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Barriers to MSPO 2.0 Certification Transition: Empirical Evidence from Independent Oil Palm Smallholders in Malaysia

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ABSTRACT

The revision of the Malaysian Sustainable Palm Oil standard requires already-certified independent smallholders to adjust established practices rather than make an initial certification decision. This study examined certification transition capacity among MSPO 1.0 certified independent oil palm smallholders preparing for MSPO 2.0. A quantitative cross-sectional survey was conducted across 11 Malaysian states from 1 November to 31 December 2024, and 400 eligible and complete questionnaires were retained. Seven observed composite indices represented certification cost,extension services, agricultural inputs, plot and boundary conditions, plantation conditions, pesticide and herbicide management, and standard operating procedure and policy implementation. Focused transition readiness was calculated from willingness, commitment and confidence in the benefits of continued certification. Descriptive results showed very high ratings for all transition barriers, with mean scores ranging from 4.49 to 4.61, alongside very high readiness at a mean of 4.70. This pattern indicates that commitment to certification can coexist with substantial operational constraints. All bivariate correlations with readiness were positive and statistically significant. The simultaneous-entry regression model was statistically significant, $F(7,392)=77.589$, $p<0.001$, and accounted for 58.1% of the observed variance in readiness ($R^2=0.581$; adjusted $R^2=0.573$). Certification cost, pesticide and herbicide management, and SOP and policy implementation showed negative conditional associations with readiness, whereas extension services, agricultural inputs, plot and boundary conditions, and plantation conditions showed positive conditional associations. These positive coefficients do not indicate that barriers improve readiness; rather, they reflect substantial overlap among implementation conditions and suggest that committed smallholders may recognise constraints more clearly. The findings support an implementation capacity approach combining targeted finance, continuing extension support, suitable inputs, agrochemical guidance, plot documentation and simplified compliance tools. The implications are most directly relevant to SDG 12, with supporting links to SDGs 8 and 15, although ESG performance and SDG progress were not directly measured.

Keywords: Agricultural Extension, Compliance Capacity, Mandatory Sustainability Standards, Sustainable Palm Oil, Sustainability Governance

INTRODUCTION

Sustainability certification converts environmental, social, and governance standards into agricultural practices, which must be proven by documentation, inspections, and periodic evaluation. Malaysia introduced the Malaysian Sustainable Palm Oil (MSPO) scheme as a national certification system and moved

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towards mandatory implementation across the industry from 2020 (Kumaran 2019; Kannan *et al.* 2021). The revised MS 2530:2022 standard, commonly described as MSPO 2.0, supersedes MS 2530:2013 and introduces more comprehensive requirements across the palm oil value chain. This standard applies to a more comprehensive set of requirements across the palm oil value chain. MS 2530-2–1:2022 outlines requirements for independent smallholders managing less than 40.46 Ha, including legal compliance, record keeping, environmental responsibility, safe working conditions, good agricultural practices and audit readiness (MSPO 2026). The transition from MSPO 1.0 to MSPO 2.0 is analytically different from the adoption of the initial certification. Adoption studies ask whether an uncertified producer enters a scheme while transition studies concern producers who already possess certification experience but must realign routines, documents and farm practices with a revised standard. Familiarity with audits may reduce uncertainty but it does not guarantee adequate finance, suitable inputs, technical guidance, documented plot boundaries or the administrative time needed for stronger compliance. Research on smallholder certification repeatedly shows that continued participation depends on resources and facilitation as well as formal willingness (Hutabarat *et al.* 2018; Ogahara *et al.* 2022; de Vos *et al.* 2023).

