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THE ROLE OF FOOD STORAGE PERFORMANCE IN THE SEM-PLS MODEL (Strengthening Household Food Security in Pajeng Village, Bojonegoro District, Indonesia)

Delly Septiana Putri[1*)], Badiatud Durroh[1)], Fina Sulistiya Ningsih[1)]

[1]Universitas Bojonegoro Indonesia

**Corresponding author:* dellyseptiana94@gmail.com

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ABSTRACT

Village food security is a strategic issue influenced by social, economic, and environmental dynamics. Pajeng Village, Gondang Subdistrict, Bojonegoro District, faces food security challenges due to declining rice production and shifting agricultural commodity markets. This study aims to develop a food barn management model that can support the food security of farming households. This study offers a new contribution by integrating group activities, institutional, and technical aspects of production into a single adaptive analysis framework and by placing food barn performance as the primary mediating variable. The study uses a quantitative approach involving 68 randomly selected food barn member farmers and is analyzed using *Structural Equation Modeling–Partial Least Squares* (SEM-PLS). The results show that group activities, institutional aspects, and technical production have a positive and significant effect on food barn performance but do not directly impact household food security. Conversely, food barn performance proved to be a key mediator, significantly improving the food security of farming families. These findings confirm that strengthening the function and governance of community-based food barns is a determining factor in achieving household food security. In terms of policy, this study recommends the development of adaptive, participatory village food barns that are integrated with local institutions as a sustainable strategy to strengthen rural food security.

Keywords: community group activities; food barn management; food security; participatory governance; village institutions.

INTRODUCTION

Food security is a pressing issue today. This is because there are interrelated social issues that occur not only at the national level but also globally, ranging from climate change and global food crises to economic impacts and dependence on food imports. As one of the main goals of sustainable development, food security requires every country to ensure the availability, access, and utilization of adequate food for the entire community (National Food Agency, 2025; Mukorrobah, 2025). Considering the various challenges facing the world today, efforts to strengthen food security are increasingly relevant and urgent for all countries, including Indonesia.

In Indonesia, food security is a national priority given its crucial importance to socio-economic stability. Challenges such as agricultural land degradation, reliance on food imports, and shifts in community consumption patterns underscore the urgency of strengthening the food system at the local level. For example, Bojonegoro Regency has the potential to become a national food barn with rice production reaching 705,963 tons in 2023 (Eka A S, 2024). However, several villages in Bojonegoro Regency, especially those in the southern region, are still classified as level 1 and 2 in the food security index (National Food Agency, 2025). One of the villages in the southern region that is still experiencing food insecurity is Pajeng Village, which is facing a decline in rice production due to

limited rainwater irrigation. As a result, rice production has become unstable, shifting to horticultural commodity production (Food Security and Agriculture Agency, 2024).

In an effort to address these challenges, strengthening food barns has become an important strategy in strengthening commodity-based food security systems. In general, food barns function as places for storing and reserving food to maintain the stability of supply, availability, and community access to food during crises (National Food Agency, 2018; Hulu & Thamrin, 2022; Saleh et al., 2021). However, many food barns in Indonesia are no longer functioning optimally. The success of food barns as a means of social security depends heavily on good governance, as weak management can reduce community participation, thereby preventing their social function from operating optimally (Harjito et al., 2016; Hartatik et al., 2023). In line with various international studies showing that community-based food management can strengthen food security through collaborative mechanisms, such as joint storage of harvests, preservation of local seeds, and the formation of collective farmer models that encourage access to markets, credit, and technology through community participation and coordination among stakeholders (Kale et al., 2024; Le Cotty et al., 2023; Vernooy et al., 2020). This indicates that the success of food barn management is not only determined by the availability of physical facilities, but also by the strength of social organizations, the quality of governance, and the community's adaptive capacity to local social and environmental dynamics.

The conditions in Pajeng Village reflect this dynamic. Based on preliminary studies, Pajeng Village is one of the villages that still maintains the tradition of cooperation in running a food barn, familiarly known as the "Lumbung Kemakmuran" (Barn of Prosperity) by the community (Admin, 2024). This food barn takes the form of a community that maintains supply and social solidarity. However, changes in production patterns due to declining rice yields require food barn management that is more adaptive to local conditions and sustainable in the face of environmental change.

In general, the performance of food barns is influenced by the activities of the food barn group, institutional factors, and techniques and production. Research conducted by Yuroh (2015) proves that the activities of the Jambesari food barn group increase the income of its member farmers. The research by Ramdan et al. (2024) sought to measure the performance of food barn groups in terms of institutional structure, clarity of rules, knowledge of institutions, achievement of objectives, and member participation, which influence the improvement of food barn performance in Ciamis Regency. Based on the research by Agustian et al. (2022), the land area controlled and the capacity of the Community Food Barn warehouse are found to influence the volume of community food reserves.

