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license**WHY DO FARMERS CHOOSE AUCTION MARKETS?
INSTITUTIONAL AND SOCIOECONOMIC
DETERMINANTS OF RED CHILI MARKETING
DECISIONS IN INDONESIA****Irma Herawaty Sitorus¹, Rahmanta¹ dan Lindawati¹**¹Magister Agribisnis, Fakultas Pertanian, Universitas Sumatera Utara*Correspondence E-Mail: irmaherawaty29@gmail.comDOI: <https://doi.org/10.30598/baileofisipvol4iss1pp108-128>**ABSTRACT**

This study examines the institutional and socioeconomic determinants of smallholder red chili farmers' decisions to participate in auction markets rather than traditional markets in North Tapanuli Regency, Indonesia. Farmers' marketing decisions are conceptualized as choices between competing market institutions rather than as responses to price incentives alone. The study employed an explanatory sequential mixed-methods design. Quantitative data were collected from 95 active red chili farmers in Siborong-borong District using purposive and snowball sampling techniques and analyzed with binary logistic regression to estimate the probability of auction market participation. The model was evaluated using goodness-of-fit statistics and odds ratio analysis. Qualitative data from in-depth interviews with farmers, traders, and market managers were used to explain the institutional mechanisms underlying farmers' market choices. The results indicate that farm size and farming experience significantly increase the likelihood of auction market participation, whereas age, education, price perception, transportation availability, and farmer group activity do not have significant effects. These findings suggest that farmers' market institution choices are driven primarily by structural capacity and institutional adaptation rather than price considerations. The study contributes to the literature by integrating smallholder market participation and institutional market choice within the context of institutional transition in Indonesia's horticultural sector, offering policy insights for more inclusive auction market revitalization and rural socioeconomic development.

Keywords: Auction Markets, Institutional Market Choice, Institutional Transition, Market Participation, Red Chili Farmers

INTRODUCTION

Agricultural market participation has long been recognized as a critical pathway for improving smallholder farmers' welfare, strengthening rural economies, and accelerating agricultural commercialization in developing countries. However, participation in agricultural markets is not merely a question of whether farmers sell their products. It is also shaped by how farmers navigate different institutional arrangements that govern market exchanges. In many developing countries, farmers are increasingly confronted with multiple marketing channels that differ in terms of price transparency, bargaining mechanisms, transaction costs, and institutional

support. Understanding why farmers choose one market institution over another has therefore become an important issue in agricultural economics, rural sociology, and institutional development studies (Firoozi et al., 2025; Khan et al., 2024; Martin et al., 2026).

In Indonesia, red chili is one of the most economically and socially significant horticultural commodities due to its high price volatility and its contribution to farmers' livelihoods. Despite various government initiatives to strengthen agricultural marketing institutions, smallholder farmers continue to experience considerable challenges in accessing efficient and equitable markets. Auction markets were introduced as collective marketing institutions designed to improve price transparency, enhance farmers' bargaining positions, reduce dependence on intermediaries, and increase marketing efficiency. Nevertheless, participation in auction markets remains relatively low and inconsistent across regions. In North Tapanuli Regency, particularly in Siborong-borong District, auction markets once played an important role in facilitating collective marketing among red chili farmers. However, their activities have gradually weakened and experienced temporary suspension after 2023, creating a situation in which farmers must choose between auction markets and traditional marketing channels.

This institutional transition is particularly important because farmers' marketing decisions cannot be adequately explained by price incentives alone. While agricultural marketing studies frequently assume that farmers behave as rational economic actors seeking higher prices, their decisions are often embedded within broader socioeconomic and institutional contexts. Farm size, transportation access, farming experience, institutional trust, social networks, and market accessibility may simultaneously shape farmers' preferences for particular marketing arrangements. As such, marketing decisions should be understood not only as economic choices but also as institutional choices that reflect farmers' capacities and adaptations to changing market environments (Fernando et al., 2026; Georgiou et al., 2025; Rumanti et al., 2025).

The literature on smallholder market participation has consistently emphasized the role of transaction costs, household assets, and market access in determining farmers' engagement with agricultural markets. Transaction cost theory suggests that farmers participate in markets when the benefits of market exchange outweigh the costs associated with information acquisition, transportation, bargaining, and institutional uncertainty (Hasan et al., 2023; Maziriri et al., 2024; Pratama et al., 2024). Kim & Lee (2024) further argues that market participation is inherently heterogeneous, as farmers possess different resource endowments that influence their ability to engage with markets. Similarly, Gater et al. (2026) demonstrate that access to institutions and household characteristics significantly affect market participation decisions among smallholders.

More recent studies have reinforced the importance of socioeconomic and institutional factors in shaping agricultural commercialization. Research conducted in African and Asian contexts has shown that farm size, education, farming experience, market information, and infrastructure significantly influence farmers' participation in agricultural markets (Gomes, 2026; Jannesar Niri et al., 2024; Pyburn et al., 2023). Larger farm sizes are often associated with higher

market participation because economies of scale reduce transaction costs and improve marketing efficiency. Likewise, farming experience contributes to farmers' ability to assess market opportunities and manage risks associated with different marketing channels.

Institutional arrangements also play a fundamental role in agricultural marketing decisions. Institutions shape how information is exchanged, transactions are conducted, and risks are distributed among market actors (Ochoa-Herrera et al., 2025; Schoneveld, 2022; Yupanqui et al., 2025). In agricultural settings, collective marketing institutions such as cooperatives and auction markets have been widely promoted as mechanisms for improving farmers' market access and bargaining power (Chaurasiya et al., 2026; Nassary et al., 2025; Tham, 2025). Collective action enables smallholders to overcome constraints associated with scale, information asymmetry, and weak market positions. Consequently, institutional participation has become increasingly recognized as an important determinant of successful agricultural commercialization (Al Abbasi et al., 2024; Kangasniemi et al., 2025; Marín-García et al., 2025).

Existing studies on auction markets have predominantly focused on marketing efficiency, price formation, and institutional performance. Auction-based marketing systems have been extensively studied in commodities such as coffee, tea, and fisheries, where transparent bidding mechanisms contribute to improved price discovery and reduced market distortions (Aza-Mengo et al., 2025; Gnych et al., 2020; Worakittikul et al., 2025). However, the literature on auction markets for horticultural commodities remains relatively limited, particularly in Indonesia. Studies conducted within Indonesian agricultural marketing contexts have largely adopted descriptive approaches that evaluate marketing margins and institutional effectiveness rather than examining farmers' individual marketing decisions through probabilistic models.

Furthermore, the majority of market participation studies conceptualize farmers' decisions as binary choices between selling and not selling in markets or between participating and not participating in commercialization processes. Much less attention has been devoted to understanding how farmers select among competing market institutions when multiple marketing alternatives coexist. This omission becomes increasingly relevant in situations of institutional transition, where farmers must continuously adapt their marketing strategies in response to changing institutional conditions. Under such circumstances, marketing choices may reflect farmers' evaluations of institutional reliability, resource capacities, and long-term economic considerations rather than immediate price incentives.

