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Production efficiency as a mediating mechanism linking financial management and agricultural institutions to farm profitability

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ABSTRACT

This study examines how financial management and agricultural institutions are associated with farm profitability through production efficiency as a mediating mechanism. The unit of analysis is the individual farm business managed by food-crop farmers in Maros Regency, South Sulawesi, Indonesia. A quantitative explanatory design was used, and survey data from 150 farmers were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results show that financial management and agricultural institutions have positive and significant relationships with production efficiency, with path coefficients of 0.667 and 0.490, respectively. Production efficiency is also positively related to farm profitability (0.618), while the direct relationships of financial management (0.222) and agricultural institutions (0.203) with profitability remain significant but smaller than their mediated pathways. Bootstrapping results indicate significant indirect effects from financial management to profitability through production efficiency (0.412) and from agricultural institutions to profitability through production efficiency (0.303), confirming partial mediation. The model explains 64.3% of the variance in production efficiency and 75.3% of the variance in farm profitability. These findings suggest that managerial and institutional interventions are more likely to improve profitability when they are explicitly directed toward more efficient input use, cost control, and productivity improvement.

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Introduction

The agricultural sector plays a strategic role in national economic development, particularly in food provision, employment generation, and rural welfare improvement (Davidova & Latruffe, 2007; Martinho, 2022). In Indonesia, agriculture continues to contribute substantially to the national economy. The contribution of agriculture to Indonesia's Gross Domestic Product (GDP), as illustrated in Figure 1, remained within the range of approximately 12%-13% during 2018-2025. The increase to around 13.7% in 2020 reflected the sector's resilience during the pandemic period; however, the subsequent decline to around 12.4%-12.7% during 2022-2025 indicates that the sector still faces challenges in generating higher value added.

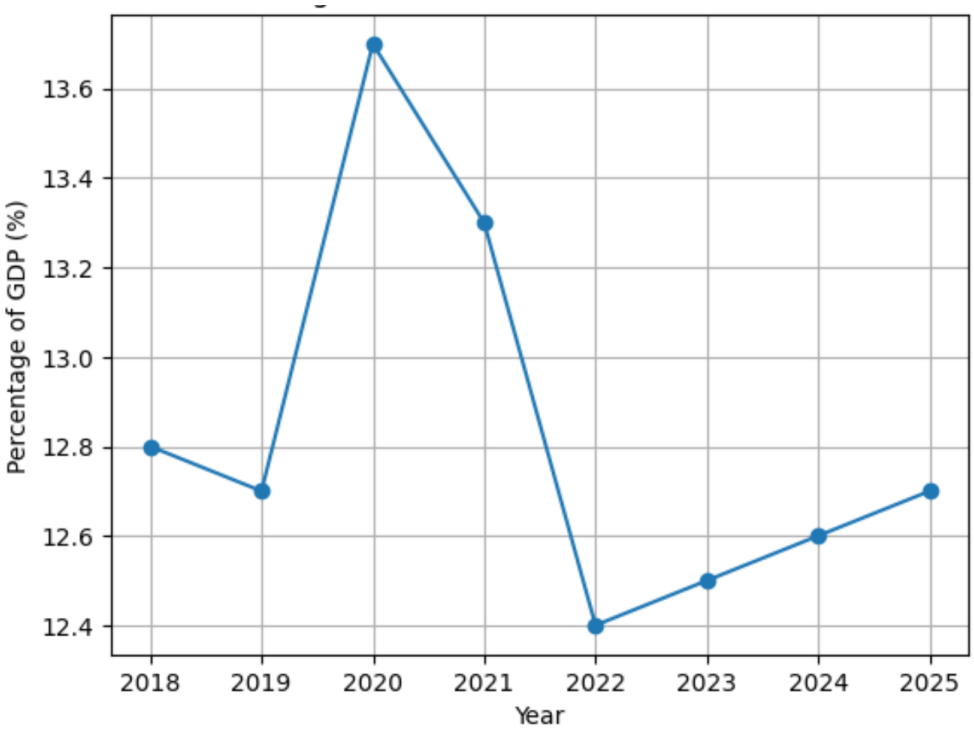

Figure 1. Contribution of the Agricultural Sector to Indonesia's GDP, 2018-2025
Source: Statistics Indonesia (BPS) and the World Bank, processed by the author. Note: 2025 data are trend estimates.

This macroeconomic pattern matters because a stable or declining agricultural GDP share does not automatically translate into higher welfare at the farm level. From a resource-efficiency and institutional support perspective, farm profitability depends on how effectively farmers transform land, labor, capital, inputs, and knowledge into marketable output. Therefore, the central issue is not only whether agriculture remains large in the national economy, but also whether individual farm businesses can manage resources efficiently enough to improve income and profitability.

