Institutional structures and transaction costs in Indonesian Sustainable Palm Oil (ISPO) certified smallholder palm oil value chains

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Abstract. Indonesian Sustainable Palm Oil (ISPO) certification aims to improve competitiveness and governance within the sustainable palm oil value chain. However, compliance with ISPO standards often creates complex institutional interactions, thereby increasing transaction costs. This study maps the institutional structure of smallholder farmers palm oil value chains and examines the differences in transaction costs between ISPO and non-ISPO smallholder farmers. A face-to-face survey was conducted with 160 smallholder farmers in the Batubara and Labuhan Batu Regencies, North Sumatra, comprising 80 ISPO and 80 non-ISPO smallholder farmers, selected through a multistage sampling design. Data were analysed using quantitative descriptive methods, transaction cost structure analysis, and the Mann-Whitney test. The results indicate that ISPO smallholder farmers value chains involve three institutional layers: primary institutions as core actors; secondary institutions that facilitate cultivation, finance, and marketing; and tertiary institutions that support value chain development through certification. In contrast, non-ISPO smallholder farmers value chains involve only primary institutions. Significant differences in transaction costs were found between ISPO and non-ISPO smallholder farmers. These findings underscore the need for policies that strengthen farmer institutions to provide inputs and harvest, thereby collectively reducing transaction costs.

1 Introduction

The Indonesian government requires palm oil businesses to implement the ISPO, a scheme mandated by national regulations. The implementation of ISPO is also crucial to ensure the continued existence of palm oil businesses, particularly smallholder farmers, in the global

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value chain [1] given the global market shifts that demand a more sustainable palm oil value chain. Based on Presidential Regulation No. 44 of 2020, ISPO can enhance the acceptance and competitiveness of Indonesian palm oil products in both national and international markets, while also reducing Greenhouse Gas (GHG) emissions through a sustainable palm oil production system. As a Good Agricultural Practice (GAP), the implementation of ISPO is also considered to contribute to increased production, productivity, and technical efficiency, thereby improving the welfare of smallholder farmers [2,3]. In 2024, smallholder farmers managed 41% of the oil palm land in Indonesia, demonstrating their strategic role in the palm oil value chain. However, smallholder farmers in Indonesia face various obstacles and challenges [4], including land legality issues [5], limited access to agricultural financing that hinders compliance with sustainable farming principles [6], and uneven access to price and market information. These obstacles could potentially result in relatively high transaction costs for smallholder farmers.

The implementation of ISPO certification is expected to enhance not only product competitiveness but also strengthen governance across all stages of the palm oil value chain, from on-farm production and transportation to fresh fruit bunch sales processes and relationships with palm oil mills. Empirically, the implementation of ISPO certification has been reported to increase productivity by 14.83%, reduce the use of chemical fertilisers and pesticides [7], improve technical efficiency compared to non-ISPO smallholder farmers [2], and make the environmental behaviour of business actors more sustainable.

In reality, ISPO are implemented by smallholder farmers in groups to achieve a minimum business scale. The existence of smallholder farmers groups is believed to foster shared norms and trust, which in turn encourages collective action, leading to lower transaction costs [8]. The existence of smallholder farmers groups such as cooperatives has also been reported to reduce transaction costs in the agricultural sector [9]. However, collective action, such as farmer groups, can also incur additional transaction costs due to the complexity of coordination and governance issues. Compliance with ISPO standards often leads to complex institutional interactions, which can increase transaction costs. Transaction costs generally arise in relation to information search, negotiation, monitoring, and contract enforcement activities in market exchanges, as well as indirect transaction costs in the form of time spent by farmers, which are monetised based on opportunity costs [10].

Despite the above considerations, empirical evidence on how ISPO certification can alter the governance structure of the value chain and reduce transaction costs faced by smallholder farmers remains limited. Therefore, this study aims to map the value chain structure and compare the transaction cost structure of ISPO and non-ISPO smallholder.