The present study contributes to this broader discussion by approaching farmers' marketing decisions as choices among market institutions rather than merely responses to price signals. By situating auction markets within the framework of institutional economics and smallholder commercialization, this study provides a more comprehensive understanding of how socioeconomic characteristics and institutional factors jointly influence market participation. The case of red chili farmers in Siborong-borong offers a particularly valuable context because it captures farmers' responses to institutional change following the weakening of collective marketing arrangements. Such a perspective allows agricultural marketing behavior to be

interpreted not simply as individual economic rationality but as a process of institutional adaptation shaped by structural conditions at the farm level.

Against this background, the study aims to examine the institutional and socioeconomic determinants influencing red chili farmers' decisions to participate in auction markets rather than traditional markets in North Tapanuli Regency, Indonesia. Specifically, the study investigates the effects of age, education, farm size, price perceptions, transportation availability, farming experience, and farmer group participation on the probability of auction market participation. By integrating insights from market participation theory and institutional market choice, this research seeks to contribute to ongoing debates on agricultural commercialization, institutional development, and rural transformation in developing countries.

RESEARCH METHOD

This study employed a mixed-methods approach using an explanatory sequential design to provide a comprehensive understanding of farmers' marketing decisions within the context of institutional market choice. The research began with a quantitative phase to identify the socioeconomic and institutional determinants influencing farmers' participation in auction markets, followed by a qualitative phase to explain the underlying mechanisms behind the statistical findings. The combination of quantitative and qualitative approaches was considered particularly appropriate because farmers' marketing decisions are multidimensional phenomena that cannot be fully explained by numerical relationships alone. Previous studies have demonstrated that market participation is influenced not only by economic variables but also by institutional contexts, transaction costs, and farmers' experiences in responding to market changes (Ariyanti et al., 2026; Bitzer et al., 2024; Nahid et al., 2026). Therefore, the explanatory sequential design enabled the study to capture both the statistical determinants of market participation and the institutional realities shaping farmers' decisions.

The research was conducted in Siborong-borong District, North Tapanuli Regency, Indonesia, which represents a unique case of institutional transition in agricultural marketing. The district was purposively selected because it has historically functioned as one of the major red chili production centers in North Sumatra and previously operated an auction market designed to facilitate collective marketing among farmers. However, the weakening and temporary suspension of auction market activities after 2023 created an institutional setting in which farmers were required to choose between auction-based and traditional marketing channels. This context provides an important opportunity to examine how farmers adapt their marketing strategies when institutional arrangements change over time.

The quantitative phase involved 95 active red chili farmers who were selected using purposive sampling and snowball sampling techniques. Purposive sampling was employed to ensure that respondents had substantial experience in red chili farming and were familiar with existing marketing channels. Snowball sampling was subsequently used to identify farmers who

had previously participated in auction markets or possessed knowledge of both marketing mechanisms. The respondents constituted the primary unit of analysis because their marketing decisions directly reflect the interaction between socioeconomic characteristics and institutional conditions. In the qualitative phase, in-depth interviews were conducted with selected farmers, local traders, and auction market managers to provide contextual explanations regarding farmers' market preferences, institutional challenges, and perceptions of collective marketing practices.

Data collection was conducted through structured questionnaires, in-depth interviews, and document reviews. Structured questionnaires were utilized to collect quantitative data on farmers' socioeconomic characteristics, including age, education level, farm size, price perceptions, transportation availability, farming experience, and participation in farmer groups. The dependent variable was marketing choice, categorized as participation in auction markets or traditional markets. In-depth interviews were undertaken to explore farmers' experiences, institutional trust, and the practical considerations influencing their marketing decisions. The integration of these methods allowed the research to move beyond identifying statistically significant relationships by uncovering the institutional dynamics that shape farmers' behavior.

Quantitative data were analyzed using binary logistic regression to estimate the probability of farmers participating in auction markets. Model adequacy was evaluated using the Hosmer-Lemeshow goodness-of-fit test, overall model fit statistics, Wald tests, odds ratios, and Nagelkerke R^2 values. Qualitative data were analyzed through thematic interpretation to explain and contextualize the quantitative findings. Data validity was ensured through methodological triangulation by comparing information obtained from questionnaires, interviews, and institutional documents, as well as source triangulation involving farmers, traders, and market managers. These validation procedures enhance the credibility and robustness of the findings while providing a more nuanced understanding of institutional market participation among smallholder red chili farmers (Aalmo, 2026; Dixit & Shaw, 2023; Sekyere et al., 2025).

RESULTS AND DISCUSSION

Socioeconomic Profile of Red Chili Farmers and Marketing Channel Choices

Table 1 presents the results of the Hosmer-Lemeshow goodness-of-fit test, which was employed to evaluate the adequacy of the binary logistic regression model in predicting farmers' decisions to participate in auction markets or traditional marketing channels. Before examining the effects of socioeconomic and institutional variables on farmers' market choices, it is essential to establish whether the statistical model appropriately represents the observed data. In studies of market participation and institutional choice, model fit assessment is particularly important because farmers' marketing decisions are inherently complex and influenced by multiple interrelated factors that extend beyond purely economic considerations (Hosmer et al., 2013).

The Hosmer-Lemeshow test remains one of the most widely used approaches for

assessing the calibration of logistic regression models. The test evaluates whether there are significant differences between the predicted probabilities generated by the model and the actual observed outcomes. A non-significant result indicates that the model adequately fits the data and is capable of explaining the observed variation in farmers' decisions (Headey et al., 2024; Kusters et al., 2022). In the context of agricultural market participation, a well-fitted model provides a stronger empirical basis for interpreting how structural and institutional characteristics influence farmers' choices among competing marketing institutions.

Table 1. Hosmer-Lemeshow Goodness-of-Fit Test for Binary Logistic Regression Model

Step	Chi-square	df	Sig.
1	0.226	8	1.000

Source: Authors' analysis (2026)

The results presented in Table 1 indicate that the binary logistic regression model has an exceptionally good fit, as reflected by a Chi-square value of 0.226 and a significance value of 1.000. Since the significance value is substantially greater than the conventional threshold of 0.05, the null hypothesis that there is no difference between the observed and predicted values cannot be rejected. This finding suggests that the proposed model is statistically appropriate for explaining farmers' marketing decisions and can reliably be used to estimate the probability of auction market participation among smallholder red chili farmers.

From a substantive perspective, the goodness-of-fit results imply that the selected independent variables are sufficiently capable of capturing the socioeconomic and institutional dimensions underlying farmers' market institution choices. This is particularly relevant because the present study conceptualizes marketing decisions not merely as economic transactions but as institutional choices shaped by farmers' structural capacities and their adaptation to changing market environments. The excellent model fit provides preliminary evidence that the explanatory framework adopted in this study aligns well with the empirical realities experienced by farmers in Siborong-borong District.

The characteristics of the 95 respondents further support the appropriateness of examining market participation through a multidimensional lens. Preliminary descriptive analyses reveal considerable heterogeneity among red chili farmers in terms of farm size, farming experience, educational attainment, and marketing preferences. Such heterogeneity has been widely recognized in the smallholder commercialization literature, which argues that farmers are not a homogeneous group responding uniformly to market incentives (Bai et al., 2026; Wahyuni et al., 2026; Yan et al., 2025). Differences in resource endowments often influence farmers' capacities to engage with particular market institutions and shape their evaluations of transaction costs and expected benefits.