This study aims to design a food barn management model to achieve household food security in Pajeng Village. Unlike previous studies, this study comprehensively and adaptively integrates these three aspects into local community conditions, particularly in areas with distribution restrictions and changinguction patterns (Agustian et al., 2022; Ramdan et al., 2024; Yuroh, 2015). In addition, this study employs a more in-depth analytical approach to explain the complex relationships among variables and to assess the impact of food barn performance on household food security across three main dimensions: food availability, access, and utilization.

The selection of the *Structural Equation Modeling-Partial Least Squares* (SEM-PLS) method to construct the analysis model for this study is based on its advantage in measuring the interrelationship of latent variables with complex empirical indicators, which has rarely been applied in previous studies. This method produces more accurate and consistent testing even with limited sample sizes and non-normal data, making it suitable for examining food barn management models that emphasize social dynamics in rural areas (Hair Jr. et al., 2021). With this approach, this study enriches the theoretical framework of food security in food barn management while providing a flexible, practical framework to strengthen national food security strategies at the village level.

MATERIALS AND METHODS

The study was conducted in Pajeng Village, Gondang District, Bojonegoro Regency, as the village has a level 2 food security status and a food barn. Data collection was conducted from June 13 to July 5, 2025, using a questionnaire with responses assessed on a Likert scale. The questionnaire instrument was developed by adapting previous studies relevant to the research needs. Data were collected without coercion or pressure on respondents. The confidentiality of data and respondent identities was maintained and used only for research purposes. This study used a quantitative approach, relying on primary data from respondent responses and secondary data from literature reviews and relevant government agencies related to the research issue.

The primary focus of the research was to develop a framework for food barn management to achieve food security in Pajeng Village. The exogenous variables in this study include Food Barn

Group Activities (X1), Food Barn Institutions (X2), and Technical and Production (X3). Meanwhile, the endogenous variables in this study include Food Barn Performance (Z) and Household Food Security (Y). The indicators for each latent variable were selected based on a review of previous studies, adapted to the social context of Pajeng Village, to comprehensively reflect aspects of group activities, institutions, and the technical and production aspects of food barn management in Pajeng Village. The variables and indicators of the study are detailed in Table 1 below.

Table 1. Variables and Indicators of food barn management

Latent Variables	Manifest Variables (Indicators)	Source
Food Barn Group Activities (X1)	1. Storage (AKLP1) 2. Packaging (AKLP2) 3. Distribution (AKLP3)	(Yuroh, 2015)
Food Barn Institutions (X2)	1. Clarity of rules (KELP1) 2. Food warehouse management (KELP2) 3. Achievement of objectives (KELP3) 4. Member participation (KELP4)	(Ramdan et al., 2024)
Technical and Production (X3)	1. Area of land controlled (TDP1) 2. Food Barn warehouse capacity (TDP2)	(Agustian et al., 2022)
Food Barn Performance (Z)	1. Input (KILP1) 2. Output (KILP2) 3. Outcome (KILP3) 4. Benefit (KILP4)	(Mardiyati, 2014)
Household Food Security (Y)	1. Food availability (KPRT1) 2. Food accessibility (KPRT2) 3. Food Utilization (KPRT3)	(National Food Agency, 2025); (Sartikasari & Purnomo, 2023); (Apid et al., 2022); (Anzani et al., 2022)

The respondents in this study were all farmers who were members of the food barn in Pajeng Village, totaling 210. The sample was determined using the *probability sampling* technique, simple random sampling, and calculated using the Slovin formula. *The margin of error* in the Slovin formula used was 10%, adjusted to the limited population to balance precision and practical representation, resulting in a sample of 68 farmers. A bias mitigation strategy was applied through random sampling to ensure even representation, given the homogeneous population.

Data processing was carried out using *Structural Equation Modeling - Partial Least Squares* (SEM-PLS) analysis. SEM-PLS analysis was chosen because it does not require data that meet classical assumptions and is suitable for analyzing complex relationships among variables (Surya et al., 2020). This structural equation modeling analysis allows for modeling and estimating complex relationships between independent and dependent variables. In the SEM-PLS analysis, measurements were performed on the outer and inner models. *Outer model* measurements were conducted to determine whether the indicators of each latent variable could explain the data by examining the relationships between latent variables and their indicators through validity and reliability testing. In contrast, *inner-model measurements were conducted to assess R2 and Q2 and to examine the sig*nificance of exogenous variables on endogenous variables (Hair Jr. et al., 2021).

