ASIAN JOURNAL OF AGRICULTURE
Volume 10, Number 1, June 2026 E-ISSN: 2580-4537
Pages: 8 https://doi.org/10.13057/asianjagric/g100120

Value chain and nutmeg farmers' welfare in Morella, Central Maluku, Indonesia

VILIA GLAUDYA PAAYS[1], MUSRAN MUNIZU[2], ARIADY ARSAL[3,♥]

[1]Department of Agricultural Business, Graduate School, Universitas Hasanuddin. Jl. Perintis Kemerdekaan Km. 10, Tamalanrea Indah, Tamalanrea, Makassar City 90245, South Sulawesi, Indonesia

[2]Faculty of Economy and Business, Universitas Hasanuddin. Jl. Perintis Kemerdekaan Km. 10, Tamalanrea Indah, Tamalanrea, Makassar City 90245, South Sulawesi, Indonesia

[3]Department of Farming System Program, Graduate School, Universitas Hasanuddin. Jl. Perintis Kemerdekaan Km. 10, Tamalanrea Indah, Tamalanrea, Makassar City 90245, South Sulawesi, Indonesia. Tel./fax.: +62-411-584200, ♥email: ariady.arsal@pasca.unhas.ac.id

Manuscript received: 6 November 2025. Revision accepted: 6 February 2026.

Abstract. *Paays VG, Munizu M, Arsal A. 2026. Value chain and nutmeg farmers' welfare in Morella, Central Maluku, Indonesia. Asian J Agric 10 (1): g100120. https://doi.org/10.13057/asianjagric/g100120.* Nutmeg is one of Indonesia's high-value plantation commodities and plays an important role in supporting rural livelihoods. However, despite its economic potential, many smallholder nutmeg farmers still experience limited welfare improvements due to weak integration within traditional value chain systems. In many producing areas, farmers face constraints such as limited market access, price uncertainty, low bargaining power, and weak institutional support. These conditions reduce farmers' ability to capture the value created along the nutmeg value chain and ultimately limit improvements in income and welfare. Therefore, understanding how value chain performance influences farmer income and welfare is essential for developing effective strategies to improve smallholder livelihoods. This study aims to analyze the direct and indirect relationships between the nutmeg value chain, farmer income, and farmer welfare in Morella Village, Central Maluku District, Indonesia, with income functioning as a mediating variable. The research employed a quantitative explanatory design using survey data collected from 84 nutmeg farmers. Data were analyzed using Structural Equation Modeling-Partial Least Squares (SEM-PLS) to examine the relationships among the variables and test the mediating role of income. The results show that value chain performance has a positive and significant effect on both farmer income and farmer welfare. Improvements in value chain activities such as production management, logistics, marketing, and institutional support contribute to increased farmer income and improved welfare conditions. In addition, income significantly influences farmer welfare and partially mediates the relationship between value chain performance and welfare outcomes. However, the direct effect of the value chain on welfare is stronger than the indirect effect through income, indicating that structural improvements in the value chain contribute to welfare beyond income increases alone. These findings highlight the importance of strengthening the nutmeg value chain to enhance smallholder welfare. Policies that improve market access, develop post-harvest processing, strengthen farmer institutions, and promote technological adoption are essential to ensure that value creation within the nutmeg value chain translates into sustainable income growth and improved welfare for smallholder farmers.

Keywords: Farmer income, farmer welfare, nutmeg, smallholder farmers, value chain

INTRODUCTION

Indonesia is widely recognized as an agrarian country with abundant land resources and rich biodiversity, making agriculture a fundamental pillar of national economic development. Beyond ensuring food security, the sector plays a crucial role in generating employment and supporting rural livelihoods, particularly for communities vulnerable to poverty (Ngadi et al. 2023). In many regions, agricultural activities serve not only as economic endeavors but also as the primary means through which rural households sustain their welfare. Within this sector, the plantation sub-sector has historically contributed to export earnings, industrial raw materials, and job creation. Among plantation commodities, nutmeg holds a distinctive position due to its high economic value, long history of cultivation, and strong linkages to global spice markets. However, the economic potential of plantation commodities does not always translate into improved welfare for primary producers, especially smallholder farmers who often face structural constraints in production and marketing systems.

Maluku Province possesses considerable agricultural and plantation potential and is one of Indonesia's major nutmeg-producing regions after North Sulawesi, North Maluku, and Aceh (Ditjenbun 2024). According to data from the BPS Provinsi Maluku (2025), Central Maluku District has the largest nutmeg plantation area and production volume in the province, covering 12,559.84 hectares with an output of 2,295.45 tons. This highlights nutmeg as a leading commodity in the region in terms of land use and economic contribution. Nutmeg produced by farmers is marketed in various forms, including seeds, mace, and fruit pulp, reflecting its diverse utilization potential. Within Central Maluku District, Morella Village constitutes one of the key nutmeg-producing areas and plays an important role in sustaining regional nutmeg supply. Nutmeg cultivation in Morella also provides employment opportunities in rural areas and contributes to local income generation (Raihan et al. 2024).