2 Research methods

2.1 Research location

This study was conducted in the Batubara and Labuhan Batu Regencies, North Sumatra Province, Indonesia. North Sumatra Province was selected using purposive sampling because it has the third-largest oil palm area in Indonesia in 2025 and is one of the provinces with smallholder farmers who have implemented ISPO in the two regencies. Smallholder farmers who have been ISPO-certified in both regencies are members of farmer organisations. ISPO farmers in Batubara Regency are members of Gabungan Kelompok Tani Mandiri - GAPOKTAN Tani Mandiri (Joint Farmer Group Tani Mandiri) and ISPO smallholder farmers in Labuhan Batu Regency are members of Asosiasi Pekebun Swadaya Kelapa Sawit Labuhan Batu-APSKSLB (Labuhan Batu Independent Smallholder Farmers Association).

2.2 Data collection

The sampling framework for this study was developed using membership lists obtained from ISPO-certified farmers' organisations in each research area. In addition, non-ISPO smallholder farmers located in the research areas were selected as comparison groups. The sample used in this study was selected using a multistage sampling method. The first stage involved determining the number of samples from each district using equal allocation sampling. This method provides a more precise sample for comparison between the research groups. Additionally, this method can address the issue of a relatively small population size compared to other groups, which can lead to bias in sample determination [11]. The number of samples in each district was set at 80, consisting of 40 ISPO smallholder farmers and 40 non-ISPO smallholder farmers, resulting in a total of 160 smallholder farmers used in this study. In the next stage, each sample was selected using the random sampling method based on farmers' group members' data and village government data.

2.3 Data analysis

This study comprised two data analyses designed to answer the research objectives. Descriptive analysis was used to map institutions in the ISPO and non-ISPO smallholder palm oil value chains. Furthermore, it analyzes and compares the transaction costs incurred from smallholder palm oil farming processes. The analysis of transaction cost structure and measurement of total transaction costs are categorised into information costs (IC), negotiation costs (NC), enforcement costs (EC), and transportation costs (TRC) [12]. Mathematically, an equation is constructed to describe the analysis of the transaction cost structure as follows:

$$TraC_j = \sum Z_{ij} \quad (1)$$

$$rZ_{ij} = \frac{z_i}{TraC_j} \quad (2)$$

$TraC_j$ is the transaction cost faced by smallholder farmers j and rZ_{ij} is the Total of transaction costs for each component of transaction costs (information costs, negotiation costs, enforcement costs, and transportation costs). The ratio of each transaction cost component can be analysed in greater depth to reveal the most significant transaction cost component faced by smallholder farmers. A comparative analysis of the transaction costs of ISPO and non-ISPO smallholder farmers was conducted using the mann withney test.

3 Result and discussion

3.1 Respondent characteristics

This study employed a survey of 80 ISPO smallholder farmers and 80 non-ISPO smallholder farmers in two districts: Batubara and Labuhan Batu Regency. The respondents were predominantly male (76%), with the majority aged between 51 and 60 years (34%). Most smallholder farmers had completed senior high school (42%) and more than 20 years of experience in oil palm farming (69%) (Fig. 1). This longer farming experience gave smallholder farmers a greater capacity to adapt, increase their income, and contribute to the transformation of the smallholder palm oil value chain.