This study addresses the following critical question: through what mechanism do farm-level financial management and agricultural institutional support translate into better profitability? The study argues that production efficiency is the main transmission mechanism. Farmers may have access to financial planning, records, credit, farmer groups, extension services, or marketing support, yet these resources will not automatically produce higher profits unless they improve input allocation, reduce unnecessary production costs, and raise output per unit of input.

Farm profitability is an important indicator of agricultural performance because it reflects the ability of farming activities to generate economic returns from production (Galluzzo, 2022). Many farmers still face high input costs, limited access to technology, weak farm management practices, and unequal access to market information (Imhanrenialena & Nwobodo-Anyadiegwu, 2025; Madani et al., 2025; Zuhri et al., 2024). These constraints are particularly relevant to small and medium-scale farmers, whose profit margins are highly sensitive to changes in input prices and production efficiency.

Production efficiency refers to the ability of farmers to use production factors optimally to obtain maximum output at minimum feasible cost (Farrell, 1957; Coelli et al., 2005). In farming systems, efficiency includes the use of land, labor, fertilizers, seeds, machinery, and cultivation technology. Inefficient input use increases production costs and reduces profit margins, while efficient input use improves the capacity of farmers to maintain economic returns even under market uncertainty.

In addition to technical factors, managerial and institutional dimensions are crucial for explaining farm performance. Financial management includes capital planning, record-keeping, cash-flow management, production cost control, and financial decision-making (Gloy & LaDue, 2003; Omobitan & Khanal, 2022). Farmers with stronger financial management practices are expected to evaluate production costs more carefully and allocate inputs more efficiently. Agricultural institutions, including farmer groups, farmer group associations, cooperatives, extension services, and market-support organizations, reduce information gaps and

provide access to technology, capital, training, and marketing channels (FAO, 2017; Raifu & Aminu, 2020; Veesam et al., 2025).

Previous studies have examined farm efficiency, profitability, managerial capability, and institutional support, but many of them emphasize direct relationships or examine these dimensions separately (Mishra et al., 2009; Rahman et al., 2020; Vanhuyse et al., 2021; Omobitan & Khanal, 2022). The novelty of this study lies in integrating financial management, agricultural institutions, production efficiency, and farm profitability into one mediation model. This approach extends prior farm management literature by showing that managerial and institutional factors are not only direct predictors of profitability but also operate through production efficiency as an intervening mechanism.

The study was conducted in Maros Regency, South Sulawesi Province, Indonesia. Maros is a food production buffer area in South Sulawesi, with major commodities such as rice and maize. The unit of analysis is the individual farm business operated by farmers. This location is relevant because farmers in the area face rising production costs, uneven access to agricultural technology, and varying levels of participation in farmer institutions. These conditions provide a suitable empirical context for testing whether financial management and institutional support improve profitability through production efficiency.

Accordingly, the research questions are: (1) Does financial management predict farm production efficiency? (2) Do agricultural institutions predict farm production efficiency? (3) Does financial management predict farm profitability? (4) Do agricultural institutions predict farm profitability? (5) Does production efficiency predict farm profitability? (6) Does production efficiency mediate the relationship between financial management and farm profitability? and (7) Does production efficiency mediate the relationship between agricultural institutions and farm profitability?

Hypothesis Development

Financial management is a critical factor in agricultural business performance. In farming, financial management refers to the ability of farmers to plan capital use, record revenue and expenses, manage cash flow, control production costs, and make financial decisions related to production inputs. These practices help farmers evaluate whether seeds, fertilizers, labor, and other inputs are being used efficiently (Gloy & LaDue, 2003; Hermawati et al., 2025; Samad, 2025).

Farmers with stronger financial management capabilities are expected to allocate resources more carefully, reduce unnecessary input use, and improve cost efficiency. Therefore, the first hypothesis is formulated as follows:.

H1: Financial management has a positive relationship with farm production efficiency. Agricultural institutions are organizational and social structures that support farming activities. They include farmer groups, cooperatives, farmer group associations, and agricultural extension services. Institutions support farmers by providing information, training, production input access, financing networks, and market opportunities (FAO, 2017; Hien & Kim, 2024; Veesam et al., 2025).

Through institutional participation, farmers can obtain knowledge on improved cultivation practices, collective input procurement, and better market coordination. Therefore, agricultural institutions are expected to be positively associated with production efficiency.

H2: Agricultural institutions have a positive relationship with farm production efficiency. Profitability reflects the ability of farm activities to generate profit from production. Effective financial management allows farmers to control production costs, avoid unnecessary expenditure, and improve the use of working capital. Prior studies show that management practices and managerial ability are associated with farm financial performance (Rahman et al., 2020; Vanhuyse et al., 2021).