Despite its strategic importance, the nutmeg value chain in Morella is still dominated by traditional arrangements involving farmers, traders, and processors, where farmers generally occupy the weakest position. Limited capacity in cultivation practices, business management, and institutional organization, along with price uncertainty, restricted market access, and weak supporting institutions, constrain farmers' bargaining power and income. These conditions increase farmers' dependence on intermediaries and limit welfare improvements despite the commodity's high economic value. Therefore, improving the welfare of nutmeg farmers requires not only increasing production but also strengthening the value chain through farmer capacity building, technological development in processing, and improved access to fair and transparent markets supported by appropriate policies and institutional frameworks (Ijassi et al. 2025). Sustainable production further depends on quality standardization, transparent trading mechanisms, and innovation incentives that encourage value addition and efficiency along the chain (Satama-Bermeo et al. 2025). In addition, partnerships among value chain actors facilitate knowledge transfer, improve access to technology, and promote more equitable profit distribution, thereby enhancing farmers' bargaining positions (Bosompem et al. 2024).

Despite increasing attention to value chain strengthening, many empirical studies on agricultural value chains focus mainly on major commodities or specific marketing aspects such as price formation and promotion. For example, Selumang et al. (2020) examined price and promotion effects on nutmeg collectors but did not explore broader linkages between value chain actors or their implications for farmer welfare. Consequently, empirical evidence connecting value chain performance with farmer income and welfare remains limited, particularly for nutmeg in eastern Indonesia where traditional marketing systems dominate and farmers rely heavily on informal trade arrangements. Understanding how value chain structures influence income generation and welfare outcomes is therefore essential for developing effective policies to improve smallholder livelihoods.

This study examines the relationships between the nutmeg value chain, farmer income, and farmer welfare among smallholder farmers in eastern Indonesia. Using a value chain-income-welfare perspective, the study considers income as a key mechanism through which improvements in value chain performance translate into welfare gains. Focusing on Morella Village in Central Maluku District as a representative nutmeg-producing area, this study analyzes both the direct and indirect effects of value chain performance on farmer welfare. The findings are expected to provide empirical insights that support value chain upgrading strategies and policy formulation to improve the welfare of smallholder farmers in similar rural contexts.

MATERIALS AND METHODS

Study area

This study was conducted in Morella Village, Leihitu District, Central Maluku District, Maluku Province, Indonesia, in January 2025. Central Maluku District is the largest nutmeg-producing area in Maluku Province, making it a relevant location for examining value chain performance and farmer welfare. Morella Village was purposively selected because nutmeg farming constitutes the primary livelihood for most rural households and is characterized by smallholder-based production and traditional marketing arrangements. The geographical location of the study area within Indonesia, Maluku Province, and Central Maluku District is illustrated in the study area map (Figure 1).

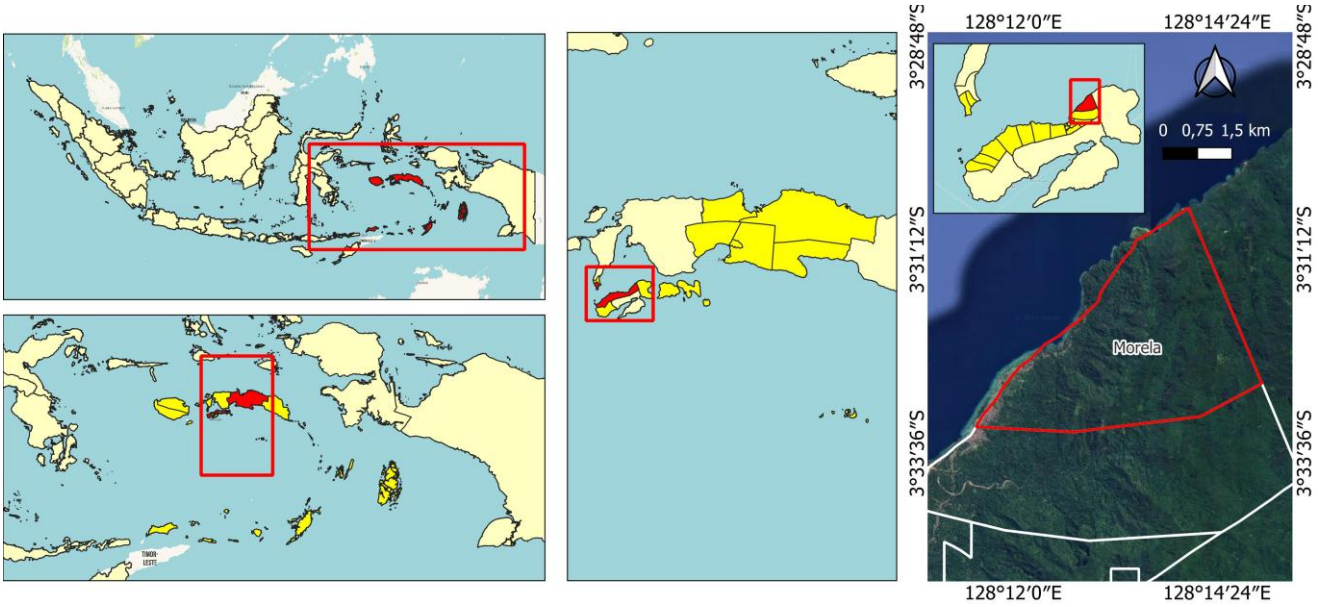

Figure 1. Map of the study area in Morella Village, Central Maluku District, Indonesia