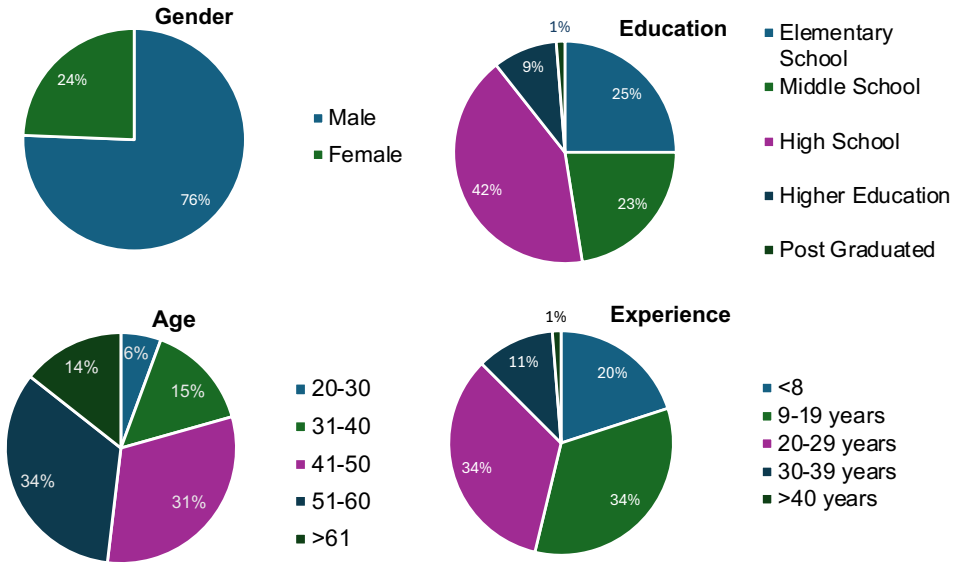

Fig. 1. Respondent characteristics

3.2 Mapping the smallholder palm oil value chain

Value chain mapping is a crucial step in explaining and describing the actors involved in the value chain. In addition to describing leading actors, value chain mapping also includes supporting actors who facilitate the development of the value chain [13]. The results of this study indicate that actors in the smallholder palm oil value chain can be classified into three groups of institutions: primary, secondary, and tertiary. Primary institutions are the leading actors in the smallholder palm oil value chain; secondary institutions are actors that influence the smooth running of the value chain in cultivation, access to capital, and marketing; and tertiary institutions are actors that support the development of the value chain in the implementation of sustainable palm oil certification, such as ISPO certification.

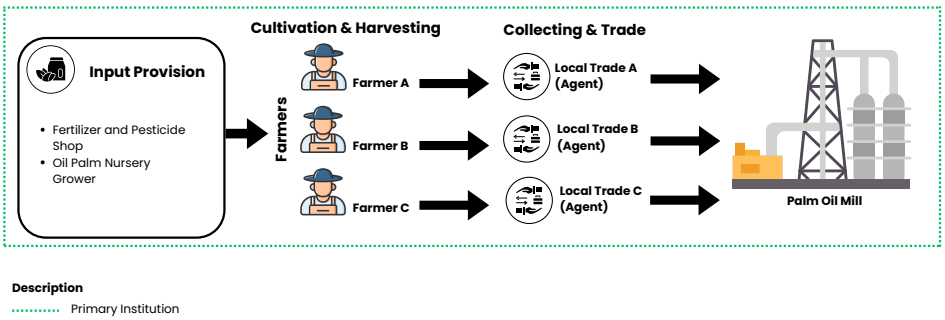

Fig. 2. The non-ISPO smallholder farmers value chain in Labuhan Batu and Batubara Regencies

The limitations of smallholder farmers in achieving ISPO certification make it difficult for them to implement ISPO certification without the support of other actors [14]. In addition, smallholder farmers are unable to implement ISPO certification without joining

smallholder institutions. In Batubara district, ISPO smallholder farmers are organised by the GAPOKTAN Tani Mandiri, while in Labuhan Batu district, they are affiliated with the Labuhan Batu Independent Palm Oil Smallholder Farmers Association (APSKSLB). Additionally, other actors are involved in achieving and maintaining ISPO certification, resulting in different actor configurations between ISPO and non-ISPO smallholder value chains. Conversely, the non-ISPO smallholder palm oil value chain does not involve secondary or tertiary institutions that support value chain development (Fig. 2).

The non-ISPO smallholder palm oil value chain in both study areas is relatively simple compared to the ISPO smallholder palm oil value chain, because it involves only primary institutions (Fig. 2) This shows that the actors in the value chain are primarily traders who supply production inputs, such as fertiliser and pesticide shops, and palm oil seed nurseries, which supply these inputs to smallholder farmers. At the cultivation and harvesting stages, the majority of non-ISPO smallholder farmers independently performed fertilisation and pesticide applications. In contrast, harvesting is primarily done by hired labourers who are paid an average wage IDR. 200-300/ Kg of fresh fruit bunches (FFB). Harvesting labourers are tasked with harvesting and placing FFB at a location agreed upon by the smallholder and collector (agent). The collector then sells FFB directly to the palm oil mill. The results of the study also show that smallholder farmers are unsure which mill the collector sells, as the collector will sell to the palm oil mill that offers the best price. Overall, interactions between actors in the non-ISPO smallholder farmers palm oil value chain are informal.