Existing MSPO research has documented national certification arrangements, smallholder transfor-mation and constraints affecting certification participation (Senawi *et al.* 2019; Kannan *et al.* 2021; Zainal Abidin *et al.* 2024). Comparable evidence from Indonesian smallholders also identifies land legality, external facilitation and implementation gaps as persistent concerns (Soebirin *et al.* 2021; de Vos *et al.* 2023). However, less empirical attention has been given to the transition between successive versions of a mandatory national standard among producers who are already certified. This distinction matters because an upgraded standard can create new demands even where initial certification has been achieved. This study uses an implementation capacity framework. Transition capacity is treated as the practical ability to maintain certification through five connected components which are financial resources, institutional support, access to suitable agricultural inputs, manageable farm and environmental conditions, and workable compliance mechanisms. The seven observed barriers examined in the study map onto these components. Certification cost represents financial pressure, extension services represent institutional support, agricultural inputs, plantation conditions and agrochemical management represent farm and environmental capacity and plot boundaries together with SOP and policy implementation represent documentation traceability and governance capacity. Accordingly, the study examines the pattern of perceived MSPO 2.0 transition barriers and their associations with focused certification transition readiness among MSPO 1.0 certified independent smallholders in Malaysia. It shows how financial, institutional, farm, environmental and governance constraints are related to willingness, commitment and confidence in continued certification. The analysis is intended to identify an interconnected implementation pattern and practical support needs while it does not estimate causal effects or rank the barriers by statistical coefficient size.

MATERIALS AND METHODS

Study Design, Population and Data Collection

Aquantitative cross sectional survey was used to examine MSPO 2.0 certification transition capacity at a defined stage of implementation (Hendrawan *et al.* 2024). Eligibility was restricted to Malaysian independent oil palm smallholders certified under MSPO 1.0

because the research concerned adjustment to a revised standard rather than first-time certification. The target population was approximately 176,658 certified independent smallholders. Krejcie and Morgan (1970) indicate a minimum sample of 384 for a large population at a 95% confidence level and 5% margin of error. Eligibility and completeness screening retained 400 records for analysis after accommodating screening and incomplete responses. Respondents were drawn from 11 states which are Johor, Kedah, Kelantan, Melaka, Negeri Sembilan, Pahang, Perak, Sabah, Sarawak, Selangor and Terengganu. Data was collected through a structured online questionnaire from 1 November to 31 December 2024.

Measurement and Statistical Analysis

The present analysis included seven observed composite indices representing the main conditions that may constrain the transition from MSPO 1.0 to MSPO 2.0. These conditions comprised certification cost, extension services, access to suitable agricultural inputs, plot and boundary management, plantation conditions, pesticide and herbicide management, and SOP and policy implementation. Each transition barrier index was calculated as the mean of three questionnaire statements relating to the respective implementation conditions. All statements were measured using a five-point response scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher index values indicated stronger perceived transition barriers. The indices were treated as observed composite measures rather than validated psychometric scales. Certification transition readiness was measured using three statements representing the respondents' willingness to participate in MSPO 2.0 implementation, commitment to completing the transition process, and confidence in the benefits of continued certification. The mean of these three statements formed the readiness index, with higher scores indicating greater certification transition readiness. Figure 1 summarises the analytical structure of the study, including the observed transition barrier indices, the certification transition readiness measure, and the statistical procedures used to examine their associations.

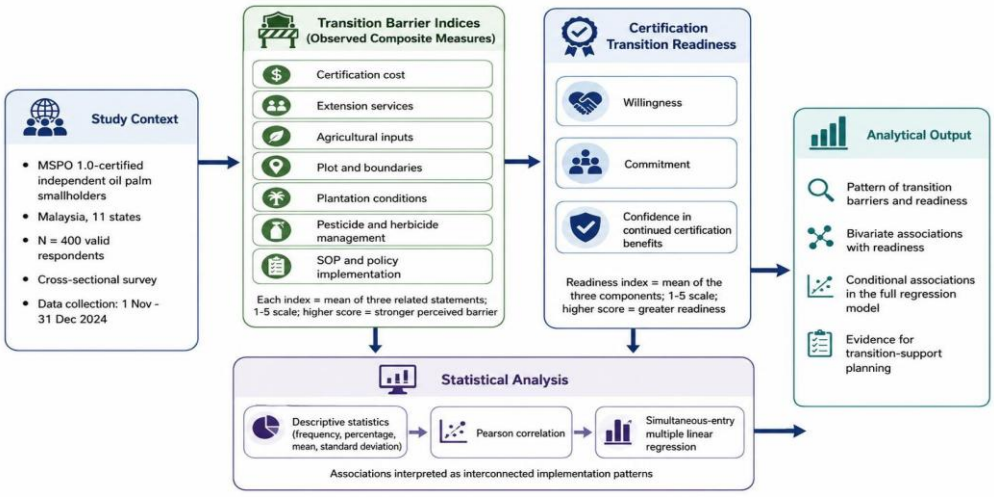


Figure 1 Analytical Framework for MSPO 2.0 Certification Transition Readiness

As shown in Figure 1, the study assessed seven transition barrier indices and one certification transition readiness index before examining their patterns using descriptive statistics, Pearson correlation and simultaneous-entry multiple linear regression. Frequencies and percentages summarised selected respondent characteristics. Means and standard deviations were recalculated directly from the primary dataset. Mean scores were interpreted as very low (1.00-