Research design

This study employed a quantitative explanatory research design to analyze the direct and indirect relationships between the nutmeg value chain, farmer income, and farmer welfare. Quantitative research was selected because it allows systematic measurement of relationships among variables using numerical data and statistical analysis, consistent with positivist research principles (Sugiyono 2017).

Population and sampling

The population of this study consisted of 541 nutmeg farmers in Morella Village. In the preliminary stage, purposive and snowball sampling were applied solely to identify key actors in the nutmeg value chain, such as collectors, wholesalers, and processors, in order to obtain a descriptive understanding of the value chain structure. These respondents were not included in the SEM-PLS analysis.

The main analysis was conducted exclusively using data from nutmeg farmers. The sample size was determined using Slovin's formula with a 10% margin of error, which is commonly applied in village-level agricultural research involving relatively homogeneous populations and field constraints. A 10% margin of error was considered appropriate given the exploratory-explanatory nature of the study and the robustness of SEM-PLS for moderate sample sizes. The sample size was determined using the Slovin formula as follows:

$$n = \frac{\mathrm{N}}{1 + \mathrm{N}e^2}$$

Where:
n: Number of samples
N: Population size
e: Error tolerance limit (error tolerance) used is 10%

The population size of nutmeg farmers in Negeri Morella is 541 people. Using the Slovin formula, the number of respondents obtained is 84 respondents.

$$n = \frac{541}{1 + 541\ (0{,}1)^2} = 84{,}399$$

Based on this calculation, a total of 84 nutmeg farmers were selected as respondents. To ensure representativeness, stratified random sampling was employed based on landholding size, which reflects differences in production capacity and income levels. Farmers were categorized into small-scale, medium-scale, and large-scale groups, and respondents from each stratum were selected proportionally through random sampling.

Data collection

Primary data were collected through direct structured interviews using a questionnaire administered to nutmeg farmers. The questionnaire captured information on value chain participation, income, and farmer welfare conditions. The instrument consisted of 16 indicators distributed across three constructs, namely value chain (9 indicators), income (3 indicators), and farmer welfare (4 indicators).

Value chain indicators were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), following established practices in value chain perception studies (Al Juboori et al. 2025). Income and farmer welfare indicators were measured using numeric continuous data, such as annual income in Rupiah, land productivity (kg/ha/year), and production volume per year, to reflect actual economic performance.

Table 1 outlines the detailed measurement of variable indicators. Indicators for the value chain variable are measured using a Likert scale with response scores ranging from 1 to 5 (Al Juboori et al. 2025). Meanwhile, indicators for income and farmer welfare are measured using numeric continuous data (Rupiah value per year, land productivity in kg/ha, and production volume per year) to represent actual economic performance of nutmeg farmers in the field. This study consists of a value chain with 9 Likert-based indicators, while income and farmer welfare each consist of 3 and 4 indicators measured using real numeric values (Figure 2).

Figure 2 is a structural model in the study that describes the relationship between variables in SEM-PLS analysis, where the Value Chain (X) variable is positioned as an exogenous variable that affects Income (Z) and Farmer Welfare (Y), while Income (Z) also affects Farmer Welfare (Y). Each variable is measured by a number of indicators, namely Value Chain with 9 indicators, Income with 3 indicators, and Farmer Welfare with 4 indicators. This model shows that the influence of Value Chain on Farmer Welfare is tested through two paths, namely the direct path and the indirect path through Income as a mediator variable.

Data analysis

Data were analyzed using Structural Equation Modeling-Partial Least Squares (SEM-PLS) with SmartPLS version 4. SEM-PLS was selected because it is suitable for relatively small to moderate sample sizes, accommodates mixed data types (ordinal and continuous), and does not require strict normality assumptions (Ghozali and Latari 2015). The SEM model consisted of one exogenous latent variable (value chain) and two endogenous latent variables (income and farmer welfare).

Measurement model specification

To ensure conceptual consistency, this study explicitly distinguishes between formative and reflective constructs. The value chain (X) was specified as a formative construct, as its indicators represent distinct activities and supporting functions-such as logistics, operations, marketing, infrastructure, and technology-that jointly form the overall value chain rather than reflect a single underlying latent trait (Porter 2008). Multicollinearity among formative indicators was assessed using the Variance Inflation Factor (VIF), with values below 5 indicating acceptable levels. Indicator relevance was evaluated through outer weights.