H3: Financial management has a positive relationship with farm profitability. Agricultural institutions can improve profitability by expanding access to inputs, technology, credit, extension services, and market channels. Institutional support also strengthens farmers' bargaining position and reduces transaction costs. Therefore, agricultural institutions are expected to be positively related to profitability.

H4: Agricultural institutions have a positive relationship with farm profitability. Production efficiency is a central determinant of farm economic performance. Efficient input use reduces waste, controls production costs, and improves output per unit of input. Therefore, production efficiency is expected to be positively associated with farm profitability.

H5: Production efficiency has a positive relationship with farm profitability. Financial management and agricultural institutions may also influence profitability indirectly through production efficiency. Financial

management can improve input allocation, while institutional support can provide knowledge and access that enhance efficient production practices. Once efficiency improves, farm profitability is expected to increase.

H6: Production efficiency mediates the relationship between financial management and farm profitability.
H7: Production efficiency mediates the relationship between agricultural institutions and farm profitability.

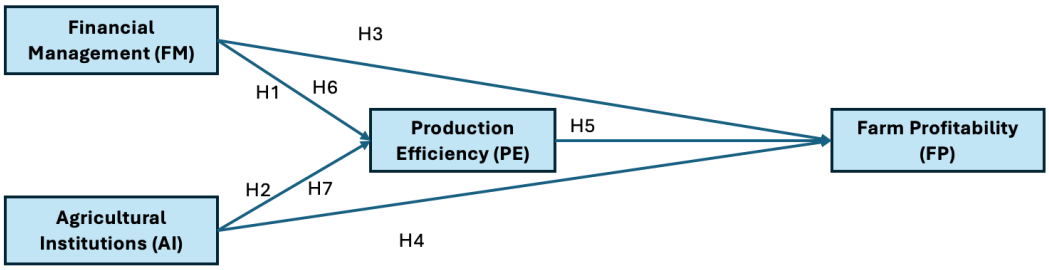

Figure 2. Research Framework

Method

Research Design and Approach

This study used a quantitative explanatory cross-sectional survey design. The term explanatory refers to the use of a theoretically specified structural model to test predictive relationships among latent variables. The statistical technique used to operationalize this design was Partial Least Squares Structural Equation Modeling (PLS-SEM). PLS-SEM was selected because the model includes multiple latent variables, indirect effects, and a mediation structure, and because the objective is prediction and explanation of farm profitability rather than covariance-based model confirmation alone.

Research Location, Period, and Unit of Analysis

The study was conducted in Maros Regency, South Sulawesi Province, Indonesia, during 2025-2026. The unit of analysis was the individual farm business managed by a farmer respondent. Maros Regency was selected purposively because of its food-crop production potential, the presence of active farmer groups, and the relevance of the area for examining production efficiency and farm profitability.

Population, Sample, and Sampling Criteria

The population consisted of food-crop farmers in Maros Regency. The sample comprised 150 farmers. Respondents were selected using purposive sampling with the following inclusion criteria: (1) actively managing a farm business, particularly rice and/or maize farming; (2) having at least one complete planting season of farming experience; (3) being directly involved in production and financial decision-making; and (4) being willing to participate voluntarily. Farmers who were only hired laborers, did not make production decisions, or submitted incomplete questionnaires were excluded.

The sample size was considered adequate for PLS-SEM. Based on the 10-times rule, the minimum sample size should be at least 10 times the largest number of indicators measuring one construct or the largest number of structural paths directed at an endogenous construct. With five indicators per construct and three predictors of farm profitability, the minimum requirement is 50 respondents. In addition, using a medium effect size assumption ($f^2 = 0.15$), alpha = 0.05, statistical power = 0.80, and three predictors, the minimum sample requirement is approximately 77 respondents. Therefore, the final sample of 150 farmers exceeds both minimum thresholds.

Data Collection and Instrument Validation

Primary data were collected through structured questionnaires administered to farmers. The questionnaire used a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Before the main survey, the instrument was reviewed by agricultural economics and farm management experts and pilot-tested with 30 farmers outside the final sample to ensure clarity, relevance, and contextual appropriateness. Minor wording adjustments were made before full data collection.

To reduce common method bias, the questionnaire separated predictor, mediator, and outcome constructs into different sections, used neutral wording, assured respondents of confidentiality, and emphasized that there were no right or wrong answers. Statistical checks were also performed after data collection. Harman's single-factor test indicated that the first factor explained 37.42% of the variance, below the 50% threshold. Full

collinearity VIF values ranged from 1.018 to 2.378, below the conservative threshold of 3.3, suggesting that common method bias was unlikely to distort the model.