1.80), low (1.81-2.60), moderate (2.61-3.40), high (3.41-4.20) or very high (4.21-5.00). Pearson correlations described bivariate associations between each barrier and focused readiness. Simultaneous-entry multiple linear regression assessed their conditional associations when considered together. Model reporting used R, R^2, adjusted R^2, the standard error of the estimate and the F-statistic, while the conditional results used unstandardised coefficient standard errors, t-statistics, p-values and 95% confidence intervals. Statistical significance was set at $p<0.05$. The barrier indices displayed severe overlap, consistent with the practical interdependence of implementation conditions. Regression coefficients were therefore interpreted as conditional associations within an interconnected system, not as isolated effects or a ranking of importance. Heteros-cedasticity-consistent HC3 robust standard errors were examined as a sensitivity check, and the significance pattern remained unchanged. Because the design was cross-sectional and based on self-reported responses, all findings are reported as associations rather than causal relationships.

RESULTS AND DISCUSSION

Respondent Context for Certification Transition

Table 1 presents characteristics relevant to the capacity of certified smallholders to manage revised requirements. Secondary education was the largest educational category, accounting for 45.0%, while 28.5% held a bachelor's degree or higher. The mixed educational profile suggests that transition communication should combine written guidance with demonstrations, visual checklists and field-based explanation rather than rely on complex documentation alone. Extension arrangements under MSPO play an important role in translating certification requirements into practical farm actions (Kannan *et al.* 2021; Senawi *et al.* 2019).

Table 1 Selected Characteristics of the Respondents (N=400)

Characteristic	Category	n	%
Education	Primary or no formal education	36	9.0
	Secondary	180	45.0
	Diploma	70	17.5
	Bachelor's degree or higher	114	28.5
Employment	Government	77	19.3
	Private sector	14	3.5
	Retired	57	14.2
	Self-employed	252	63.0
Smallholder category	Full-time	160	40.0
	Part-time	240	60.0
Land tenure	Leased	233	58.3
	Owned	167	41.8
Farm size	1-10 acres	253	63.2
	11-20 acres	105	26.3
	More than 20 acres	42	10.5

Employment status and smallholder category described different aspects of respondents' livelihoods. Although 63.0% were self-employed, only 40.0% were full-time smallholders and 60.0% were part-time smallholders. Self-employment may involve non-farm businesses or several income activities. It should not be treated as equivalent to full-time oil palm work. The predominance of part-time smallholders makes the time required for training, record keeping, audit preparation and corrective action particularly relevant. Land and farm structure also shape practical transition capacity. Leased holdings accounted for 58.3% of respondents, creating possible documentation and boundary verification demands where tenure evidence or plot records must be assembled. Tenure arrangements can affect both compliance evidence and willingness to invest in long-term farm improvements (Murken and Gornott 2022; de Vos *et al.* 2023). In addition, 63.2% managed 1-10 acres. Smaller holdings may have less scope to distribute fixed compliance expenditure across production, increasing the value of targeted finance, shared services and simplified records (Hutabarat *et al.* 2018; Herdiansyah *et al.* 2020).

Patterns of Transition Barriers and Readiness

The descriptive results reveal a concentrated pattern of implementation pressure as shown in Table 2. Every barrier mean fell within the very high range and the spread between the lowest and highest barrier means was only 0.126 points. Agricultural inputs, pesticide and herbicide management, and extension services formed the upper part of this tightly grouped pattern, but the small differences do not support a substantive ranking. Instead, the results indicate that financial, institutional, farm and administrative constraints were experienced simultaneously.