Table 1. Operational definitions of variables and indicators

Variable	Definition	Indicator	Scale
Value Chain (X) (Porter 2008)	The entire series of activities carried out by the main actors and supporters, ranging from cultivation, harvesting, post-harvesting, processing, to distribution and marketing of nutmeg in Morella Village.	Internal logistics Operations External logistics Marketing and sales Services Infrastructure Human resources Technology Procurement	Likert (1-5)
Income (Z) (Ridho 2020)	Total income received by nutmeg farmers in Morella Village from nutmeg farming activities during a certain period.	Annual income Land productivity per hectar Total from various sources of income	Numeric (continuous)
Farmer Welfare (Y) (Fahrudin 2019)	The level of fulfillment of economic, social, and livelihood sustainability needs of nutmeg farmers in Morella Village as a result of their involvement in the nutmeg value chain.	Crop productivity Labor productivity Working age population Access to services	Numeric (continuous)

Source: Developed by the author

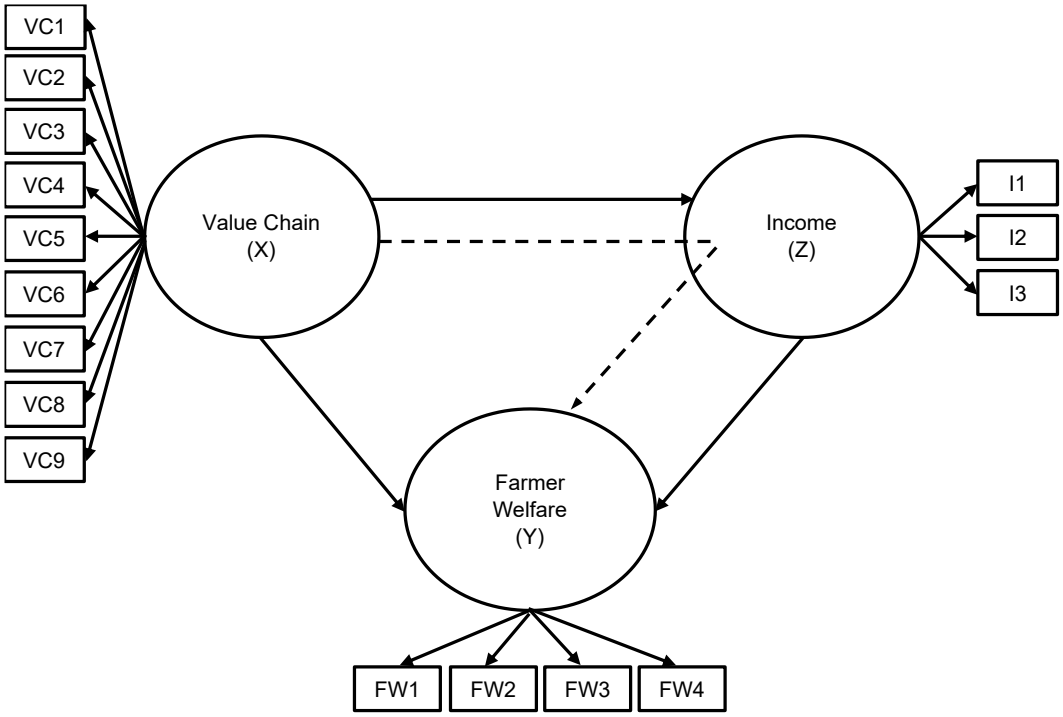

Figure 2. Structural model of SEM-PLS

The income (Z) and farmer welfare (Y) constructs were modeled as reflective constructs, as their indicators represent manifestations of underlying economic and welfare conditions. For reflective constructs, validity and reliability were assessed using factor loadings, Average Variance Extracted (AVE), Composite Reliability, and Cronbach's Alpha, following established SEM criteria (Anuraga et al. 2017).

Structural model evaluation

The structural model was evaluated using the coefficient of determination (R^2) to assess the explanatory power of the endogenous constructs and effect size (f^2) to determine the magnitude of each structural relationship (Chin 1998). The model examined the direct effects of the value chain on income and farmer welfare, as well as the direct effect of income on farmer welfare. In addition, the indirect effect of the value chain on farmer welfare through income was tested to assess the mediating role of income.

This specification enables a comprehensive assessment of both direct and indirect pathways through which value chain performance influences farmer income and welfare outcomes.

RESULTS AND DISCUSSION

Evaluation of measurement models (outer model)

This study evaluates the measurement model through various tests consisting of convergent validity, discriminant validity, and reliability tests. Convergent validity measures how much the indicators of latent variables share variance with each other, usually indicated by factor loadings. To evaluate discriminant validity, which tests how different a construct is from other constructs using cross loading values, Fornell-Larcker criteria, and Average Variance Extracted (AVE). Conversely, reliability tests use composite reliability values and Cronbach's alpha to assess how reliable a measurement tool is for measuring a construct.

