processing is supported by cognitive and social abilities that foster adaptability, relational awareness, and reflective action, certification can shift—from being a compliance-driven obligation to something that feels accessible, relevant, and even empowering.

Central to this shift is the recognition that smallholders are not passive beneficiaries of sustainability policy but active agents who think critically, relate contextually, and make decisions within the contours of complex and often precarious realities. As with any inquiry grounded in a specific place, this study carries certain boundaries. Conducted in West Kalimantan, its findings are shaped by the socio-cultural and institutional context of that region.

While many insights are transferable, caution should be taken when applying them wholesale to other geographies without attending to local nuance. Still, the framework introduced here—

centred on cognitive engagement and social competence—offers conceptual flexibility and can serve as a scaffold for broader exploration across varying settings. Future research could take this further by adopting more immersive, longitudinal approaches that trace how these competencies evolve over time and in response to shifting governance and market dynamics. Attention to intersecting influences such as gender relations, digital access, or the role of informal knowledge networks may enrich our understanding of the subtle ways smallholders interpret and negotiate sustainability demands. Equally, designing participatory processes that treat smallholders not as endpoints, but as co-creators of solutions may yield approaches that are not only more inclusive but more enduring in practice.

Conflict of Interest Statement

The author declares that she has no conflict of interest.

References

Adler, P. S., & Kwon, S.-W. (2002). Social capital: Prospects for a new concept. *The Academy of Management Review*, *27*(1), 17-40. https://doi.org/10.2307/4134367

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, *103*(3), 411-423. https://doi.org/10.1037/0033-2909.103.3.411

Apriani, E., Kim, Y.-S., Fisher, L. A., & Baral, H. (2020). Non-state certification of smallholders for sustainable palm oil in Sumatra, Indonesia. *Land Use Policy*, *99*, 105112. https://doi.org/10.1016/j.landusepol.2020.105112

Astleitner, H., & Ortner, C. (2017). Interpersonal competence development of university students-exploring a social problem-solving measurement approach. *Journal of Education and Human Development*, *6*(2), 58-75. https://doi.org/10.15640/jehd.v6n2a7

Ayompe, L. M., Schaafsma, M., & Egoh, B. N. (2021). Towards sustainable palm oil production: The positive and negative impacts on ecosystem services and human wellbeing. *Journal of Cleaner Production*, *278*, 123914. https://doi.org/10.1016/j.jclepro.2020.123914

Baron, R. A., & Markman, G. D. (2003). Beyond social capital: The role of entrepreneurs' social competence in their financial success. *Journal of Business Venturing*, *18*(1), 41-60. https://doi.org/10.1016/S0883-9026(00)00069-0

Baudinet, O. (2013). *Prosocial behaviour in adolescents: Classroom and sport specific environments*. Massey University. http://hdl.handle.net/10179/5162

Costa, D., Fernandes, N., Arantes, J., & Keating, J. (2022). A dual-process approach to prosocial behaviour under COVID-19 uncertainty. *PLOS One*, *17*(3), e0266050. https://doi.org/10.1371/journal.pone.0266050

Dermawan, A., & Hospes, O. (2018). Sustainability pathways in oil palm cultivation: A comparison of Indonesia, Colombia and Cameroon. In Rival, A. (Ed.), *Achieving sustainable cultivation of oil palm Volume 1* (1st ed., pp. 33-48). Burleigh Dodds Science Publishing Limited. https://doi.org/10.19103/as.2017.0018.03

Ding, W., Shao, Y., Sun, B., Xie, R., Li, W., & Wang, X. (2018). How can prosocial behaviour be motivated? The different roles of moral judgment, moral elevation, and moral identity among the young Chinese. *Frontiers in Psychology*, *9*(814), 1-10. https://doi.org/10.3389/fpsyg.2018.00814

Dou, Y., da Silva, R. F. B., McCord, P., Zaehringer, J. G., Yang, H., Furumo, P. R., Zhang, J., Pizarro, J. C., & Liu, J. (2020). Understanding how smallholders integrated into pericoupled and telecoupled systems. *Sustainability (Switzerland)*, *12*(4), 1-21. https://doi.org/10.3390/su12041596

Gagné, R. M. (1984). Learning outcomes and their effects: Useful categories of human performance. *American Psychologist*, *39*(4), 377-385. https://doi.org/10.1037/0003-066X.39.4.377

Gál, Z., Kasik, L., Jámbori, S., Fejes, J. B., & Nagy, K. (2022). Social problem-solving, life satisfaction and well-being among high school and university students. *International Journal of School & Educational Psychology*, *10*(1), 170-180. https://doi.org/10.1080/21683603.2020.1856249

Gosselin, P., Ladouceur, R., & Pelletier, O. (2005). Évaluation de l'attitude d'un individu face aux différents problèmes de vie: Le questionnaire d'attitude face aux problèmes (QAP). *Journal de Thérapie Comportementale et Cognitive*, *15*(4), 141-