The first step in SEM-PLS analysis is to determine the latent variables and their indicators to construct *the outer model* and *inner model. The outer model* is assessed for convergent validity (loading factor > 0.7) and data reliability (Cronbach's alpha and composite reliability, *Rho-c* > 0.7). According to Fornell and Larcker (1981) and Azizan et al. (2022), a construct is considered valid if its loading factor is > 0.7. A questionnaire instrument is reliable if Cronbach's alpha and composite reliability are≥ 0.7 (Sugiarta et al., 2023). The *inner model* measurement focused on the R2 value of endogenous latent variables as an indicator of model strength and on testing the significance of the path using the *bootstrapping* technique. The higher the R^2 value, the more dominant the influence of exogenous variables on endogenous variables (Alhabib & Arisena, 2023). In addition, a Q^2 test was conducted to assess the model's ability to predict observational data outside the estimation sample using the formula $Q^2 = 1 – [1 – (R^2adj)$ (Harisudin et al., 2023). The hypothesis in this study can be accepted if the beta coefficient is positive, the t-statistic>1.96, and the p-value is < 0.05 (Ardiani et al., 2025). The final step is to interpret the results and draw conclusions about the model testing, the relationship between variables, and the practical implications for food barn management.

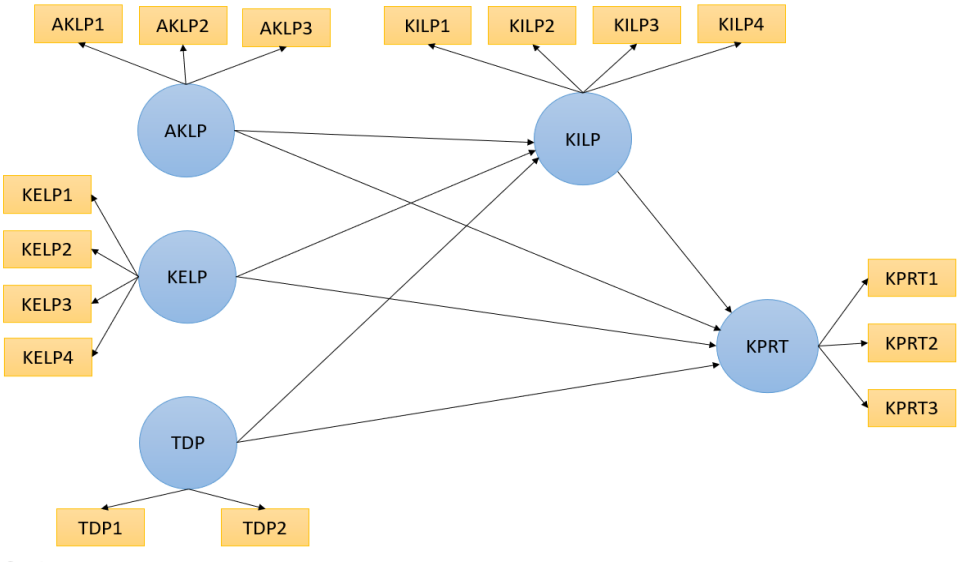

Figure1 . Structural model design

RESULTS AND DISCUSSION

Respondent Characteristics

Respondents in this study included 68 farmers who were members of the food barn in Pajeng Village, Gondang District, Bojonegoro Regency, with quite diverse socio-economic characteristics. Their socio-economic characteristics were analyzed based on age range, farming experience, gender, education level, family dependents, and land area cultivated. This variation shows that the food barn in Pajeng Village is managed by a group of farmers with heterogeneous backgrounds that reflect the real context of agriculture in the region. Further details on the respondents' characteristics are presented in Table 2.

Table 2 . Characteristics of research respondents

No.	Description	Number	Percentage
1.	Age (Years)		
	0-30	11	16
	31-60	44	65
	>60	13	19
2.	Length of time farming (years)		
	< 5	6	9
	5-20	28	41
	>20	34	50
3.	Education		
	No schooling	5	7
	Elementary	26	38
	Junior High School	17	25
	High School	20	29
4.	Gender		
	Male	66	97
	female	2	3
5.	Number of Dependents (Persons)		
	0-1	25	37
	2	20	29
	3	21	31
	4	1	1
	5	1	1
6	Land controlled		
	< 0.25	12	18
	0.25-0.5	48	71
	> 0.5	8	12