Figure 3 presents the outer loading results of the research model, indicating that all indicators of the Value Chain, Income, and Farmer Welfare constructs meet the established validity criteria. To complement the visual representation, Table 2 summarizes the outer loading and Average Variance Extracted (AVE) values for each latent variable.

Convergent validity was assessed using outer loadings and Average Variance Extracted (AVE) for the reflective constructs. The results indicate that all constructs satisfy the established convergent validity criteria, demonstrating that the indicators adequately represent their respective latent variables. As shown in Table 2, the outer loading and AVE values confirm that the measurement model exhibits satisfactory convergent validity.

Table 3 shows the results of the Fornell-Larcker test, which indicate that the AVE square root value for each variable (shown on the diagonal of the table) is greater than the correlation between variables outside the diagonal. This means that each construct in this study has met the criteria for discriminant validity, because each variable can clearly distinguish itself from other variables.

As shown in Table 4, the Cronbach's alpha and composite reliability values for all constructs indicate satisfactory internal consistency, confirming that the measurement instruments are reliable for further analysis (Barati et al. 2019). These results demonstrate that the indicators consistently capture their respective latent constructs.

Although value chain activities are often conceptualized as formative, this study specifies the value chain as a reflective construct. This specification is based on the assumption that changes in overall value chain performance are simultaneously reflected across its dimensions, such as logistics efficiency, operational effectiveness, marketing capability, and technological support. Accordingly, the indicators are treated as manifestations of an underlying latent construct rather than as independent components forming it. This conceptualization justifies the application of reflective measurement evaluation criteria in this study.

Structural model evaluation (Inner model)

Structural model evaluation (inner model) is evaluated as the next stage in analyzing PLS-SEM findings after the measurement model (outer model) has produced satisfactory results. To find evidence that the theoretical model is valid, the structural model uses the R-square, F-square, and Goodness of Fit tests (Hair et al. 2019).

Table 5 presents the R-square and adjusted R-square values for the endogenous constructs. The results indicate that the value chain explains a substantial proportion of variance in farmer welfare and a moderate proportion of variance in income. Overall, the model demonstrates adequate explanatory power, particularly in explaining farmer welfare outcomes, supporting the empirical relevance of the proposed conceptual framework (Chin 1998).

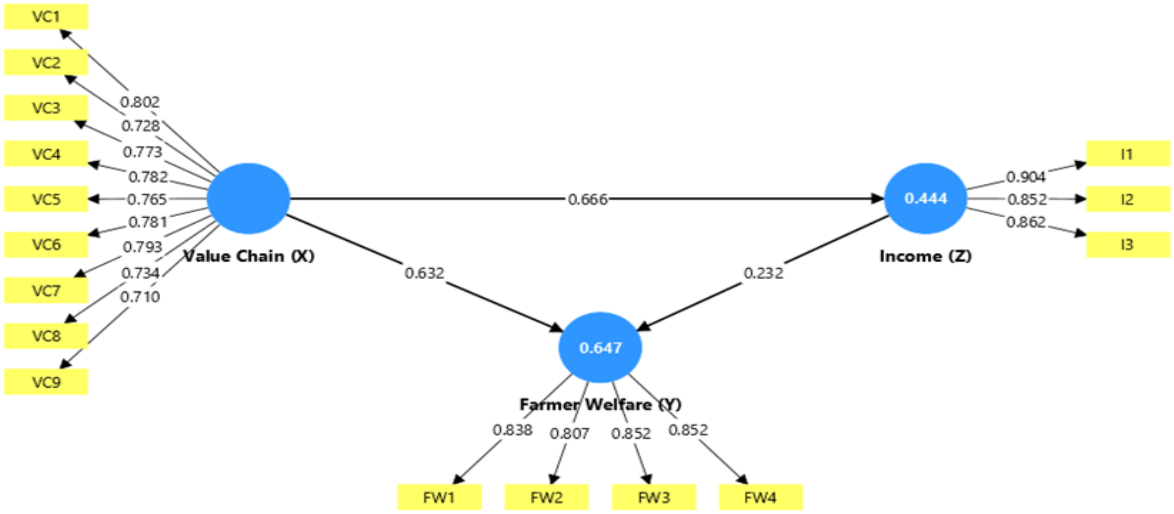

Figure 3. Convergent validity

Table 6 reports the effect size (f-square) values for the structural relationships in the model. The results show that income has a relatively small effect on farmer welfare, while the value chain exhibits a substantial effect on both farmer welfare and income. These findings indicate that variations in farmer welfare and income are driven more strongly by value chain performance than by income alone (Hair et al. 2021).