Table 2. Descriptive Statistics for MSPO 2.0 Transition Barriers and Readiness

Observed composite index	Mean	SD	Interpretation
Certification cost	4.532	0.369	Very high
Extension services	4.581	0.360	Very high
Agricultural inputs	4.614	0.352	Very high
Plot and boundaries	4.562	0.370	Very high
Plantation conditions	4.488	0.362	Very high
Pesticide and herbicide management	4.603	0.377	Very high
SOP and policy implementation	4.550	0.372	Very high
Certification transition readiness	4.704	0.266	Very high

Focused transition readiness was also very high (M=4.704, SD=0.266). Thus, strong willingness, commitment and confidence in continued certification coexisted with very high perceived barriers. This is not contradictory. Smallholders can value continued certification and remain committed to MSPO 2.0 while recognising that implementation requires finance, guidance, inputs, documentation and changes to farm routines. Readiness in the present study represents transition orientation and it does not mean that all operational requirements have already been secured.

Associations Between Barriers and Transition Readiness

The bivariate results were uniformly positive as shown in Table 3. Extension services had a correlation of r=0.581 with focused readiness, while the other associations ranged from r=0.270 to

r=0.471. All were statistically significant at p<0.001. These correlations show that respondents reporting stronger readiness also tended to report stronger recognition of implementation barriers. It should not be read as evidence that constraints increase readiness. Rather, willingness and commitment may make the practical demands of transition more visible.

Table 3 Pearson Correlations Between Transition Barriers and Certification Transition Readiness

Transition barrier	r	p
Certification cost	0.438	<0.001
Extension services	0.581	<0.001
Agricultural inputs	0.464	<0.001
Plot and boundaries	0.306	<0.001
Plantation conditions	0.471	<0.001
Pesticide and herbicide management	0.438	<0.001
SOP and policy implementation	0.270	<0.001

Note: Two-tailed Pearson correlations with focused certification transition readiness; N=400.

When the seven barriers were entered simultaneously, the model was statistically significant and accounted for 58.1% of variation in focused readiness as shown in Table 4. The coefficient directions changed from all positive bivariate patterns to a mixture of positive and negative conditional associations. Certification cost, pesticide and herbicide management, and SOP and policy implementation had statistically significant negative conditional coefficients. Extension services, agricultural inputs, and plot and boundary conditions had statistically significant positive conditional coefficients. Plantation conditions had a positive coefficient but did not retain a statistically significant conditional association. Because several barrier indices overlapped severely, each coefficient represents the association of the remaining portion of that index after the other conditions are held constant.

Table 4. Multiple Linear Regression Results for Certification Transition Readiness

Transition barrier	**B**	**SE**	**t**	**p**	**95% CI for B**
Certification cost	−0.431	0.083	−5.202	<0.001	−0.594 to −0.268
Extension services	0.512	0.045	11.299	<0.001	0.423 to 0.601
Agricultural inputs	2.348	0.224	10.472	<0.001	1.907 to 2.789
Plot and boundaries	1.508	0.134	11.276	<0.001	1.245 to 1.771
Plantation conditions	0.093	0.054	1.719	0.086	−0.013 to 0.200
Pesticide and herbicide management	−1.722	0.188	−9.142	<0.001	−2.092 to −1.351
SOP and policy implementation	−1.686	0.123	−13.689	<0.001	−1.929 to −1.444

Note: Dependent variable: focused certification transition readiness. R=0.762; R^2=0.581; adjusted R^2=0.573; standard error of the estimate= 0.17370;F(7,392)=77.589; p<0.001. Coefficients are unstandardisedconditional associations from the simultaneous-entry model and are not ranked by magnitude. HC3 robust standard errors produced the same significance pattern.

The negative cost coefficient indicates that, conditional on the other implementation conditions, greater financial pressure was associated with lower readiness. The negative conditional associations for agrochemical management and SOP implementation similarly suggest that difficulties in

converting requirements into safe field practice and verifiable records can constrain transition orientation. The positive conditional coefficients for extension services, agricultural inputs, and plot and boundary conditions must not be interpreted as evidence that stronger barriers improve readiness. They are consistent with committed smallholders recognising these implementation gaps more clearly once shared variance with the other barriers is controlled. Plantation conditions did not retain a statistically significant conditional association in the full model. The mixed signs are therefore evidence of an interconnected implementation pattern rather than separate, measurable effects.