Table 1. Research Design Flow

Stage	Activity	Output
1	Problem identification and theory mapping	Research gap, mediation logic, and research questions
2	Instrument development	Operational indicators for FM, AI, PE, and FP
3	Expert review and pilot test	Improved wording and contextual suitability
4	Main survey of farmers	150 valid responses from farm-level respondents
5	Measurement model evaluation	Loadings, AVE, Cronbach alpha, composite reliability, Fornell-Larcker, HTMT
6	Structural model evaluation	R2, f2, Q2, VIF, SRMR, NFI, path coefficients, mediation effects
7	Interpretation and implications	Theoretical, empirical, and policy implications

Table 2. Operationalization and Indicators of Research Variables

Variable	Operational Definition	Indicators	Scale	Source
Financial Management (FM)	Farmers ability to plan, manage, and control financial resources in farming activities.	FM1 financial planning; FM2 income and expense recording; FM3 production cost control; FM4 cash-flow management; FM5 financial decision-making	Likert 1-5	Gloy & LaDue (2003); Omobitan & Khanal (2022)
Agricultural Institutions (AI)	Institutional support that assists farmers in accessing information, technology, capital, and markets.	AI1 participation in farmer groups; AI2 access to extension services; AI3 access to institutional financing; AI4 cooperation among farmers; AI5 marketing support	Likert 1-5	FAO (2017); Raifu & Aminu (2020); Veesam et al. (2025)
Production Efficiency (PE)	Farmers ability to use production factors optimally to obtain output at minimum feasible cost.	PE1 input-use efficiency; PE2 labor-use efficiency; PE3 land-use efficiency; PE4 control of production cost inefficiency; PE5 farm productivity	Likert 1-5	Farrell (1957); Coelli et al. (2005); Battese & Coelli (1995)
Farm Profitability (FP)	Ability of farming activities to generate profit from production operations.	FP1 increased farm income; FP2 profit-to-cost ratio; FP3 production cost reduction; FP4 profit stability; FP5 farming sustainability	Likert 1-5	Gloy & LaDue (2003); Martinho (2022); Vanhuyse et al. (2021)

Data Analysis Technique

Data were analyzed using SmartPLS. The analysis consisted of two stages. First, the measurement model was evaluated using indicator loadings (>0.70), Average Variance Extracted (AVE >0.50), Cronbach's alpha (>0.70),

Composite Reliability (>0.70), Fornell-Larcker criterion, and HTMT (<0.90). Second, the structural model was evaluated using R2, f2, Q2, SRMR, NFI, VIF, path coefficients, t-statistics, p-values, and bootstrapped confidence intervals. Hypothesis testing used a 5,000-sample bootstrapping procedure. A relationship was considered significant when $p < 0.05$ and the 95% confidence interval did not include zero.

Results and Discussions

Respondent Characteristics

Respondents were predominantly male (68%), and most were in productive age groups, especially 41-50 years (34%) and 30-40 years (28%). Educational attainment was concentrated at senior high school (36%) and junior high school (30%). Most respondents had 11-20 years of farming experience (36%) and managed 0.5-1 hectare of land (38%). These characteristics indicate that the study represents experienced small- to medium-scale farmers, which is appropriate for analyzing farm-level financial management, institutional support, production efficiency, and profitability.

Table 3. Characteristics of Research Respondents

Characteristics	Category	Frequency	Percentage (%)
Gender	Male	102	68
	Female	48	32
Age (Years)	< 30	18	12
	30-40	42	28
	41-50	51	34
	> 50	39	26
Education Level	Primary School	36	24
	Junior High School	45	30
	Senior High School	54	36
	Higher Education	15	10
Farming Experience (Years)	< 5	21	14
	5-10	39	26
	11-20	54	36
	> 20	36	24
Land Size (Ha)	< 0.5	33	22
	0.5-1	57	38
	1-2	42	28
	> 2	18	12

Descriptive Statistics of Variables and Data Distribution

The mean values ranged from 3.660 to 3.846, indicating relatively high respondent perceptions across constructs. Farm profitability had the highest mean (3.846), followed by production efficiency (3.788), financial management (3.701), and agricultural institutions (3.660). Standard deviations ranged from 0.731 to 0.843, suggesting low to moderate variation across responses.