Hypothesis testing

The hypothesis testing in this study aims to ascertain whether the proposed hypotheses have a significant influence. To ascertain the significance level of the influence of the relationship between variables, the t-statistic value must be more than the t-table value (1.96), and the p-values must be less than 5% with a 95% confidence level. The hypothesis is deemed significant or accepted if the t-statistic value is greater than 1.96 and the p-value is less than 0.05. However, if the t-statistic value is less than 1.96 and the p-value is greater than 0.05, the hypothesis is rejected or considered not significant.

Table 7 presents the results of the direct and indirect effects in the structural model. The findings indicate that the value chain has a positive and statistically significant effect on both farmer welfare and income. In addition, income also shows a positive and significant effect on farmer welfare. The indirect path confirms that income partially mediates the relationship between the value chain and farmer welfare, indicating the presence of both direct and indirect transmission mechanisms.

Overall, the results demonstrate that improvements in value chain performance are associated with higher farmer income and improved welfare outcomes. While the direct effect of the value chain on farmer welfare is stronger, the mediating role of income remains statistically significant, suggesting that income functions as an important-though not dominant-pathway through which value chain improvements influence farmer welfare.

Table 2. Loading factor and AVE value

Latent Variable	Indicator	Farmer Welfare (Y)	Income (Z)	Value Chain (X)	AVE	Description
Farmer Welfare (Y)	(FW1) Crop productivity	0.838			0.702	Valid
	(FW2) Labor productivity	0.807				
	(FW3) Working age population	0.852				
	(FW4) Access to services	0.852				
Income (Z)	(I1) Annual income		0.904		0.762	Valid
	(I2) Land productivity per hectar		0.852			
	(I3) Total from various sources of income		0.862			
Value Chain (X)	(VC1) Internal logistics			0.802	0.583	Valid
	(VC2) Operations			0.728		
	(VC3) External logistics			0.773		
	(VC4) Marketing and Sales			0.782		
	(VC5) Services			0.765		
	(VC6) Infrastructure			0.781		
	(VC7) Human resources			0.793		
	(VC8) Technology			0.734		
	(VC9) Procurement			0.710		

Source: SmartPLS results in 2025

Table 3. Fornell-Larcker

	Farmer Welfare (Y)	Income (Z)	Value Chain (X)
Farmer Welfare (Y)	0.838		
Income (Z)	0.652	0.873	
Value Chain (X)	0.786	0.666	0.764

Source: SmartPLS results in 2025

Table 4. Reliability test

	Cronbach's alpha	Composite reliability (rho_c)
Farmer Welfare (Y)	0.858	0.904
Income (Z)	0.846	0.906
Value Chain (X)	0.911	0.926

Source: SmartPLS results in 2025

Table 5. R-square

	R-square	R-square adjusted
Farmer Welfare (Y)	0.647	0.639
Income (Z)	0.444	0.437

Source: SmartPLS results in 2025

Table 6. F-square

	F-square
Income (Z) → Farmer Welfare (Y)	0.085
Value Chain (X) → Farmer Welfare (Y)	0.629
Value Chain (X) → Income (Z)	0.797

Source: SmartPLS results in 2025

Table 7. Direct effects and indirect effects

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Value Chain (X) → Farmer Welfare (Y)	0.632	0.646	0.067	9.358	0.000
Value Chain (X) → Income (Z)	0.666	0.669	0.061	10.890	0.000
Income (Z) → Farmer Welfare (Y)	0.232	0.223	0.075	3.068	0.002
Value Chain → Income → Farmer Welfare	0.154	0.149	0.052	2.974	0.003

Source: SmartPLS results 2025

Discussion

The results of the SEM-PLS analysis indicate that the value chain construct is well represented by its key operational and supporting dimensions, including logistics, operations, marketing and sales, infrastructure, human resources, technology, and procurement. These dimensions collectively reflect the overall performance of the nutmeg value chain and confirm that value chain improvement is a multidimensional process rather than a single operational intervention. Similarly, income and farmer welfare are adequately captured by indicators that reflect actual economic performance and livelihood conditions, allowing for a meaningful interpretation of their relationships within the model.

The strong direct effect of the value chain on farmer welfare suggests that improvements in value chain performance generate welfare benefits that extend beyond income alone. In the context of nutmeg farming in Morella Village, enhanced coordination among value chain actors, improved access to markets, reduced transaction uncertainty, and better production support systems can directly improve farmers' living conditions. These structural improvements may reduce vulnerability, increase livelihood stability, and enhance access to services, which are key components of welfare but are not always immediately reflected in income measures. This finding supports the argument that welfare outcomes in smallholder-based agricultural systems are influenced by institutional and structural factors embedded in the value chain.

The relatively small effect size of income on farmer welfare compared to the direct effect of the value chain can be explained by the nature of smallholder agricultural income. Nutmeg farming income is typically seasonal, volatile, and highly dependent on harvest cycles and market prices. As a result, increases in income may not be sufficiently stable or sustained to produce proportional improvements in welfare indicators such as education, health access, or long-term livelihood security. This condition limits the ability of income to function as a dominant transmission mechanism between value chain performance and welfare outcomes. Similar observations have been reported by Wardah et al. (2024), who emphasize that income gains alone are often insufficient to significantly improve farmer welfare without accompanying structural improvements.