Integrated Interpretation of Transition Capacity

Financial and institutional capacity must be considered together. Certification transition can involve recurring expenditure for records, corrective action, protective equipment, storage, training and farm improvement even when initial certification costs were previously supported. Evidence from smallholder certification shows that compliance costs can offset gains and create dependence on external assistance (Hutabarat *et al.* 2018; de Vos *et al.* 2023). Continuous extension is therefore not simply an awareness activity. It is the mechanism through which revised requirements are interpreted, farm-specific gaps are identified and financial support is directed to necessary actions. The conditional negative association for cost and positive pattern for extension are compatible with a system in which willingness remains present, but implementation depends on accessible finance and sustained guidance. Farm and environmental capacity centres on suitable inputs,plantation conditions and pesticide and herbicide management. Compliant production requires timely access to appropriate fertilisers, protective equipment and pest-management options as well as drainage, access and maintenance conditions that support good agricultural practice. Input constraints among palm oil producers have been linked to limited capital and technology access (Aminu and Umoh 2020). Agricultural inputs retained a positive conditional association, whereas pesticide and herbicide management retained a negative conditional association. Plantation conditions were positively related to readiness at the bivariate level but did not retain a statistically significant conditional association in the full model. This pattern further supports interpreting the indices as overlapping implementation conditions rather than independent effects. Support should therefore combine access to suitable products with field coaching on selection, storage, application, personal protection, record keeping and integrated pest management. Documentation and governance capacity connects plot boundaries, traceability and SOP implementation. Accurate plot identification and tenure documentation underpin audit evidence and supply-chain traceability, especially where land is leased. Clear boundaries alone are insufficient if smallholders cannot translate policies into routine records for fertilisation, harvesting, chemical use, safety and environmental management. The negative SOP coefficient shows how difficult it is to operationalise written requirements once shared implementation constraints are taken into consideration, while the positive conditional association for plot and boundary conditions may reflect increased recognition among respondents getting ready for transition. Digital mapping assistance, standardised plot files, bilingual templates, visual checklists and short farm logs should be designed as one compliance system rather than separate interventions. Across these themes, the central result is not that one barrier is more important than another. The indices capture a linked implementation environment: finance affects input purchases and corrective action; extension affects agrochemical practice and documentation; tenure affects traceability

and investment; and SOP tools determine whether field activity becomes auditable evidence. This interpretation is consistent with reviews showing that certification outcomes remain limited when programmes focus on formal compliance without addressing smallholder livelihoods, tenure and implementation support (Ogahara *et al.* 2022).

ESG, SDG and Implementation Implications

Environmental, social and governance (ESG) categories provide a useful interpretive framework for organising the transition issues, but the study did not directly measure ESG performance. Environmentally, access to appropriate agricultural inputs, manageable plantation conditions and responsible pesticide and herbicide management affect the capacity to meet good agricultural and environ-mental requirements. Socially, certification cost and uneven extension access raise inclusion concerns because resource constrained smallholders may be committed to continued certification yet lack the means or time to implement it. From a governance perspective, plot documentation, traceability, SOP use and verifiable records determine whether compliance can be demonstrated consistently under the revised standard (MSPO 2026). The findings are most closely aligned with Sustainable Development Goal (SDG)12, particularly the emphasis on sustainable production and responsible resource management. Supporting contributions can be interpreted for SDG 8 through inclusive livelihoods, access to finance, training and safe work practices, and for SDG 15 through improved land management and reduced environmental risk (United Nations 2015). These are conceptual connections only. The survey did not measure SDG indicators or demonstrate achievement of any SDG target. A practical transition support package should integrate six elements: targeted finance for documented corrective needs; continuing extension support beyond one-off training; access to inputs and safety equipment; farm-specific agrochemical guidance; plot and tenure documentation linked to traceability; and simplified, bilingual or visual compliance tools. Delivery through coordinated local clusters could reduce duplication and allow finance, field advice and documentation support to be sequenced around the same farm assessment. Such support would align regulatory expectations with the capacity of already-certified smallholders to remain consistently engaged in the certified supply chain.