This diversity was also reflected during the qualitative interviews conducted as part of the explanatory sequential design. Several farmers emphasized that their marketing decisions involved considerations extending beyond price differentials. One farmer, identified by the

initials "AS," explained that larger production volumes made auction markets more attractive because collective marketing mechanisms facilitated the sale of greater quantities of red chili within a relatively transparent pricing environment. Meanwhile, another farmer, "BM," noted that experience in farming enabled producers to better anticipate market fluctuations and determine the most advantageous marketing channel at different times. Their reflections suggest that participation in auction markets is closely associated with farmers' accumulated experience and their ability to navigate institutional arrangements rather than simply pursuing short-term price gains.

The model fit results are therefore more than a statistical prerequisite for subsequent analyses. They establish the robustness of the empirical framework employed in this study and support the argument that farmers' decisions to participate in auction markets can be meaningfully examined through the interplay of socioeconomic characteristics and institutional conditions. In institutional market settings characterized by ongoing transition, understanding these determinants requires analytical approaches capable of capturing both structural heterogeneity and farmers' adaptive responses to changing marketing institutions. The excellent goodness-of-fit demonstrated by the Hosmer-Lemeshow test confirms that the binary logistic regression model provides a reliable foundation for exploring these dynamics in greater depth.

Structural Capacity Matters: Farm Size and Farming Experience as Determinants of Auction Market Participation

The findings of this study demonstrate that farmers' participation in auction markets is fundamentally shaped by their structural capacities rather than by market incentives alone. Within the context of institutional transition in Siborong-borong District, farmers' decisions to engage with auction markets are closely associated with their ability to utilize the opportunities offered by collective marketing institutions. Structural characteristics such as farm size and farming experience provide farmers with the necessary resources and adaptive capabilities to navigate different marketing arrangements. Consequently, market participation should not be viewed merely as an economic response to price signals but rather as an institutional choice that reflects farmers' capacities to access, evaluate, and benefit from particular market institutions.

To assess the explanatory power of the binary logistic regression model, the present study employed the Cox and Snell R Square and Nagelkerke R Square statistics. These measures are commonly used to evaluate the proportion of variation in the dependent variable that can be explained by the independent variables included in the model (Divate et al., 2026; Makai & Popoola, 2025). The results are presented in Table 2.

Table 2. Model Summary of Binary Logistic Regression

Step	-2 Log Likelihood	Cox & Snell R Square	Nagelkerke R Square
1	17.772a	0.699	0.932

Source: Authors' analysis (2026)

The Nagelkerke R Square value of 0.932 indicates that approximately 93.2 percent of the variation in farmers' decisions to participate in auction markets can be explained by the socioeconomic and institutional variables included in the model. The remaining 6.8 percent is attributable to factors outside the estimated model. From a statistical perspective, this represents a remarkably high explanatory power, suggesting that the selected variables are highly relevant in explaining institutional market participation among smallholder red chili farmers. Moreover, the relatively low value of the -2 Log Likelihood statistic further supports the adequacy of the estimated model.

The strong explanatory capacity of the model reinforces an important argument emerging from this study: auction market participation is primarily determined by farmers' structural capacities and their ability to adapt to institutional conditions. In agricultural commercialization studies, structural capacity refers to the resources and capabilities that enable farmers to effectively participate in market systems, including productive assets, accumulated knowledge, and experiential competencies (Andreotti et al., 2022; Anokye et al., 2025; Iswanto et al., 2026). Farmers possessing greater structural capacities are more likely to perceive institutional arrangements such as auction markets as economically and socially beneficial.

The significance of farm size in influencing auction market participation can be understood through the logic of inclusive agricultural commercialization. Larger farm sizes generally generate higher production volumes, thereby reducing transaction costs associated with collective marketing and increasing the potential benefits obtained through auction mechanisms. Farmers with larger landholdings are often better positioned to meet quantity requirements, absorb market risks, and engage in more strategic marketing decisions. In this regard, auction markets function not merely as marketing channels but as institutional arrangements that reward farmers who possess sufficient productive capacities to participate effectively.

Similarly, farming experience contributes substantially to farmers' institutional adaptation processes. Experienced farmers tend to possess greater familiarity with market fluctuations, institutional practices, and transaction mechanisms. Their accumulated knowledge enables them to compare the advantages and disadvantages of different marketing channels and to make more informed decisions regarding market participation. Rather than responding exclusively to temporary price differentials, experienced farmers are more likely to evaluate the long-term benefits associated with institutional stability, market transparency, and collective bargaining opportunities.

The qualitative findings further illuminate this relationship. During the in-depth interviews, one respondent, identified by the initials "Rian," explained that farmers with larger production capacities often prefer auction markets because collective marketing arrangements simplify transactions when selling larger quantities of red chili. According to him, auction markets become particularly advantageous when production volumes are sufficiently high to justify transportation and coordination efforts. Another farmer, "Bagus," emphasized that years of

farming experience had taught him that marketing decisions should not be based solely on daily price fluctuations. He noted that understanding how market institutions operate is equally important in determining where and when agricultural products should be sold.

These narratives illustrate that institutional participation is a process of adaptation rather than a purely economic calculation. Farmers' experiences enable them to interpret institutional signals, assess market reliability, and strategically position themselves within changing marketing environments. Such findings resonate with recent rural transformation studies, which argue that institutional adaptation constitutes an essential component of agricultural commercialization among smallholders (Del Sarto et al., 2026; O'Connell & Schot, 2025; Wittman, 2023). Market participation is therefore inseparable from farmers' capacities to adjust their production and marketing strategies in response to institutional change.

Beyond Price Incentives: Why Socioeconomic Variables Do Not Always Shape Market Institution Choices

One of the most compelling findings of this study lies not only in the variables that significantly influence farmers' participation in auction markets but also in those that do not. The binary logistic regression analysis reveals that age, formal education, price perception, and farmer group activity do not significantly affect red chili farmers' decisions to market their products through auction markets. Rather than being interpreted as statistically unimportant variables, these findings provide valuable theoretical insights into how farmers make institutional market choices in the context of changing agricultural marketing systems. They suggest that participation in auction markets is a more complex process than the conventional assumption that farmers are primarily motivated by price incentives or demographic characteristics.

In agricultural market participation studies, farmers are often portrayed as rational actors who seek to maximize economic returns by selecting marketing channels that offer the highest prices or the lowest transaction costs. However, recent developments in behavioral institutional economics argue that economic decisions are embedded within institutional environments that shape individual preferences, expectations, and adaptive behaviors (Gunaratne et al., 2026; Tabe-Ojong et al., 2023). From this perspective, choosing a marketing channel is not merely a decision to sell agricultural products but also a decision to engage with a particular institutional arrangement. Consequently, farmers' choices cannot always be predicted solely by socioeconomic characteristics or short-term economic considerations.