Table 4. Descriptive Statistics of Variables

Variable	Indicator	Mean	Std. Deviation
Financial Management (FM)	FM1	3.642	0.821
	FM2	3.715	0.798
	FM3	3.804	0.776
	FM4	3.688	0.805
	FM5	3.655	0.812
	Average FM	3.701	0.802
Agricultural Institutions (AI)	AI1	3.598	0.843
	AI2	3.674	0.816
	AI3	3.742	0.801
	AI4	3.620	0.829
	AI5	3.667	0.822
	Average AI	3.660	0.822

Variable	Indicator	Mean	Std. Deviation
Production Efficiency (PE)	PE1	3.755	0.790
	PE2	3.812	0.768
	PE3	3.884	0.742
	PE4	3.768	0.781
	PE5	3.721	0.799
	Average PE	3.788	0.776
Farm Profitability (FP)	FP1	3.812	0.775
	FP2	3.865	0.748
	FP3	3.912	0.731
	FP4	3.845	0.759
	FP5	3.798	0.782
	Average FP	3.846	0.759

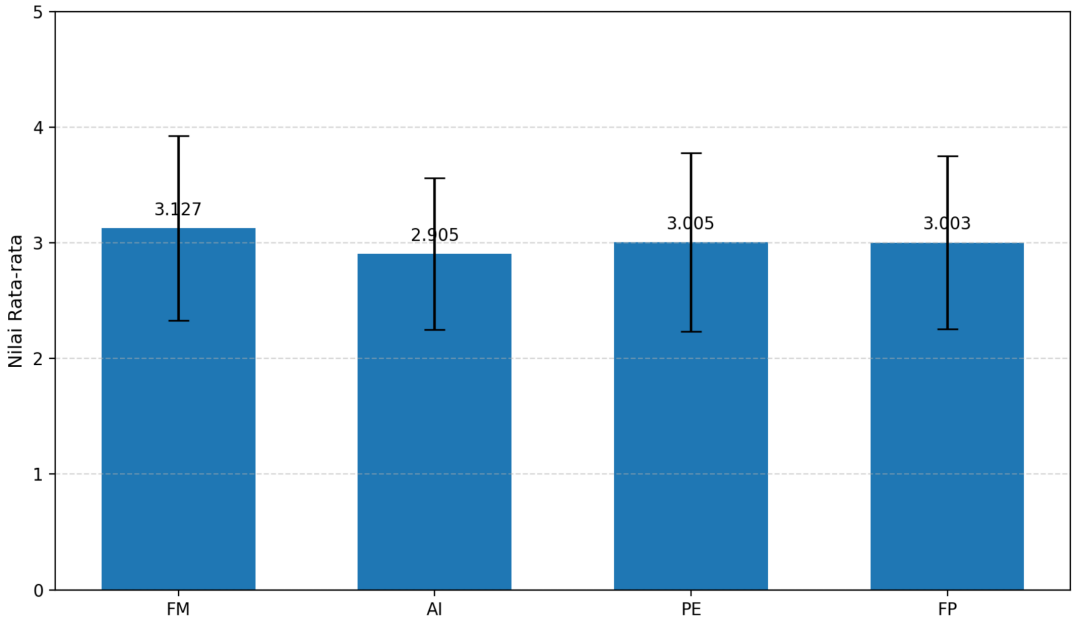

Figure 3. Mean and Standard Deviation of Research Variables

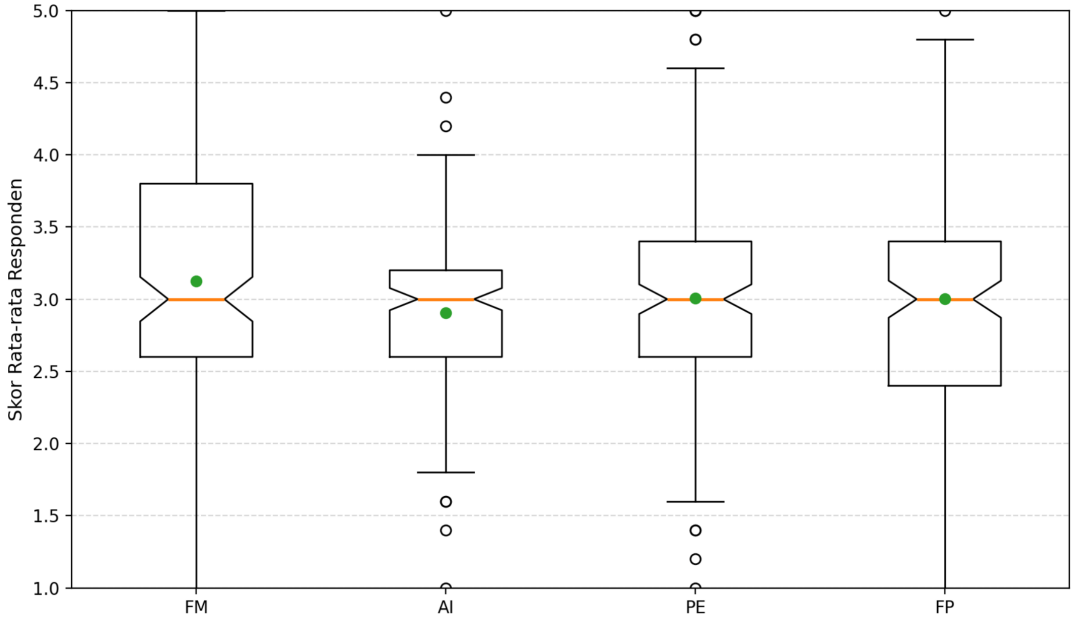

Figure 4. Data Distribution and Outliers of Research Variables

Measurement Model Evaluation

All indicator loadings exceeded 0.70, indicating satisfactory indicator reliability. AVE values ranged from 0.834 to 0.863, exceeding the 0.50 threshold and confirming convergent validity. Cronbach's alpha and composite reliability values were above 0.90 for all constructs, indicating strong internal consistency.

Table 5. Construct Validity and Reliability Results

Variable	Indicator	Loading	AVE	Cronbach's Alpha	Composite Reliability
Financial Management (FM)	FM1	0.926			
	FM2	0.929			
	FM3	0.930	0.863	0.960	0.969
	FM4	0.923			
	FM5	0.935			
Agricultural Institutions (AI)	AI1	0.937			
	AI2	0.894			
	AI3	0.916	0.834	0.950	0.962
	AI4	0.910			
	AI5	0.908			
Production Efficiency (PE)	PE1	0.920			
	PE2	0.925			
	PE3	0.923	0.846	0.954	0.965
	PE4	0.904			
	PE5	0.927			
Farm Profitability (FP)	FP1	0.937			
	FP2	0.922			
	FP3	0.936	0.862	0.960	0.969
	FP4	0.914			
	FP5	0.933			

Table 6. Discriminant Validity: Fornell-Larcker Criterion

Variable	AI	FM	FP	PE
AI	0.913			
FM	-0.065	0.929		
FP	0.465	0.601	0.928	
PE	0.447	0.636	0.850	0.920

Table 7. Discriminant Validity: HTMT Criterion

Construct Pair	HTMT	Decision (<0.90)
AI-FM	0.067	Accepted
AI-FP	0.472	Accepted
AI-PE	0.454	Accepted
FM-FP	0.611	Accepted
FM-PE	0.645	Accepted
FP-PE	0.858	Accepted