The value chain of ISPO smallholder farmers differs significantly from that of non-ISPO smallholder farmers, particularly in terms of the actors involved in achieving and maintaining ISPO certification. In both study areas, the value chain of ISPO smallholder farmers is characterised by the existence of primary, secondary, and tertiary institutions. Although they share the same institutional structure, the actors involved differ. In the Labuhan Batu regency, production inputs do not only come from agricultural supply stores and oil palm seed nurseries; APSKSLB plays a role in providing organic fertiliser sold through a cooperative formed by the farmer association for IDR. 95.000/ sack (50 Kg), reflecting a more coordinated and institutionalised input supply system (Fig. 3).

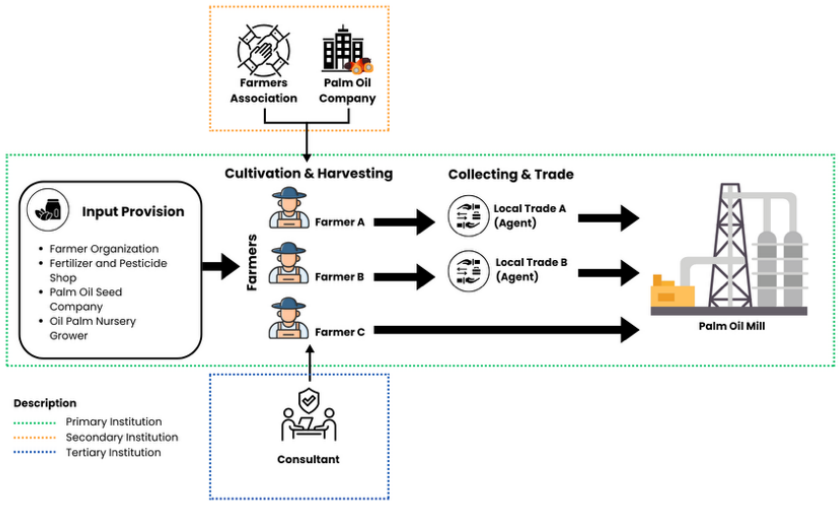

Fig. 3. The value chain of ISPO smallholder farmers in Batubara Regency

Although the smallholder farmers have been certified, they still carry out cultivation independently. The cultivation process included fertilisation (fertiliser frequency, type, and

dosage), pesticide application (spraying frequency, type, and dosage), and weeding. Additionally, during the harvesting stage, smallholder farmers are assisted by harvest workers who are paid an average wage IDR. 150-300/ Kg FFB. The collectors then transported and sold the material to the mill. However, some smallholder farmers can sell directly to the mill because they have sufficient land area and production to meet its weight standards.

In the ISPO smallholder farmers' palm oil value chain in Labuhan Batu Regency, production activities are carried out independently by farmers. However, they are continuously supervised by a partner company and an internal control system that is part of the Farmers' Association. These actors, classified as secondary institutions, are tasked with ensuring the proper implementation of ISPO Principles and Criteria (P&C). In addition, tertiary institutions such as consultants support the development of the value chain by providing training to smallholder farmers, including training in agroforestry and on Gender Equality, Disability, and Social Inclusion (GEDSI) issues.