The partial significance test using the Wald statistic provides important evidence regarding the determinants of auction market participation. The results of the binary logistic regression model are presented in Table 3.

Table 3. Results of Binary Logistic Regression Estimates

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Age (X1)	-0.403	0.225	3.204	1	0.073	0.669
Formal Education (X2)	0.019	0.525	0.001	1	0.972	1.019
Farm Size (X3)	5.424	1.034	6.420	1	0.011	6.662
Price Perception (X4)	0.038	0.981	0.002	1	0.969	1.039
Transportation Availability (X5)	0.296	1.321	0.050	1	0.823	1.344
Farming Experience (X6)	0.720	0.337	4.572	1	0.032	0.487
Farmer Group Activity (X7)	2.011	1.515	1.762	1	0.184	7.473
Constant	4.200	11.672	0.130	1	0.719	66.719

Source: Authors' analysis (2026)

The findings indicate that age does not significantly influence farmers' decisions to participate in auction markets ($p = 0.073$). This suggests that younger and older farmers exhibit relatively similar patterns of institutional market choice. In the context of red chili marketing, participation in auction markets appears to depend less on farmers' demographic characteristics and more on their ability to engage with collective marketing mechanisms. The result challenges the common assumption that younger farmers are inherently more innovative or institutionally adaptive than their older counterparts. Agricultural commercialization processes are often mediated by local institutional arrangements that may reduce generational differences in market behavior.

Similarly, formal education was found to have no significant effect on auction market participation ($p = 0.972$). Although educational attainment is frequently associated with improved access to information and decision-making capabilities, participation in auction markets may not necessarily require advanced formal education. Market-related information in rural communities is often disseminated through informal networks, farmer interactions, and local institutions. Consequently, institutional familiarity and practical experience may be more influential than years of schooling in shaping farmers' marketing decisions.

Perhaps the most theoretically significant finding is that price perception does not significantly influence farmers' decisions to participate in auction markets ($p = 0.969$). Conventional market participation theories generally assume that farmers choose marketing channels that maximize expected economic returns. However, the present findings suggest that auction market participation cannot be adequately explained by price incentives alone. Farmers do not simply select the marketing institution that offers the highest price at a particular point in time. Instead, they evaluate broader institutional considerations, including transaction certainty, accessibility, production capacity, and their ability to adapt to institutional arrangements.

This finding substantially extends the literature on agricultural market participation by demonstrating that market institution choice differs conceptually from price maximization behavior. Auction markets are institutional arrangements that require farmers to possess sufficient structural capacities to benefit from collective marketing mechanisms. As a result, price becomes only one component among many considerations influencing marketing decisions.

Transportation availability also does not significantly influence auction market participation ($p = 0.823$). While transportation infrastructure is widely recognized as an important determinant of market access in developing countries, its limited role in this study may indicate that transportation constraints are relatively similar among respondents or that farmers have developed practical mechanisms for overcoming logistical challenges. Consequently, transportation availability alone is insufficient to explain farmers' preferences for auction or traditional markets.

Likewise, farmer group activity was not found to significantly influence market participation decisions ($p = 0.184$). Although collective action has frequently been associated with successful agricultural commercialization, active participation in farmer groups does not necessarily translate into engagement with auction markets. Institutional participation in farmer organizations and participation in collective marketing institutions may represent two distinct dimensions of rural social organization. Farmers may actively participate in farmer groups for production-related activities while continuing to prefer traditional marketing arrangements for economic or practical reasons.

Taken together, these findings suggest that farmers' institutional market choices cannot be reduced to demographic characteristics or immediate economic incentives. Instead, auction market participation emerges as a product of structural capacity, institutional confidence, and farmers' adaptive responses to changing market institutions. Recent scholarship in behavioral institutional economics emphasizes that agricultural markets should be understood as socially and institutionally embedded systems in which economic decisions are shaped by formal and informal institutional arrangements (Amidu et al., 2026; Uddin et al., 2025). Similarly, the new institutional economics perspective highlights that market governance mechanisms influence how individuals evaluate transaction opportunities and institutional reliability (Idroes et al., 2024; Uzar et al., 2026).

Institutional Transition and Farmers' Adaptation in Auction Market Participation

The findings of this study cannot be fully understood without considering the broader institutional context in which farmers make their marketing decisions. The case of red chili marketing in Siborong-borong District reflects an ongoing process of institutional transition resulting from the weakening and temporary suspension of auction market activities after 2023. This transition has fundamentally altered the marketing landscape for smallholder farmers by reducing the institutional certainty previously provided by collective marketing mechanisms. Consequently, farmers are not merely choosing between two marketing channels; they are adapting to changes in the institutional arrangements that govern agricultural transactions. Their decisions to participate in auction markets or return to traditional marketing systems represent responses to evolving institutional realities rather than simple reactions to economic incentives.

Institutional transition is particularly significant in agricultural markets because institutions shape the rules, expectations, and governance mechanisms that influence farmers'

behavior. Agricultural markets are socially embedded systems in which institutional arrangements determine how information is exchanged, how risks are distributed, and how economic relationships are maintained among market actors. When institutions weaken or become unstable, farmers must reassess their marketing strategies based on their perceptions of reliability, accessibility, and institutional benefits. In this sense, institutional change often produces behavioral adaptations that extend beyond conventional price considerations (Ding et al., 2025; Nguyen et al., 2025).

The situation in Siborong-borong illustrates this process of institutional adaptation. Auction markets were initially established to strengthen collective marketing practices by providing transparent price mechanisms and improving farmers' bargaining positions. However, the weakening of auction market activities has created institutional uncertainty regarding market accessibility, continuity of transactions, and collective marketing opportunities. Such conditions require farmers to continuously evaluate whether participation in auction markets remains beneficial relative to more familiar traditional marketing arrangements. Consequently, farmers' marketing decisions should be understood as adaptive strategies developed in response to institutional change rather than static economic preferences.

The present findings demonstrate that farmers' choices are strongly associated with their structural capacities, particularly farm size and farming experience, which influence their ability to adapt to changing market institutions. Farmers possessing greater productive capacities are generally better equipped to absorb institutional uncertainties and to take advantage of collective marketing mechanisms when opportunities arise. Conversely, smaller farmers may perceive institutional instability as an additional transaction cost that increases the risks associated with participating in auction markets. This observation reinforces the notion that institutional participation is conditional upon both institutional quality and farmers' capacities to engage with institutional arrangements effectively.

Recent scholarship on institutional resilience in food systems argues that resilient agricultural institutions are characterized not only by their capacity to withstand disruptions but also by their ability to facilitate adaptation among market participants during periods of change (Hashim et al., 2024; Syahrone et al., 2026). Institutional resilience therefore encompasses the relationships between institutions and the actors who depend upon them. In contexts where institutional arrangements are weakened or transformed, farmers are compelled to develop adaptive behaviors that allow them to maintain market access and economic stability. The case of Siborong-borong demonstrates that institutional resilience is not solely a characteristic of market institutions themselves but also reflects farmers' abilities to respond strategically to institutional transitions.