The profile of food barn member farmers shows that they are of productive age between 30 and 60 years old, have more than 20 years of farming experience, have completed elementary school, are male, have fewer than two family members, and cultivate 0.25-0.5 hectares of land. This age range shows greater labor efficiency than the other age groups (Damayanti et al., 2025). Meanwhile, farmers' long experience correlates positively with household food security (Cahyani & Antari, 2025; Damayanti & Khoirudin, 2016). Education does not hinder farmers' food security, given their high productivity at mature ages and extensive experience. Small family size eases the burden on household food security, though large families can strengthen it if many members work (Damayanti & Khoirudin, 2016). This differs from the research by Saputro & Fidayani (2020), which found that family size does not affect food security. The dominance of male farmers aligns with Damayanti et al. (2025), who found that direct involvement in agricultural production strengthens food security. The average farm size in Pajeng Village is less than 0.5 hectares, indicating that farmers in this village are classified as smallholders. Farm size is a factor that significantly influences farming activities (Vernando et al., 2022). The smaller the farm size, the lower the food security, especially for farming households.

Model Evaluation

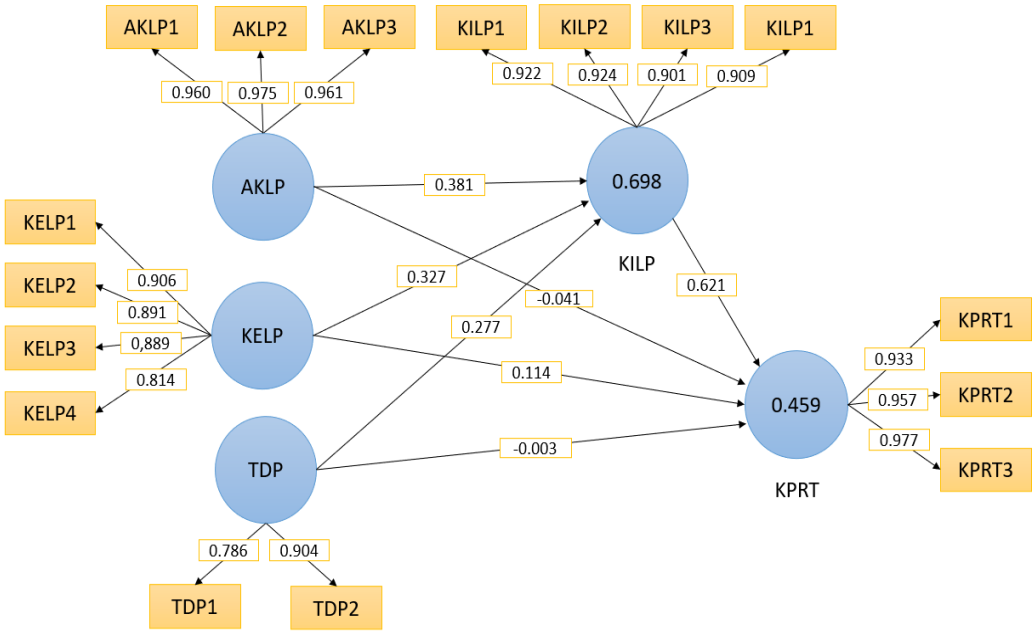

Figure2 . Evaluation of the food barn management model

1. Measurement Model Evaluation (Validity and Reliability)

The evaluation of the measurement model in this study assessed the convergent validity and reliability of the collected data. Convergent validity assesses the suitability of indicators for measuring a variable in accordance with the underlying theory, ensuring that the indicators consistently describe the variable being tested (Alhabib & Arisena, 2023). Indicators are considered valid if the resulting *factor loading* value is > 0.7 (Intan et al., 2025). Based on the test results, the *factor loadings* for all indicators are> 0.7, indicating that each indicator explains its variable. More detailed *factor-loading test results are shown* in Table 3.

Table 3 . Convergent validity testing results

Variable	Indicator	Loading Factor	Interpretation
Food barn group activities (X1)	AKLP1	0.96	Valid
	AKLP2	0.975	Valid
	AKLP3	0.961	Valid
Food Barn Institution (X2)	KELP1	0.906	Valid
	KELP2	0.891	Valid
	KELP3	0.889	Valid
	KELP4	0.814	Valid

Table 3 . Convergent validity testing results

Variable	Indicator	Loading Factor	Interpretation
Technical and Production (X3)	TDP1	0.786	Valid
	TDP2	0.904	Valid
Food barn performance (Z)	KILP1	0.922	Valid
	KILP2	0.924	Valid
	KILP3	0.901	Valid
Household Food Security (Y)	KPRT1	0.933	Valid
	KPRT2	0.957	Valid
	KPRT3	0.977	Valid

Reliability in this study was assessed using two approaches: *Cronbach's alpha* and *Composite reliability* (*Rho-C*). The test results show that most variables reached a value of 0.7 in both measurements, indicating that all variables were reliable. The Technical and Production (TDP) variable had a *Cronbach's alpha* of 0.617 but was still accepted because its Composite reliability was 0.835, indicating the consistency and stability of the indicators in representing the related construct. High reliability values indicate that the research instrument can be trusted to measure aspects of food barn management in Pajeng Village. The reliability test results are shown in Table 4.