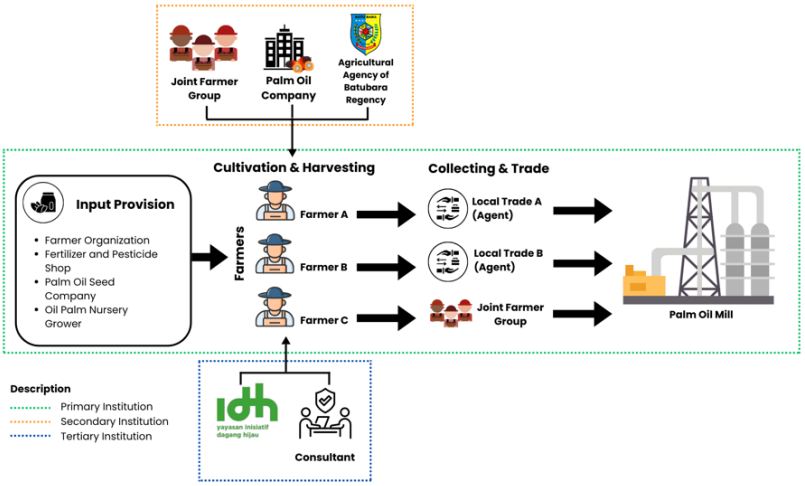

Fig. 4. The value chain of ISPO smallholder farmers in Batubara Regency

However, the ISPO smallholder farmers value chain in Batubara Regency differs from that of Labuhan Batu, particularly in terms of input supply and marketing. Production inputs are primarily sourced from agricultural supply stores, supplemented by assistance from GAPOKTAN Tani Mandiri, which provides free dolomite to certified members who have demonstrated sustainable palm-oil practices. Like Labuhan Batu, cultivation activities are managed independently by farmers, while harvesting is carried out by hired labour (Fig. 4). The main difference between the two ISPO-certified value chains lies in the role of GAPOKTAN Tani Mandiri, which began to function as a place for members to sell their FFB. This one-stop marketing system supports traceability compared to the ISPO value chain in Labuhan Batu, enabling GAPOKTAN Tani Mandiri to sell FFB directly to partner companies. Furthermore, more formal relationships between actors provide price certainty to smallholder farmers.

The secondary institutions in the smallholder palm oil value chain in Batubara Regency include GAPOKTAN Tani Mandiri, which has established an Internal Control System, as well as partner companies and the Agriculture Office, all of which ensure the proper implementation of ISPO P&C and government priority programs, such as the Smallholder Oil Palm Replanting Programmed. Tertiary institutions in the ISPO smallholder value chain in Batubara include the Inisiatif Dagang Hijau Foundation (IDH) and consultants who

prepare ISPO certification requirements. The institutional structure of the value chain in Batubara Regency involves more actors than other value chains, making development within the value chain easier.

3.3 Analysis of transaction cost structure in ISPO and Non-ISPO value chains

Differences in the institutional structure of the ISPO value chain led to differences in governance, resulting in differences in transaction costs. Transaction costs are categorised into four types: information, negotiation, enforcement, and transportation costs [12]. Information costs refer to the expenses incurred by farmers to obtain information related to the provision of production inputs, the search for labour, and other information necessary for smallholder oil palm cultivation. Negotiation costs refer to the costs incurred by smallholder farmers in determining the prices of production inputs, labour costs, and FFB prices. Enforcement costs can be defined as the waiting time for farmers to receive proceeds from FFB sales, FFB rejection by mills, and land and building taxes that smallholder farmers must pay. Transportation costs are expenses incurred by farmers when delivering production inputs from suppliers to plantations and when transporting FFB from plantations to mills.

Table 1 shows the transaction costs incurred by the ISPO and non-ISPO smallholder farmers during their farming activities. In the provision of inputs, transportation costs are the most significant component of transaction costs because inputs are procured individually by ISPO and non-ISPO smallholder farmers. Transportation costs for input procurement by ISPO smallholder farmers (IDR. 155,080) are relatively higher than those of non-ISPO smallholder farmers (IDR. 99,186), indicating more intensive fertiliser application among ISPO smallholder farmers, resulting in higher transaction costs. In the study area, the transportation costs for input supply, particularly fertilisers, ranged from IDR 5,000 to IDR 50,000 per sack, with each sack weighing 50 Kg.

Table 1. Transaction costs for ISPO and non-ISPO smallholder farmers (IDR/Ha/year)

Farming Activities	Transaction Cost	ISPO Smallholder Farmers		Non-ISPO Smallholder Farmers	
		(IDR)	%	(IDR)	%
Input Provision	Information	7,760	0.6	4,764	0.4
	Enforcement	0	0	0	0
	Negotiation	0	0	0	0
	Transportation	155,080	12.4	99,186	7.6
	Others	0	0	0	0
Production	Information	26,956	2.2	4,048	0.3
	Enforcement	38,521	3.1	41,400	3.2
	Negotiation	0	0	0	0
	Transportation	0	0	0	0
	Others	0	0	0	0
Harvesting	Information	35,999	2.9	63,301	4.9
	Enforcement	0	0	0	0
	Negotiation	0	0	0	0
	Transportation	0	0	0	0
	Others	984,842	78.8	1,085,226	83.6
Total		**1,249,158**	**100**	**1,297,924**	**100**