The Fornell-Larcker criterion and HTMT values confirm discriminant validity. All HTMT values were below 0.90, indicating that each construct is empirically distinguishable from the others.

Structural Model Evaluation

The R2 value for production efficiency was 0.643, indicating that financial management and agricultural institutions explain 64.3% of its variance. The R2 value for farm profitability was 0.753, indicating that financial

management, agricultural institutions, and production efficiency jointly explain 75.3% of profitability variance. Q2 values were above zero for both endogenous constructs, indicating predictive relevance. The SRMR value of 0.043 and NFI value of 0.927 indicate acceptable model fit. Inner VIF values below 3.3 suggest that multicollinearity is not a serious concern.

Table 8. Coefficient of Determination, Predictive Relevance, and Effect Size

Construct / Relationship	R2	Q2	f2	Interpretation
Production Efficiency (PE)	0.643	0.534	-	Strong explanatory power
Farm Profitability (FP)	0.753	0.612	-	Very strong explanatory power
FM -> PE	-	-	1.242	Very large effect size
AI -> PE	-	-	0.670	Large effect size
PE -> FP	-	-	0.552	Large effect size
FM -> FP	-	-	0.089	Small effect size
AI -> FP	-	-	0.100	Small effect size

Table 9. Model Fit and Collinearity Diagnostics

Index	Value	Criterion	Decision
SRMR	0.043	<0.080	Good fit
NFI	0.927	Closer to 1 indicates better fit	Acceptable fit
Inner VIF range	1.018-2.378	<3.3	No serious multicollinearity / common method concern

Hypothesis Testing

All hypothesized relationships were statistically significant at $p < 0.05$. To avoid overclaiming causality from cross-sectional data, these results are interpreted as significant predictive relationships within the specified theoretical model. Financial management and agricultural institutions were positively associated with production efficiency. Production efficiency was positively associated with farm profitability. The indirect effects of financial management and agricultural institutions on profitability through production efficiency were also significant. Because the direct paths from financial management and agricultural institutions to profitability remained significant when the mediator was included, the mediation pattern is interpreted as partial mediation.