The concept of institutional adaptation is particularly useful in explaining why some farmers continue to engage with auction markets despite institutional uncertainties, while others prefer traditional marketing channels. Traditional markets often provide established social networks, flexible transaction arrangements, and greater predictability in times of institutional

instability. Auction markets, by contrast, require institutional confidence and sufficient productive capacities to justify participation. Consequently, farmers' market institution choices emerge from their assessments of institutional reliability rather than from price considerations alone.

The Agricultural Market Governance Framework further emphasizes that market institutions play a critical role in shaping incentives, reducing transaction costs, and facilitating inclusive participation among agricultural producers (Araujo et al., 2025; Asamoah et al., 2025; Van Berkel, 2026). Effective market governance extends beyond establishing formal market mechanisms; it also requires maintaining institutional continuity and ensuring that market institutions remain accessible and beneficial to diverse groups of farmers. Where institutional governance weakens, participation rates may decline despite the potential economic advantages offered by collective marketing arrangements.

The findings of this study therefore suggest that auction market participation should be viewed as an adaptive institutional process. Farmers' marketing decisions are embedded within broader governance structures that continuously evolve over time. Institutional transition influences how farmers perceive market opportunities, evaluate risks, and allocate their productive resources. As institutions change, farmers adjust their behavior accordingly, demonstrating that agricultural commercialization is not merely a process of market integration but also a process of institutional negotiation and adaptation.

Reframing Market Participation: From Selling Decisions to Institutional Market Choice

The findings of this study invite a broader reconsideration of how market participation is conceptualized within the literature on agricultural commercialization and smallholder market integration. Traditionally, market participation has been understood as farmers' decisions to sell or not sell their agricultural products, with considerable emphasis placed on economic incentives such as prices, transaction costs, and market accessibility. While this perspective has contributed significantly to understanding commercialization processes among smallholders, it tends to overlook an equally important dimension of farmers' behavior: the institutional context in which market transactions occur. In contemporary agricultural systems, particularly in developing countries where multiple marketing arrangements coexist, participation in markets is increasingly shaped by farmers' choices among competing market institutions rather than by economic considerations alone (Kawarazuka et al., 2022; Lowder et al., 2025; Malapit et al., 2020).

The empirical findings of this study demonstrate that auction market participation cannot be adequately explained through a conventional price-centered framework. Although agricultural marketing studies frequently assume that farmers will choose marketing channels offering the greatest economic returns, the present results suggest that farmers' decisions are more nuanced and institutionally embedded. The significance of farm size and farming experience, coupled with the non-significance of price perception and several demographic

variables, indicates that market participation is fundamentally linked to farmers' capacities to engage with institutional arrangements. In other words, farmers do not merely decide where to sell their products; they decide which market institution best accommodates their productive capacities, experiences, and adaptive capabilities.

This distinction is particularly important because auction markets represent more than alternative marketing channels. They are institutional arrangements that govern how transactions are conducted, how prices are determined, and how collective marketing mechanisms operate. Participation in auction markets therefore requires farmers to possess sufficient structural capacities to benefit from institutional advantages such as price transparency, collective bargaining opportunities, and reduced information asymmetries. Consequently, institutional participation involves a different set of considerations than those traditionally associated with market participation models.

The concept of institutional market choice provides a useful framework for understanding these dynamics. Institutional market choice refers to farmers' decisions to participate in specific market institutions based on their assessments of institutional benefits, transaction requirements, and adaptive capacities. From this perspective, agricultural commercialization is not simply a process of integrating farmers into markets but also a process of integrating farmers into institutional arrangements that shape market outcomes. Such an understanding aligns with recent developments in institutional economics, which emphasize that markets are governed by formal and informal institutions that influence individual behavior and economic performance (Ng et al., 2022; Padovezi et al., 2025).

The findings further suggest that structural capacity plays a central role in determining farmers' market institution choices. Structural capacity encompasses productive resources, accumulated farming experience, and the ability to navigate institutional environments. Farmers with larger farm sizes are more capable of meeting the operational requirements of collective marketing mechanisms, while experienced farmers are better equipped to evaluate institutional opportunities and respond to market uncertainties. Structural capacity therefore becomes a prerequisite for effective institutional participation rather than merely an economic advantage in agricultural production.

This perspective has important implications for understanding the effectiveness of auction markets in rural development. Market institutions cannot be assumed to benefit all farmers equally if significant differences exist in their capacities to participate. Auction market performance is therefore influenced not only by institutional design but also by the extent to which institutions are able to accommodate heterogeneous farmer characteristics. Policies aimed at improving market participation must consequently move beyond efforts to increase commodity prices or improve short-term market incentives. Institutional strengthening and farmer capacity development are equally critical components of successful agricultural commercialization strategies.

Recent discussions on inclusive agricultural commercialization similarly emphasize that institutional arrangements must be designed to support equitable participation among smallholders with varying levels of resources and capabilities (Avni & Moser, 2026; Kasula et al., 2026). Inclusive commercialization is achieved not simply by expanding market access but by ensuring that farmers possess the capacities required to benefit from available market institutions. Within this framework, strengthening institutional resilience and enhancing farmers' adaptive capacities become essential elements of sustainable rural transformation.

The conceptual contribution emerging from this study can therefore be understood as a sequential relationship in which farmers' structural capacities shape their institutional adaptation processes, which subsequently influence their market institution choices and determine their likelihood of participating in auction markets. Ultimately, successful institutional participation contributes to more inclusive forms of rural commercialization. This conceptual pathway highlights that market participation is neither a purely economic phenomenon nor a uniform process experienced similarly by all farmers. Rather, it is an adaptive and institutionally embedded process shaped by the interaction between individual capacities and institutional conditions.

By reframing market participation as institutional market choice, this study contributes to ongoing debates within agricultural economics and rural development regarding the nature of smallholder commercialization. Auction market participation should not be viewed merely as farmers' responses to market prices but as outcomes of institutional engagement processes that require structural capacity, institutional adaptation, and supportive governance arrangements. Such an approach provides a more comprehensive understanding of how market institutions influence agricultural transformation and offers a stronger theoretical foundation for designing inclusive policies aimed at revitalizing collective marketing institutions in rural areas.

CONCLUSION

This study concludes that red chili farmers' participation in auction markets in North Tapanuli Regency is shaped primarily by their structural capacities and their ability to adapt to changing market institutions rather than by price considerations or individual socioeconomic characteristics alone. Farmers' decisions to participate in auction markets are better understood as institutional market choices, in which farm size and farming experience play a central role in determining their capacity to engage with collective marketing arrangements. The findings indicate that auction market participation is embedded within broader processes of institutional transition, where farmers continuously assess the benefits, accessibility, and reliability of available marketing institutions. Consequently, market participation among smallholders should not be conceptualized merely as a decision to sell agricultural products but also as a decision to participate in particular institutional arrangements that govern market transactions. By integrating the perspectives of smallholder market participation and institutional market choice,

this study offers a more nuanced understanding of agricultural commercialization in developing-country contexts and highlights the importance of strengthening both farmers' capacities and market institutions in efforts to revitalize auction markets and promote more inclusive rural development.