Despite the positive contribution of value chain strengthening, welfare gains remain constrained by several external factors. Price volatility in nutmeg markets exposes farmers to income uncertainty, even when production and marketing processes are efficient. In addition, asymmetric market power between farmers and traders often limits farmers' ability to capture a larger share of value added. Policy limitations, such as the absence of price stabilization mechanisms or weak institutional support for farmer organizations, further restrict the potential welfare impact of value chain improvements. These external conditions highlight that value chain upgrading must be complemented by supportive policy frameworks to ensure that welfare gains are sustainable.

The significant effect of the value chain on income confirms that efficient management of production, post-harvest handling, and marketing activities contributes to higher farmer income. This finding is consistent with previous studies emphasizing the role of value chain optimization in enhancing farm-level income and economic performance (Ibnu 2023; Wardah et al. 2024). However, the results also indicate that income functions as a partial mediator, suggesting that while income increases remain important, they do not fully explain welfare improvements. This reinforces the need to view income as one of several pathways through which value chain performance influences farmer welfare.

The mediating role of income demonstrates that value chain improvements indirectly enhance welfare by increasing farmers' earning capacity. This finding aligns with previous studies showing that income is a key component of economic welfare in farming communities (Abidin et al. 2023; Kadir et al. 2025). Nevertheless, the partial nature of this mediation indicates that welfare improvements are also driven by non-income factors such as improved access to information, services, and institutional support. Therefore, interventions that focus exclusively on income enhancement may overlook other critical determinants of farmer welfare.

Overall, the discussion highlights that strengthening the nutmeg value chain has both direct and indirect implications for farmer welfare. Direct welfare gains arise from improved structural conditions within the value chain, while indirect gains operate through increased income. These findings underscore the importance of integrated value chain development strategies that simultaneously address production efficiency, market access, institutional strengthening, and policy support. Such an approach can enhance the resilience and competitiveness of nutmeg farmers while ensuring that economic gains translate into meaningful welfare improvements.

From a policy perspective, local governments should not only function as regulators but also act as facilitators of value chain development through targeted capacity-

building programs, improved market access, and institutional support for farmers. Strengthening farmer organizations, promoting processing and technological innovation, and enhancing market transparency can help farmers capture greater value added and reduce vulnerability to external shocks. By aligning value chain upgrading with farmer empowerment initiatives, welfare improvements among nutmeg farmers can become more stable and sustainable.

In conclusion, this study confirms that the nutmeg value chain has a significant direct and indirect influence on farmer welfare in Morella Village, with income functioning as a partial mediator. These findings reinforce the value chain-income-welfare framework by demonstrating that welfare improvements are not solely driven by income growth, but also by structural efficiencies and integration within the value chain. Empirically, this study strengthens the application of PLS-SEM in agribusiness research, particularly in the context of local spice commodities and smallholder farming systems.

From a policy and practical perspective, the results suggest that value chain upgrading strategies should focus on improving market access, post-harvest handling, processing, and institutional support to ensure that value creation reaches farmers more effectively. Rural development policies and farmer empowerment programs need to emphasize capacity building, technology adoption, and organizational strengthening so that improvements in the value chain lead to sustainable income growth and welfare enhancement. Despite its contributions, this study is limited by its cross-sectional design and self-reported data; therefore, future research should employ longitudinal and comparative approaches across different commodities to strengthen causal inference and generalizability.

ACKNOWLEDGEMENTS

The authors would like to thank all those who contributed to this research, especially Universitas Hasanuddin, the Graduate School, and the Agribusiness Study Program from South Sulawesi, Indonesia. Our gratitude also goes to the supervisors who have assisted the author from the beginning to the end of this research. In addition, the author declares that there are no conflicts of interest that could influence the results and interpretation of this research.

REFERENCES

Abidin I, Yafiz M, Harahap MI. 2023. Pengaruh pendapatan dan pola konsumsi terhadap kesejahteraan petani tomat di Desa Bulan Baru Kabupaten Karo. Kabilah J Social Community 8 (1): 1148-1163. https://doi.org/10.35127/kabillah.v8i1.254. [Indonesian]

Al Juboori R, Barker D, Kim YJ. 2025. Predictors of academic adjustment among international students in rural Southern USA. Intl J Environ Res Public Health 22 (2): 253. https://doi.org/10.3390/ijerph22020253.

Anuraga G, Sulistiyawan E, Munadhiroh S. 2017. Structural Equation Modeling - Partial Least Square untuk Pemodelan Indeks Pembangunan Kesehatan Masyarakat (IPKM) di Jawa Timur. Seminar Nasional Matematika dan Aplikasinya. 21 Oktober 2017. Universitas Airlangga, Surabaya. [Indonesian]

Barati M, Taheri-Kharameh Z, Farghadani Z, Rásky É. 2019. Validity and reliability evaluation of the Persian version of the Heart Failure-Specific Health Literacy Scale. Intl J Community Based Nurs Midwifery 7 (3): 222-230. https://doi.org/10.30476/ijcbnm.2019.44997.