In production activities, ISPO and non-ISPO smallholder farmers face the cost of information regarding good oil palm cultivation techniques. ISPO smallholder farmers who are members of farmers' organisations receive regular training, which requires them to incur

transportation costs to attend these sessions. The amount of information cost is influenced by the distance between the farmer's home and the training location. ISPO smallholder farmers incur relatively higher costs than non-ISPO smallholder farmers. ISPO smallholder farmers incur information costs for the IDR. 26,956, whereas non-ISPO smallholder farmers incur costs of IDR. 4,048. Additionally, both ISPO and non-ISPO smallholder farmers incur enforcement costs in the form of annual land and building taxes. ISPO smallholder farmers incur IDR costs 38,521, whereas non-ISPO smallholder farmers incur IDR costs. 41,400.

Furthermore, during harvesting activities, smallholder farmers incur information and other costs. Information costs are related to routine communication between smallholder farmers and harvesters. The information costs incurred by non-ISPO smallholder farmers (IDR. 63,301) are relatively higher than those incurred by ISPO smallholder farmers (IDR. 35,999), indicating that ISPO smallholder farmers operate using a more regular harvesting schedule. In addition to information costs, other costs such as food, snacks, drinks, and cigarettes for harvesting labourers are borne by both groups of farmers. Other costs related to harvesting activities were the most significant expenses incurred by the ISPO (IDR. 984,842), and non-ISPO (IDR. 1,085,226). Overall, the transaction costs incurred by non-ISPO smallholder farmers were relatively higher than those incurred by ISPO smallholder farmers.

3.4 Comparative analysis of transaction costs for ISPO and Non ISPO smallholder Farmers

A transaction cost difference test was conducted to statistically examine the difference in transaction costs between ISPO and non-ISPO smallholder farmers. The normality of transaction cost data was tested using the Shapiro-Wilk test, which produced a p-value <0.05, indicating a violation of the normality assumption (Table 2). As a result, the non-parametric Mann-Whitney statistic was used to examine the difference in transaction costs between ISPO and non-ISPO smallholder farmers.

Table 2. Normality test (shapiro-wilk test)

Variable	Obs	W	V	Z	Prob.
Transaction Cost	160	0.59176	50.207	8.908	0.00000

Table 3. Mann withney test

Variable	U Test	Z	Prob.
Transaction Cost	50.207	8.908	0.00000

The mann-whitney test (Table 3) results indicate a significant difference ($p < 0.05$) between the transaction costs incurred by ISPO and non-ISPO smallholder farmers. These results suggest that the distribution of transaction costs incurred by ISPO smallholder farmers differs from that of non-ISPO smallholder farmers. Although there are differences in transaction costs between ISPO and non-ISPO smallholder farmers, this does not indicate inefficiency within each farmer group. However, these results may indicate a shift from informal to formal transaction cost structures, resulting from changes in the value chain governance of each farmer group. More formal coordination between actors, such as contracts and sustainability certification, is often associated with clearer rules, reduced opportunism among value chain actors, and better resource allocation, thereby changing the transaction costs for each actor in the value chain [15]. In this way, formal coordination can strengthen the value chain.

4 Conclusion

Research results have shown that the value chain of ISPO-certified smallholder palm oil has primary institutional structure (smallholder farmers, collectors/agents, and palm oil mills), secondary institutional structure (farmer organisations, supporting companies, and local government), and tertiary institutional structure (consultants and other institutions that support ISPO certification) in achieving and maintaining ISPO certification.

The most significant transaction costs faced by both ISPO and non-ISPO smallholder farmers were those related to harvesting activities. Smallholder farmers must prepare for the consumption costs associated with harvest labour. Additionally, the cost of transporting inputs is relatively high compared to other expenses. The results also reveal differences in transaction costs between ISPO and non-ISPO smallholder farmers. Therefore, collective action is necessary for smallholder farmers to provide inputs and manage the harvesting process, which has relatively higher costs compared to other transaction costs, thereby strengthening the role of farmer institutions.

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