153. https://doi.org/10.1016/S1155-1704(05) 81235-2

Gruber, M. (2020). An evolutionary perspective on adoption-diffusion theory. *Journal of Business Research*, *116*, 535-541. https://doi.org/10.1016/j.jbusres.2020.02.024

Günaydın, H. D. (2022). The impact of social problem skills on academic motivation by means of COVID-19 fear. *Current Psychology*, *41*(1), 427-436. https://doi.org/10.1007/s12144-021-01665-z

Hayden, M. T., Mattimoe, R., & Jack, L. (2021). Sensemaking and financial management in the decision-making process of farmers. *Journal of Accounting & Organizational Change*, *ahead-of-p*(ahead-of-print), 1-24. https://doi.org/10.1108/JAOC-11-2020-0186

Huynh, S. V. (2018). Social awareness and responsible decision making of students in grade 4 and 5 in Vietnam. *Journal of Education and Human Development*, *7*(4), 7-15. https://doi.org/10.15640/jehd.v7n4a1

Kaur, M. (2018). Social problem-solving skills in children: An exploratory study. *Journal of Advances and Scholarly Researches in Allied Education (JASRAE)*, *15*(8), 21-29. https://doi.org/10.29070/JASRAE

Kuivanen, K. S., Alvarez, S., Michalscheck, M., Adjei-Nsiah, S., Descheemaeker, K., Mellon-Bedi, S., & Groot, J. C. J. (2016). Characterising the diversity of smallholder farming systems and their constraints and opportunities for innovation: A case study from the Northern Region, Ghana. *NJAS - Wageningen Journal of Life Sciences*, *78*, 153-166. https://doi.org/10.1016/j.njas.2016.04.003

Lans, T., Blok, V., & Gulikers, J. (2015). Show me your network and I'll tell you who you are: Social competence and social capital of early-stage entrepreneurs. *Entrepreneurship & Regional Development*, *27*(7-8), 458-473. https://doi.org/10.1080/08985626.2015.1070537

Lin, T., Ko, A. P., Than, M. M., Catacutan, D. C., Finlayson, R. F., & Isaac, M. E. (2021). Farmer social networks: The role of advice ties and organisational leadership in agroforestry adoption. *PLOS One*, *16*(8), 1-18. https://doi.org/10.1371/journal.pone.0255987

Lord, R. G., & Maher, K. J. (1990). Alternative information-processing models and their implications for theory, research, and practice. *The Academy of Management Review*, *15*(1), 9-28. https://doi.org/10.2307/258103

Makkonen, H. (2021). Information processing perspective on organisational innovation adoption process. *Technology Analysis & Strategic Management*, *33*(6), 612-624. https://doi.org/10.1080/09537325.2020.1832218

Matthews, G. (2008). Personality and information processing: A cognitive-adaptive theory. In Boyle, G. J., Matthews, G., & Saklofske, D. H. (Eds.), *Personality theory and testing* (Volume 1, pp. 56-79). SAGE Publications. https://doi.org/10.4135/9781849200462.n3

Maulia, L. N. A., Ramadhon, S., Mustaqim, M., Hendriawan, D., Rusman, Djohar, A., & Abdulhak, I. (2020). Analysis of information processing learning model in improving arabic reading skills. *Journal of Physics: Conference Series*, *1477*, 42016. https://doi.org/10.1088/1742-6596/1477/4/042016

Meijs, C., Gijselaers, H. J. M., Xu, K. M., Kirschner, P. A., & De Groot, R. H. M. (2021). The relation between cognitively measured executive functions and reported self-regulated learning strategy use in adult online distance education. *Frontiers in Psychology*, *12*(641972), 1-12. https://doi.org/10.3389/fpsyg.2021.641972

Meredith, K. B. (2009). *Can problem solving affect the understanding of rational numbers in the middle school setting?* https://core.ac.uk/download/4279312.pdf

Mojtahedzadeh, R., Mahmoodi-Bakhtiari, B., & Emami, S. (2018). Psychometric properties of the communication skills attitude scale (CSAS) measure in a sample of Iranian medical students. *Journal of Advances in Medical Education & Professionalism*, *6*(1), 14-21. https://pubmed.ncbi.nlm.nih.gov/29344525/

Nurliza, N., Dolorosa, E., & Suryadi, U. E. (2018). The discrepancy between knowledge and competency of independent smallholder farmers for sustainable palm oil. *Jurnal Penyuluhan*, *14*(1), 179-191. https://doi.org/10.22500/142018

Pacheco, P., Schoneveld, G., Dermawan, A., Komarudin, H., & Djama, M. (2020). Governing sustainable palm oil supply: Disconnects, complementarities, and antagonisms between state regulations and private standards. *Regulation and Governance*, *14*(3), 568-598. https://doi.org/10.1111/rego.12220

Phulkerd, S., Sacks, G., Vandevijvere, S., Worsley, A., & Lawrence, M. (2017). Barriers and potential facilitators to the implementation of government policies on front-of-pack food labeling and restriction of unhealthy food advertising in Thailand. *Food Policy*, *71*, 101-110. https://doi.org/10.1016/j.foodpol.2017.07.014