Bosompem M, Arhin P, Nunoo J, Amoah KK. 2024. Smallholder farmers' participation in cassava value addition practices: What drivers matter in Ghana? J Agric Food Res 16: 101120. https://doi.org/10.1016/j.jafr.2024.101120.

Chin WW. 1998. The partial least squares approach to structural equation modeling. In: Marcoulides GA (eds). Modern Methods for Business Research. Psychology Press, New Jersey.

Direktorat Jenderal Perkebunan (Ditjenbun). 2024. Plantation Statistics Vol 1 2023-2025. Direktorat Jenderal Perkebunan Kementerian Pertanian, Jakarta. [Indonesian]

Fahrudin. 2019. Pengantar Kesejahteraan Sosial. Penebar Swadaya, Jakarta. [Indonesian]

Ghozali I, Latari H. 2015. Concepts, Techniques, Applications using SmartPLS 3.0. Universitas Diponegoro Press, Semarang. [Indonesian]

Hair JF, Hult GT, Ringle CM, Sarstedt M. 2021. A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Sage Publications, California. https://doi.org/10.1007/978-3-030-80519-7.

Hair JF, Risher JJ, Sarstedt M, Ringle CM. 2019. When to use and how to report PLS-SEM. Eur Bus Rev 31 (1): 2-24. https://doi.org/10.1108/EBR-11-2018-0203.

Ibnu M. 2023. Penerapan standar dan sertifikasi dalam rantai nilai kopi: Peluang dan kendala bagi petani. Jurnal Litbang Media Informasi Penelitian Pengembangan dan IPTEK 19 (1): 1-16. https://doi.org/10.33658/jl.v19i1.327. [Indonesian]

Ijassi W, Evrard D, Zwolinski P. 2025. Characterizing value chain patterns of urban factories. J Clean Prod 520: 146061. https://doi.org/10.1016/j.jclepro.2025.146061.

Kadir S, Panigoro M, Sudirman S, Hafid R, Damiti F. 2025. Pengaruh pendapatan dan konsumsi rumah tangga terhadap kesejahteraan keluarga petani cabai. J Econ Bus Educ 3 (1): 13-32. https://doi.org/10.37479/jebe.v3i1.27419. [Indonesian]

Ngadi N, Zaelany AA, Latifa A, Harfina D, Asiati D, Setiawan B, Ibnu F, Triyono T, Rajagukguk Z. 2023. Challenge of agriculture development in Indonesia: Rural youth mobility and aging workers in agriculture sector. Sustainability 15 (2): 922. https://doi.org/10.3390/su15020922.

Porter ME. 2008. Competitive Advantage: Creating and Sustaining Superior Performance. Simon and Schuster, New York.

Raihan A, Tanchangya T, Rahman J, Ridwan M. 2024. The influence of agriculture, renewable energy, international trade, and economic growth on India's environmental sustainability. J Environ Energy Econ 3 (1): 37-53. https://doi.org/10.56946/jeee.v3i1.324.

Ridho AS. 2020. Pengembangan Diversifikasi Usaha yang Berbasis Pada Usaha Tani Padi dan Pengaruhnya terhadap Pendapatan Petani di Desa Tanjung Agung Kabupaten Muara Enim. [Thesis]. Universitas Sriwijaya, Palembang. [Indonesian]

Satama-Bermeo G, Lopez-Guede JM, Rahebi J, Teso-Fz-Betoño D, Boyano A, Akizu-Gardoki O. 2025. PRISMA review: Drones and AI in inventory creation of signage. Drones 9 (3): 221. https://doi.org/10.3390/drones9030221.

Selumang HS, Areros WA, Tatimu V. 2020. Harga dan promosi terhadap keputusan pembelian pala kering pedagang pengumpul Kecamatan Siau Barat Utara. Productivity 1 (4): 368-373. [Indonesian]

Statistics Indonesia Maluku Province (BPS Provinsi Maluku). 2025. Maluku Province in Figures 2025. BPS-Statistics Maluku Province, Ambon. [Indonesian]

Sugiyono. 2017. Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Alfabeta, Bandung. [Indonesian]

Wardah S, Surya RZ, Yoanda D. 2024. Model pengukuran kinerja dan nilai tambah rantai pasok agroindustri kopra untuk meningkatkan kesejahteraan petani kelapa (Studi Kasus: CV. X di Kabupaten Indragiri Hilir). Selodang Mayang Jurnal Ilmiah Badan Perencanaan Pembangunan Daerah Kabupaten Indragiri Hilir 10 (1): 31-39. https://doi.org/10.47521/selodangmayang.v10i1.347. [Indonesian]