ETHICAL STATEMENT AND DISCLOSURE

This study was conducted in accordance with established ethical principles, including informed consent, protection of informants' confidentiality, and respect for local cultural values. Special consideration was given to participants from vulnerable groups to ensure their safety, comfort, and equal rights to participate. No external funding was received, and the authors declare no conflict of interest. All data and information presented were collected through valid research methods and have been verified to ensure their accuracy and reliability. The use of artificial intelligence (AI) was limited to technical assistance for writing and language editing, without influencing the scientific substance of the work. The authors express their gratitude to the informants for their valuable insights, and to the anonymous reviewers for their constructive feedback on an earlier version of this manuscript. The authors take full responsibility for the content and conclusions of this article.

REFERENCES

- Aalmo, G. O. (2026). Social-innovation pathways for the blue bioeconomy: Evidence from BlueRev. *Social Sciences & Humanities Open*, 14, 103183. <https://doi.org/10.1016/j.ssaho.2026.103183>
- Al Abbasi, A. A., Saha, S., Begum, I. A., Rola-Rubzen, M. F., McKenzie, A. M., & Alam, M. J. (2024). Does rural transformation affect rural income inequality? Insights from cross-district panel data analysis in Bangladesh. *Heliyon*, 10(9), e30562. <https://doi.org/10.1016/j.heliyon.2024.e30562>
- Amidu, H., Annan, E., Kiti, J., & Tahiru, A. S. (2026). Water pollution and treatment challenges from artisanal gold mining in Ghana: A decade review (2014–2024). *Scientific African*, 32, e03413. <https://doi.org/10.1016/j.sciaf.2026.e03413>
- Andreotti, F., Bazile, D., Biaggi, C., Callo-Concha, D., Jacquet, J., Jemal, O. M., King, O. I., Mbosso, C., Padulosi, S., Speelman, E. N., & van Noordwijk, M. (2022). When neglected species gain global interest: Lessons learned from quinoa's boom and bust for teff and minor millet. *Global Food Security*, 32, 100613. <https://doi.org/10.1016/j.gfs.2022.100613>
- Anokye, K., Darko, A. O., Portia, A., Amuah, E. E. Y., Sodoke, S., Agya, B. A., Douti, N. B., Kazapoe, R. W., & Bentil, J. (2025). Exploring waste activation and mineralization for environmental and economic sustainability in Ghana. *Cleaner Waste Systems*, 11, 100315. <https://doi.org/10.1016/j.clwas.2025.100315>
- Araujo, V. De, Jardim, P., Pessôa, P., Vasconcelos, J., Souza, M., Garcia, J., Švajlenka, J., & Christoforo, A. (2025). Finger-Joint Lumber: A Systematic Literature Review and a Global Industry Survey on this Ecofriendly Structural Building Material. *Journal of Renewable*

- Materials*, 13(12), 2479–2524. <https://doi.org/10.32604/jrm.2025.02025-0127>
- Ariyanti, O., Sampaio, D., & Bailey, A. (2026). “Tourism is our rice field in Kuta”: The ambivalent experiences of ageing in place in the tourist city. *Wellbeing, Space and Society*, 10, 100414. <https://doi.org/10.1016/j.wss.2026.100414>
- Asamoah, O., Danquah, J. A., Bamwesigye, D., Akalibey, S., Appiah, M., & Pappinen, A. (2025). A systematic review of the potential of non-timber forest products to alleviate poverty. *Ecological Frontiers*, 45(5), 1123–1134. <https://doi.org/10.1016/j.ecofro.2025.05.002>
- Avni, N., & Moser, S. (2026). Mapping waterfront (re)developments in Southeast Asia: Speculation, entrepreneurial urbanism, and blue gentrification. *Cities*, 170, 106714. <https://doi.org/10.1016/j.cities.2025.106714>
- Aza-Mengoa, G. A., Bajos-Arguello, K., & Venus, T. E. (2025). The role of social innovation in the bioeconomy: The case of Costa Rica’s pineapple value web. *Journal of Environmental Management*, 393, 126748. <https://doi.org/10.1016/j.jenvman.2025.126748>
- Bai, J., Johar, S. B., Mohammad, N. B., & Xia, J. (2026). Traditional village protection and sustainable development: Knowledge graph construction and hotspot evolution. *Sustainable Futures*, 11, 101577. <https://doi.org/10.1016/j.sftr.2025.101577>
- Bitzer, V., Moździerz, M., Kuijpers, R., Schouten, G., & Juju, D. B. (2024). Gender and forest resources in low- and middle-income countries: A systematic literature review. *Forest Policy and Economics*, 163, 103226. <https://doi.org/10.1016/j.forpol.2024.103226>
- Chaurasiya, S., Preuss, N., & You, F. (2026). Life cycle assessment of seaweed-based biorefineries: environmental impacts, hotspots, and pathways for a circular bioeconomy. *RSC Sustainability*, 4(5), 2011–2041. <https://doi.org/10.1039/D5SU00840A>
- Del Sarto, N., Ferrigno, G., Isabelle, D. A., & Cazares, C. C. (2026). Accelerators revisited: Taking stock and charting the path forward. *Journal of Engineering and Technology Management*, 81, 101985. <https://doi.org/10.1016/j.jengtecman.2026.101985>
- Ding, Q., Li, R., Liu, Q., & Cui, W. (2025). Human-powered electricity generation: Current technologies, challenges, and potential application in sustainable society construction. *Energy Conversion and Management*: X, 28, 101239. <https://doi.org/10.1016/j.ecmx.2025.101239>
- Divite, A. D., Moses, J. A., Anandakumar, S., Sinija, V. R., & Venkatachalapathy, N. (2026). Toward sustainability in coconut processing: current challenges, emerging concepts, and circular solutions. *Sustainable Food Technology*, 4(3), 2439–2456. <https://doi.org/10.1039/D5FB00508F>
- Dixit, A., & Shaw, R. (2023). Smart Cities in Nepal: The concept, evolution and emerging patterns. *Urban Governance*, 3(3), 211–218. <https://doi.org/10.1016/j.ugj.2023.08.003>
- Fernando, W. M., Ratnayake, R. M. C., Thibbotuwawa, A., & Perera, H. N. (2026). Transforming smallholder agri-food supply chains through digital product passports: A pathway to sustainable markets and innovative business models. *Journal of Open Innovation: Technology, Market, and Complexity*, 12(1), 100736. <https://doi.org/10.1016/j.joitmc.2026.100736>
- Firoozi, A. A., Firoozi, A. A., & Maghami, M. R. (2025). Harnessing photovoltaic innovation: Advancements, challenges, and strategic pathways for sustainable global development. *Energy Conversion and Management*: X, 27, 101058. <https://doi.org/10.1016/j.ecmx.2025.101058>
- Gater, G., Chen, X. H., & Tee, K. (2026). The impact of China’s environmental regulations on