Table 10. Hypothesis Testing and Bootstrapped Confidence Intervals

Hypothesis	Relationship	Coefficient	t-statistic	p-value	95% CI	Effect Type	Result
H1	FM -> PE	0.667	9.874	0.000	0.535-0.789	Direct	Supported
H2	AI -> PE	0.490	7.215	0.000	0.365-0.615	Direct	Supported
H3	FM -> FP	0.222	2.978	0.003	0.080-0.365	Direct	Supported
H4	AI -> FP	0.203	2.654	0.008	0.056-0.350	Direct	Supported
H5	PE -> FP	0.618	8.432	0.000	0.475-0.751	Direct	Supported
H6	FM -> PE -> FP	0.412	6.745	0.000	0.297-0.539	Indirect	Partial mediation
H7	AI -> PE -> FP	0.303	5.982	0.000	0.202-0.421	Indirect	Partial mediation

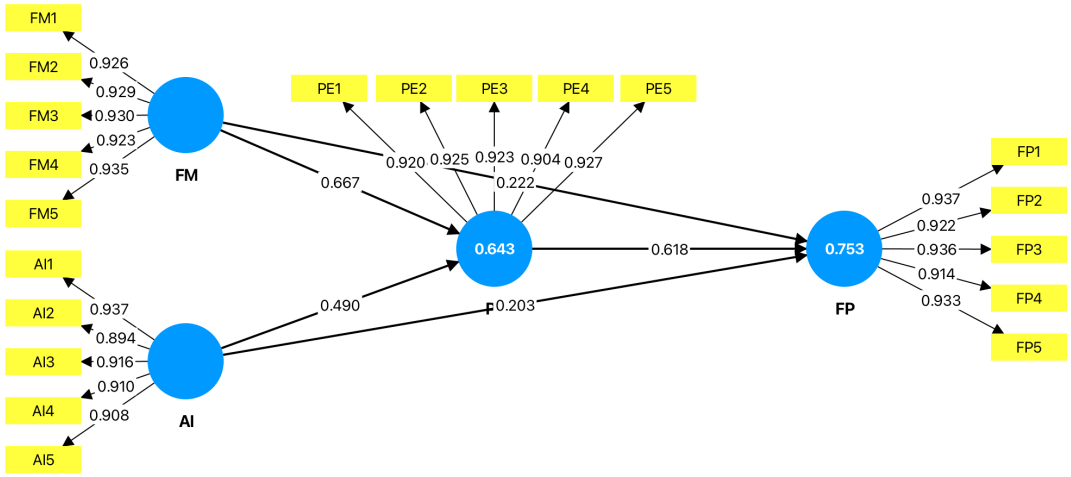

Figure 5. Structural Model Path Diagram

Discussion

Financial Management, Agricultural Institutions, and Production Efficiency

The positive relationship between financial management and production efficiency indicates that farmers who plan capital use, record income and expenditures, control production costs, and manage cash flow tend to report more efficient production practices. This finding supports the resource-efficiency perspective: financial management improves the quality of input allocation and helps farmers reduce unnecessary production costs. The finding is aligned with studies showing that farm management practices and managerial ability are related to financial and operational performance (Gloy & LaDue, 2003; Rahman et al., 2020; Vanhuyse et al., 2021).

Agricultural institutions also showed a positive relationship with production efficiency. This suggests that farmer groups, cooperatives, extension services, and institutional networks contribute to efficiency by providing access to information, technology, production inputs, financing, and marketing channels. However, the magnitude of this path should not be interpreted as a universal causal effect. In this study, the coefficient reflects the strength of association within the surveyed farm context and the specified PLS-SEM model.

Production Efficiency and Farm Profitability

Production efficiency was positively associated with farm profitability. This result is theoretically expected because efficient input use reduces waste and improves the relationship between output and production cost. The finding does not imply that efficiency is the only factor shaping profitability; market prices, weather, farm size, crop type, and farmer ability may also influence profit outcomes. Nevertheless, within this model, production efficiency serves as the central pathway through which managerial and institutional resources are linked with profitability. Comparative Positioning with Prior Empirical Studies

Table 11. Comparative Positioning with Prior Empirical Studies

Study	Context	Main Focus	Relevance to This Study
Gloy & LaDue (2003)	US dairy farms	Financial management practices and profitability	Supports the relevance of farm financial management.
Davidova & Latruffe (2007)	Czech farms	Technical efficiency and financial management	Supports links between financial conditions and efficiency.
Mishra et al. (2009)	New and beginning farmers	Farm characteristics and financial performance	Shows that profitability is shaped by multiple farm-level factors.
Xaba et al. (2018)	South African cooperatives	Efficiency and profitability	Supports efficiency-profitability association.
Rahman et al. (2020)	Bangladesh aquaculture	Management practices and financial performance	Supports managerial capability as a performance factor.
Raifu & Aminu (2020)	Nigeria agriculture	Finance, institutions, and agricultural performance	Supports the institutional dimension in agricultural outcomes.