Putri, E. I. K., Dharmawan, A. H., Hospes, O., Yulian, B. E., Amalia, R., Mardiyaningsih, D. I., Kinseng, R. A., Tonny, F., Pramudya, E. P., Rahmadian, F., & Suradiredja, D. Y. (2022). The oil palm governance: Challenges of sustainability policy in Indonesia. *Sustainability (Switzerland)*, *14*(3), 1-20. https://doi.org/10.3390/su14031820

Rachmawati, S., Lumbanraja, P., & Siahaan, E. (2021). The effect of adaptive ability, communication skills, and work environment on performance of medan mayor's office with teamwork as intervening variables. *Journal Research of Social Science*, *Economics*, *and Management*, *1*(4), 406-417. https://doi.org/10.36418/jrssem.v1i4.37

Rodríguez-Fornells, A., & Maydeu-Olivares, A. (2000). Impulsive/careless problem solving style as predictor of subsequent academic achievement. *Personality and Individual Differences*, *28*(4), 639-645. https://doi.org/10.1016/S0191-8869(99)00127-0

Rogers, E. M. (1983). Diffusion of innovations. In Bruce, J. R. (Ed.), *Achieving cultural change in networked libraries*. https://doi.org/10.4324/9781315263434-16

Rose-Krasnor, L. (1997). The nature of social competence: A theoretical review. *Social Development*, *6*(1), 111-135. https://doi.org/10.1111/j.1467-9507.1997.tb00097.x

Ruttan, R., & Nordgren, L. F. (2015). The strength to face the facts: Self-regulation defends against defensive information processing. *Academy of Management Proceedings*, *2015*(1), 18548. https://doi.org/10.5465/ambpp.2015.216

Şenol, F. B., & Metin, E. N. (2021). Social information processing in preschool children: Relations to social interaction. *Participatory Educational Research*, *8*(4), 124-138. https://doi.org/10.17275/PER.21.82.8.4

Statista.com. (2023). *Total land area of oil palm plantations in Indonesia from 2012 to 2021*. https://www.statista.com/statistics/971424/total-area-of-oil-palm-plantations-indonesia/

Statistics-Indonesia. (2021). *Indonesian oil palm statistics 2021*. BPS-Statistics Indonesia. https://www.bps.go.id/en/publication/2022/11/30/254ee6bd32104c00437a4a61/indonesian-oil-palm-statistics-2021.html

Statistics Indonesia. (2020). *Indonesian oil palm statistics 2020*. BPS-Statistics Indonesia. https://www.bps.go.id/en/publication/2021/11/30/5a3d0448122bc6753c953533/indonesian-oil-palm-statistics-2020.html

Stemmet, L., Roger, D., Kuntz, J., & Borrill, J. (2015). General and specific avoidance:

The development and concurrent validation of a new measure of avoidance coping. *European Journal of Psychological Assessment*, *31*(3), 222-230. https://doi.org/10.1027/1015-5759/a000220

Teddy, G., Lembani, M., Hwabamungu, B., & Molosiwa, D. (2019). Policy and implementation gap: A multi-country perspective. *International Journal of Advanced Research*, *7*(12), 678-704. https://doi.org/10.21474/IJAR01/10197

Torrens-Burton, A., Basoudan, N., Bayer, A. J., & Tales, A. (2017). Perception and reality of cognitive function: Information processing speed, perceived memory function, and perceived task difficulty in older adults. *Journal of Alzheimer's Disease*, *6*(4), 1601-1609. https://doi.org/10.3233/JAD-170599

TransformEd. (2019). *Social awareness: Sample strategies*. https://transformingeducation.org/wp-content/uploads/2019/04/2018_Social-Awareness-Strategies_website.pdf

UNM. (1999). *The Self-Regulation Questionnaire (SRQ)*. The University of New Mexico. https://casaa.unm.edu/inst/SelfRegulation Questionnaire (SRQ).pdf

Watts, J., Pasaribu, K., Irawan, S., Tacconi, L., Martanila, H., Wiratama, C. G. W., Musthofa, F. K., Sugiarto, B. S., & Manvi, U. P. (2021). Challenges faced by smallholders in achieving sustainable palm oil certification in Indonesia. *World Development*, *146*(4), 105565. https://doi.org/10.1016/j.worlddev.2021.105565

Yanita, M., & Ningsih, R. (2021). Social and economic characteristics of ISPO certified oil palm smallholders. In Rubiyo & Indrawanto, C. (Eds.), *The First International Conference on Assessment and Development of Agricultural Innovation (ICADAI)* (Vol. 306, pp. 1-9). E3S Web of Conferences. https://doi.org/10.1051/e3sconf/202130602053

Zhou, M., & Ee, J. (2012). Development and validation of Social Emotional Competency Questionnaire (SECQ). *International Journal of Emotional Education*, *4*(2), 27-42. https://doaj.org/article/a61aaafc783c4f7ca81698d71d8a9320