- carbon intensity. *Journal of Environmental Management*, 410, 130031. <https://doi.org/10.1016/j.jenvman.2026.130031>
- Georgiou, P. N., Rentizelas, A., & Kaltsoukalas, K. (2025). Business Models for phytoremediation-to-biofuel transformation ecosystems: A Stakeholder-Supply Chain Nexus approach. *Sustainable Futures*, 10, 101267. <https://doi.org/10.1016/j.sftr.2025.101267>
- Gnych, S., Lawry, S., McLain, R., Monterroso, I., & Adhikary, A. (2020). Is community tenure facilitating investment in the commons for inclusive and sustainable development? *Forest Policy and Economics*, 111, 102088. <https://doi.org/10.1016/j.forpol.2019.102088>
- Gomes, C. (2026). Clean coal technologies as transitional buffers in South Africa's just energy transition: Safeguarding livelihood amid decarbonisation. *Scientific African*, 31, e03210. <https://doi.org/10.1016/j.sciaf.2026.e03210>
- Gunaratne, D., Sinkovics, N., Sinkovics, R. R., & Molina-Castillo, F.-J. (2026). The scaling of game-changer business models to address societal grand challenges. *Multinational Business Review*, 34(1), 1–25. <https://doi.org/10.1108/MBR-07-2024-0130>
- Hasan, M., Abedin, M. Z., Amin, M. Bin, Nekmahmud, M., & Oláh, J. (2023). Sustainable biofuel economy: A mapping through bibliometric research. *Journal of Environmental Management*, 336, 117644. <https://doi.org/10.1016/j.jenvman.2023.117644>
- Hashim, N., Ali, M. M., Mahadi, M. R., Abdullah, A. F., Wayayok, A., Mohd Kassim, M. S., & Jamaluddin, A. (2024). Smart Farming for Sustainable Rice Production: An Insight into Application, Challenge, and Future Prospect. *Rice Science*, 31(1), 47–61. <https://doi.org/10.1016/j.rsci.2023.08.004>
- Headey, D. D., Alderman, H., Hoddinott, J., & Narayanan, S. (2024). The glass of milk half-empty? Dairy development and nutrition in low and middle income countries. *Food Policy*, 122, 102585. <https://doi.org/10.1016/j.foodpol.2023.102585>
- Idroes, G. M., Hardi, I., Hilal, I. S., Utami, R. T., Novianidy, T. R., & Idroes, R. (2024). Economic growth and environmental impact: Assessing the role of geothermal energy in developing and developed countries. *Innovation and Green Development*, 3(3), 100144. <https://doi.org/10.1016/j.igd.2024.100144>
- Iswanto, A., Fadlly, H., Nur, M., Hidayatullah, D., Rakhmad Idris, A. S., Syahrul, N., Wibowo, A. R. R., Bahri, S., Rusnandar, N., Made Budiasa, I., Wayan Nitayadnya, I., & Atisah. (2026). 'The blooming flower under the Garuda Bird': Articulation and agency in safeguarding intangible culture in Indonesia's new capital city. *Social Sciences & Humanities Open*, 13, 102314. <https://doi.org/10.1016/j.ssaho.2025.102314>
- Jannesar Niri, A., Poelzer, G. A., Zhang, S. E., Rosenkranz, J., Pettersson, M., & Ghorbani, Y. (2024). Sustainability challenges throughout the electric vehicle battery value chain. *Renewable and Sustainable Energy Reviews*, 191, 114176. <https://doi.org/10.1016/j.rser.2023.114176>
- Kangasniemi, M., Bhalla, G., Knowles, M., Pereira, K. C., & Gentilini, U. (2025). The role of social protection in achieving resilient and inclusive rural transformation. *Global Food Security*, 44, 100836. <https://doi.org/10.1016/j.gfs.2025.100836>
- Kasula, P., Dedekorkut-Howes, A., Shearer, H., & Baum, S. (2026). Social inclusion of urban villages: A systematic review of global urban planning practices. *Cities*, 169, 106509. <https://doi.org/10.1016/j.cities.2025.106509>
- Kawarazuka, N., Doss, C. R., Farnworth, C. R., & Pyburn, R. (2022). Myths about the feminization of agriculture: Implications for global food security. *Global Food Security*, 33, 100611. <https://doi.org/10.1016/j.gfs.2022.100611>

- Khan, N., Sudhakar, K., & Mamat, R. (2024). Macroalgae farming for sustainable future: Navigating opportunities and driving innovation. *Heliyon*, 10(7), e28208. <https://doi.org/10.1016/j.heliyon.2024.e28208>
- Kim, C., & Lee, J. (2024). Discovering patterns and trends in customer service technologies patents using large language model. *Heliyon*, 10(14), e34701. <https://doi.org/10.1016/j.heliyon.2024.e34701>
- Kusters, K., de Graaf, M., Ascarrunz, N., Benneker, C., Boot, R., van Kantén, R., Livingstone, J., Maindo, A., Mendoza, H., Purwanto, E., Rodríguez, C., Ssemmanda, R., Thang, T. N., & Zagt, R. (2022). Formalizing community forest tenure rights: A theory of change and conditions for success. *Forest Policy and Economics*, 141, 102766. <https://doi.org/10.1016/j.forpol.2022.102766>
- Lowder, S. K., Bhalla, G., & Davis, B. (2025). Decreasing farm sizes and the viability of smallholder farmers: Implications for resilient and inclusive rural transformation. *Global Food Security*, 45, 100854. <https://doi.org/10.1016/j.gfs.2025.100854>
- Makai, L., & Popoola, O. (2025). A review of micro-hybrid energy systems for rural electrification, challenges and probable interventions. *Renewable Energy Focus*, 53, 100687. <https://doi.org/10.1016/j.ref.2025.100687>
- Malapit, H., Ragasa, C., Martinez, E. M., Rubin, D., Seymour, G., & Quisumbing, A. (2020). Empowerment in agricultural value chains: Mixed methods evidence from the Philippines. *Journal of Rural Studies*, 76, 240–253. <https://doi.org/10.1016/j.jrurstud.2020.04.003>
- Marín-García, E. J., Ocampo-López, C., & Bejarano, J. B. P. (2025). Impact of technology transfer on food security in developing territories: a bibliometric analysis and systematic literature review. *Sustainable Futures*, 10, 100770. <https://doi.org/10.1016/j.sftr.2025.100770>
- Martin, A., Sareen, S., Kammen, D. M., Mulvaney, D., Stock, R., Meckling, J., Elkind, E., Girard, B., Ferrall-Wolf, I., & Miles, S. (2026). Governance challenges for a rapid and just solar energy transition. *Energy Policy*, 215, 115312. <https://doi.org/10.1016/j.enpol.2026.115312>
- Maziriri, E. T., Dzingirai, M., Nyagadza, B., & Mabuyana, B. (2024). From perceived parental entrepreneurial passion to technopreneurship intention: The moderating role of perseverance and perceived parental entrepreneurial rewards. *Sustainable Technology and Entrepreneurship*, 3(1), 100051. <https://doi.org/10.1016/j.stae.2023.100051>
- Nahid, F. A., Ali, M. C., Islam, M. M., Akter, K., & Mahmud, H. (2026). Ammonia-to-power in Bangladesh: techno-economic potential, barriers, and a strategic roadmap for the power sector. *Energy Conversion and Management: X*, 30, 101867. <https://doi.org/10.1016/j.ecmx.2026.101867>
- Nassary, E. K., Magubika, A. J., & Tryphone, G. M. (2025). Global perspectives on sorghum production: A SPAR-4-SLR framework of its role, trends, and climate-resilient strategies. *Crop Design*, 4(4), 100121. <https://doi.org/10.1016/j.crope.2025.100121>
- Ng, J. S. C., Chervier, C., Ancrenaz, M., Naito, D., & Karsenty, A. (2022). Recent forest and land-use policy changes in Sabah, Malaysian Borneo: Are they truly transformational? *Land Use Policy*, 121, 106308. <https://doi.org/10.1016/j.landusepol.2022.106308>
- Nguyen, V. T. H., Le-Huynh, T.-L., Gadola, S., Nguyen, Q., Walters, G., & Owuor, M. A. (2025). Local-global linkages in biodiversity governance: The regime complex of the convention on biological diversity agenda for nature pledges. *Environmental Science & Policy*, 173, 104246. <https://doi.org/10.1016/j.envsci.2025.104246>
- O'Connell, A.-L., & Schot, J. (2025). A theoretical and systematic examination of finance in