Vanhuyse et al. (2021)	England farms	Management practices and financial performance	Supports management-performance relationship.
Matei & Onofrei (2021)	Farm profitability	Financial management practices	Supports cost control and financial planning arguments.
Omobitan & Khanal (2022)	US small farms	Sources of farm expense financing	Supports financial management relevance in small farms.
Martinho (2022)	EU farms	Profitability and financial performance	Supports profitability as a central farm performance indicator.
Galluzzo (2022)	Italian farms	PLS-SEM and farm management	Supports SEM-PLS use in farm management studies.
Fitri et al. (2024)	Indonesian potato farming	SEM-PLS and farm sustainability	Supports contextual relevance for Indonesian agriculture.
Hien & Kim (2024)	Vietnam rice industry	Farmer-agribusiness relationship quality	Supports institutional and relational mechanisms.
Hermawati et al. (2025)	Indonesia agriculture SMEs	Technology adoption and policy	Supports managerial and technology factors.
Veesam et al. (2025)	Farmer producer organizations	Institutional performance using PLS path modeling	Supports the role of farmer organizations.
Imhanrenialena & Nwobodo-Anyadiegwu (2025)	Rural Nigeria	Financial literacy and sustainable food production	Supports financial capability in production decisions.

Mediating Role of Production Efficiency

The mediation analysis provides the main empirical contribution of this study. Financial management and agricultural institutions were not only directly related to profitability but also indirectly related through production efficiency. Since the indirect effects were statistically significant and the direct effects remained significant, production efficiency functions as a partial mediator. This means that managerial and institutional improvements may affect profitability through more than one route, but the efficiency route is a key transmission mechanism.

This finding extends farm management literature by moving beyond a simple input-output explanation of profitability. It shows that managerial capacity and institutional support need to be transformed into efficient production behavior before they generate stronger economic outcomes. In practical terms, training in financial management and institutional strengthening should be evaluated not only by participation rates or access indicators, but also by whether they improve input-use efficiency, cost per unit of output, productivity, and profit-to-cost ratio.

Alternative Explanations and Validity Considerations

Several alternative explanations should be considered. First, reverse causality is possible: more profitable farmers may have greater capacity to implement financial management practices and participate in institutions. Second, omitted variables such as farmer ability, crop type, land quality, weather shocks, market prices, and access to technology may also influence both efficiency and profitability. Third, measurement error may arise because the constructs were measured using self-reported Likert-scale indicators. This study mitigated these concerns by using theory-based indicators, pilot testing, reliability and validity checks, collinearity diagnostics, and common method bias procedures. However, because the design is cross-sectional, the results should be interpreted as theoretically grounded associations rather than definitive causal effects.

Theoretical and Policy Implications

Theoretically, this study contributes by positioning production efficiency as a mechanism that connects farm-level managerial and institutional resources to profitability. The model suggests that profitability cannot be fully explained by access to institutions or financial management capacity alone; these resources must be converted into more efficient production practices.

Policy implications follow directly from the mediation results. First, financial management training should include practical modules on input budgeting, cost recording, and cash-flow planning linked to production decisions. Second, farmer institutions should be assessed by their ability to improve technical practices, input procurement efficiency, and market coordination. Third, extension programs should use intermediate efficiency indicators, such as input-output ratio, production cost per unit, yield per hectare, and profit-to-cost ratio, before

claiming profitability impacts. If these efficiency indicators do not improve, institutional and financial interventions should be redesigned.

Conclusions

This study concludes that production efficiency is a key mechanism linking financial management and agricultural institutions to farm profitability among food-crop farmers in Maros Regency, South Sulawesi, Indonesia. Financial management and agricultural institutions were positively associated with production efficiency, and production efficiency was positively associated with profitability. The mediation results show that production efficiency partially mediates the relationship between managerial and institutional factors and farm economic performance. The main theoretical contribution is that farm profitability should not be understood only as a direct outcome of financial or institutional support. Rather, profitability improves when these supports are translated into efficient input use, cost control, and productivity gains. This shifts the focus of farm development from access-oriented interventions to efficiency-oriented interventions. The findings are most applicable to small- and medium-scale food-crop farmers operating in contexts similar to Maros Regency, where production cost pressures, institutional participation, and farm management capacity are central issues. Generalization to other regions, crops, or large-scale commercial farms should be made cautiously. The main limitation is the cross-sectional survey design, which restricts strong causal inference and may not capture temporal changes in efficiency and profitability. Future studies should use longitudinal data, include objective farm financial records, and test additional controls such as crop type, land quality, weather conditions, market prices, and technology adoption. Overall, agricultural policies should be directed not only toward improving farmers' access to institutions and financial knowledge, but also toward enhancing production efficiency as a central driver of farmers' welfare.

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