CONCLUSION

This study shows that being certified under MSPO 1.0 does not automatically mean that independent smallholders are fully prepared for the transition to MSPO 2.0. Many respondents were willing and committed to remain certified, yet they continued to face practical constraints involving cost, technical support, farm management, agrochemical practices, documentation and compliance procedures.

Therefore, transition readiness must be understood as more than willingness. It also depends on whether smallholders have the resources and support needed to implement the revised requirements in practice. The findings suggest that these barriers are closely connected and should not be addressed separately. A more effective transition strategy should combine targeted financial assistance, continuous extension support, access to suitable inputs, practical agrochemical guidance, plot documentation, traceability assistance and simplified compliance tools.

Since the study was cross-sectional, the results represent associations rather than causal effects. Overall, a successful MSPO 2.0 transition is likely to require closer alignment between the revised standard and the actual implementation capacity of independent smallholders.

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REFERENCES

Aminu FO, Umoh J. 2020. Factors influencing economic performance of palm oil producers in Akwa Ibom State, Nigeria. Int J Oil Palm. 3(3):69–77.

de Vos RE, Suwarno A, Slingerland M, van der Meer PJ, Lucey JM. 2023. Pre-certification conditions of independent oil palm smallholders in Indonesia: assessing prospects for RSPO certification. Land Use Policy. 130:106660. DOI:10.1016/j.landusepol.2023.106660.

Hendrawan D, Chrisendo D, Musshoff O. 2024. Strengthening oil palm smallholder farmers' resilience to future industrial challenges. Sci Rep. 14:12105. DOI:10.1038/s41598-024-62426-z.

Herdiansyah H, Negoro HA, Rusdayanti N, Shara S. 2020. Palm oil plantation and cultivation: prosperity and productivity of smallholders. Open Agric. 5(1):617–630. DOI:10.1515/opag-2020-0063.

Hutabarat S, Slingerland M, Rietberg PI, Dries L. 2018. Costs and benefits of certification of independent oil palm smallholders in Indonesia. Int Food Agribus Manag Rev. 21(6):681–700. DOI:10.22434/IFAMR2016.0162.

Kannan P, Mansor NH, Rahman NK, Tan SP, Mazlan SM. 2021. A review on the Malaysian sustainable palm oil certification process among independent oil palm smallholders. J Oil Palm Res. 33(1):171–180. DOI:10.21894/jopr.2020.0056.

Krejcie RV, Morgan DW. 1970. Determining sample size for research activities. Educ Psychol Meas. 30(3):607–610. DOI:10.1177/001316447003000308.

Kumaran S. 2019. The dynamics for mandatory MSPO certification scheme to be successfully implemented. J Oil Palm Environ Health. 10:1–7.

Malaysian Sustainable Palm Oil (MSPO). 2026. Standards: MSPO 2.0, MS 2530:2022.

Murken L, Gornott C. 2022. The importance of different land tenure systems for farmers' response to climate change: a systematic review. Clim Risk Manag. 35:100419. DOI:10.1016/j.crm.2022.100419.

Ogahara Z, Jespersen K, Theilade I, Nielsen MR. 2022. Review of smallholder palm oil sustainability reveals limited positive impacts and identifies key implementation and knowledge gaps. Land Use Policy. 120:106258. DOI:10.1016/j.landusepol.2022.106258.

Senawi R, Rahman NK, Mansor N, Kuntom A. 2019. Transformation of oil palm independent smallholders through Malaysian sustainable palm oil. J Oil Palm Res. 31(3):496–507. DOI:10.21894/jopr.2019.0038.

Soebirin EJ, Maswadi, Suharyani A. 2021. The readiness of self-manage oil palm farmers at Sekadau District in ISPO implementation. Int J Oil Palm. 4(2):46–57.

United Nations. 2015. Transforming our world: the 2030 Agenda for Sustainable Development.

Zainal Abidin MN, Abdul Fatah F, Noor WNWM, Aris NFM. 2024. A review on adoption of the Malaysian Sustainable Palm Oil (MSPO)certification scheme. IOP Conf Ser Earth Environ Sci. 1397(1):012035. DOI:10.1088/1755-1315/1397/1/012035.