- strategic niche management. *Environmental Innovation and Societal Transitions*, 56, 100991. <https://doi.org/10.1016/j.eist.2025.100991>
- Ochoa-Herrera, V., Apraez, M., Flor, D., Flores, C., Valencia, M., & Velasco, A. (2025). Comprehensive analysis of plastic regulations in Ecuador: Evaluating the path to a circular economy. *Cleaner Production Letters*, 9, 100108. <https://doi.org/10.1016/j.clpl.2025.100108>
- Padovezi, A., Ludvig, A., Weiss, G., Chazdon, R. L., Rogelja, T., Adams, C., & Secco, L. (2025). Unravelling Brazil's approach: Policy and governance gaps for social innovation in forest and landscape restoration. *Land Use Policy*, 155, 107583. <https://doi.org/10.1016/j.landusepol.2025.107583>
- Pratama, J. H., Rahmawati, Z., Widyanto, A. R., Gunawan, T., Wan Abdullah, W. N., Azua Jamari, N. L., Hamzah, A., & Fansuri, H. (2024). Advancements in green diesel production for energy sustainability: a comprehensive bibliometric analysis. *RSC Advances*, 14(48), 36040–36062. <https://doi.org/10.1039/D4RA06262K>
- Pyburn, R., Slavchevska, V., & Kruijssen, F. (2023). Gender dynamics in agrifood value chains: Advances in research and practice over the last decade. *Global Food Security*, 39, 100721. <https://doi.org/10.1016/j.gfs.2023.100721>
- Rumanti, A. A., Daryanto, Y., Amelia, M., Rizaldi, A. S., Zulkarnain, I., & Andrawina, L. (2025). The role of organizational and stakeholder factors in strengthening digital literacy and communication for edu-tourism. *Journal of Open Innovation: Technology, Market, and Complexity*, 11(3), 100618. <https://doi.org/10.1016/j.joitmc.2025.100618>
- Schoneveld, G. C. (2022). Transforming food systems through inclusive agribusiness. *World Development*, 158, 105970. <https://doi.org/10.1016/j.worlddev.2022.105970>
- Sekyere, C. K. K., Odoi-Yorke, F., Baah, B., Oppon, J. A., Agbenorhevi, A. E., & Atepor, L. (2025). Mapping urban climate change research: Insights from 20 years of global research trends, thematic evolution, and future perspectives. *Nature-Based Solutions*, 8, 100271. <https://doi.org/10.1016/j.nbsj.2025.100271>
- Syahroni, D., Milenia, N. N. B., Hermawan, M. T. T., Fisher, M. R., & Maryudi, A. (2026). Changing models of commercialization of conservation areas and their impacts: A systematic literature review. *Trees, Forests and People*, 25, 101250. <https://doi.org/10.1016/j.tfp.2026.101250>
- Tabe-Ojong, M. P. J., Molua, E. L., Nanfouet, M. A., Mkong, C. J., Kiven, V., & Ntegang, V. A. (2023). Oil palm production, income gains, and off-farm employment among independent producers in Cameroon. *Ecological Economics*, 208, 107817. <https://doi.org/10.1016/j.ecolecon.2023.107817>
- Tham, L. T. (2025). Qualitative scenarios analysis for upgrading timber value chains: A case study in Thua Thien Hue province, central Vietnam. *Trees, Forests and People*, 21, 100952. <https://doi.org/10.1016/j.tfp.2025.100952>
- Uddin, M., Bal, H., & Hoque, N. (2025). Paving the way towards effective entrepreneurship education in private higher educational institutions in emerging economy: An analysis of barriers and strategies. *Sustainable Futures*, 10, 101027. <https://doi.org/10.1016/j.sftr.2025.101027>
- Uzar, U., Eyuboglu, K., & Alola, A. A. (2026). Ecological effects of income inequality, financial development, and natural resources in E7 Countries. *Innovation and Green Development*, 5(2), 100336. <https://doi.org/10.1016/j.igd.2026.100336>

- Van Berkel, R. (2026). Circular economy in Southeast Asia: insights from an exploratory analysis of 75 business cases. *Cleaner Environmental Systems*, 21, 100439. <https://doi.org/10.1016/j.cesys.2026.100439>
- Wahyuni, F. D., Fathoni, A., Sukma, D., Ardie, S. W., Zainuddin, I. M., Qi, B., & Sudarsono, S. (2026). Harnessing genome editing for post-harvest improvement of crops: a comprehensive bibliometric and literature review. *Current Research in Biotechnology*, 11, 100384. <https://doi.org/10.1016/j.crbiot.2026.100384>
- Wittman, H. (2023). Food sovereignty: An inclusive model for feeding the world and cooling the planet. *One Earth*, 6(5), 474–478. <https://doi.org/10.1016/j.oneear.2023.04.011>
- Worakittikul, W., Srisathan, W. A., Rattanpon, K., Kulkaew, A., Groves, J., Pontun, P., & Naruetharadhol, P. (2025). Cultivating sustainability: Harnessing open innovation and circular economy practices for eco-innovation in agricultural SMEs. *Journal of Open Innovation: Technology, Market, and Complexity*, 11(1), 100494. <https://doi.org/10.1016/j.joitmc.2025.100494>
- Yan, L., Gooi, L.-M., Huang, W., & Wang, X. (2025). Ecotourism and economic sustainable development of local communities from the lens of technological innovation: the synergistic role of green industry and social capital. *International Review of Economics & Finance*, 104, 104720. <https://doi.org/10.1016/j.iref.2025.104720>
- Yupanqui, C., Dias, N., Goodarzi, M. R., Sharma, S., Vagheei, H., & Mohtar, R. (2025). A review of water-energy-food nexus frameworks, models, challenges and future opportunities to create an integrated, national security-based development index. *Energy Nexus*, 18, 100409. <https://doi.org/10.1016/j.nexus.2025.100409>