Table 4 . Data reliability test results

Construct	Cronbach's Alpha	Composite Reliability (Pc)	Criteria
Food Barn Group Activities (AKLP)	0.963	0.976	Reliable
Food Barn Institutional Capacity (KELP)	0.898	0.929	Reliable
Technical and Production (TDP)	0.617	0.835	Reliable
Food Barn Performance (KILP)	0.935	0.953	Reliable
Household Food Security (KPRT)	0.953	0.970	Reliable

2. Structural Model Evaluation

Structural model evaluation analysis (*Inner Model*) is a test that aims to assess the model's strength and significance. This test is conducted by looking at the coefficient of determination (R^2) on endogenous variables to determine the extent to which exogenous variables can explain endogenous variables, as well as measuring *path coefficients* between variables using the *bootstrapping* method to assess the significance of the relationship between latent variables (Anggita et al., 2019). The R^2 value assesses how much variation in endogenous latent variables is explained by exogenous latent variables. The higher the R^2 value, the stronger the influence of exogenous variables on endogenous variables (Alhabib & Arisena, 2023). In addition to R^2, a Q^2 test was conducted to assess the model's ability to predict observational data outside the estimation sample. The higher the Q^2 value compared to 0, the stronger the predictive relevance (Sohaib et al., 2020).

The research model shows that food barn performance is strongly explained by the variables that influence it and has good predictive capabilities. Household food security is explained at a moderate level, but it still has adequate predictive relevance, so the model remains feasible for explaining and predicting both variables. Table 5 shows the R^2 and Q^2 values from the research analysis.

Table 5 . Results of R^2 and Q^2 Testing

Endogenous Variables	R^2	Q^2	Description
Food Barn Performance (KILP)	0.698	0.468	Strong; Has predictive relevance.
Household Food Security (KPRT)	0.459	0.180	Moderate; Has predictive relevance.

Path coefficient assessment was performed using bootstrapping to determine whether the hypothesis could be accepted or rejected, as indicated by the significance values between constructs, t-statistics, and p-values (Yusuf, 2022). This test used the Smart-PLS 4.1.0.0 application. The hypothesis testing results indicated that the direct relationship between variable X (group activities, institutional, technical, and production) and variable Z (food barn performance) was positive and significant, as was the relationship between variable Z and variable Y, which was very positive and significant. Meanwhile, the direct relationship between variable X and variable Y, namely household food security, is not positively and significantly affected. The relationship between variables X and Y can be positive and significant when variable Z serves as an intervening variable. The complete path coefficient assessment results are shown in Table 6.

Table 6 . Path coefficient test results

Hypothesis	Results			Description
	Beta Coefficient	t-statistic	p-value	
H1: Group activities in food storage have a positive and significant effect on food storage performance	0.381	2.854	0.004	Accepted
H2: Food barn group activities have a positive and significant effect on household food security	-0.041	0.254	0.799	Not accepted
H3: Food barn institutions have a positive and significant effect on food barn performance.	0.327	2.540	0.011	Accept
H4: Food barn institutionalism has a positive and significant effect on household food security.	0.114	0.961	0.337	Not Accepted
H5: Technical and production factors have a positive and significant effect on food barn performance	0.277	3.344	0.001	Accept
H6: Technical and production factors have a positive and significant effect on household food security.	-0.003	0.027	0.979	Not accepted
H7: Food barn performance has a positive and significant effect on household food security.	0.621	4.105	0.000	Accept
H8: Food barn group activities have a positive and significant effect on the food security of farming households through the performance of food barns.	0.237	2.026	0.043	Accepted
H9: Food barn institutions have a positive and significant effect on the food security of farming households through the performance of food barns.	0.203	2.202	0.028	Accepted
H10: Technical and production factors have a positive and significant effect on the food security of farming households through the performance of food barns.	0.172	2.737	0.006	Accepted

Model of Food Security Management for Farming Households

1. The Effect of Food Barn Group Activities on Food Barn Performance and Food Security of Farming Households

The results of the study show that food barn group activities, such as storage, packaging, and distribution, can significantly improve the performance of food barns, as these activities help maintain stocks more effectively, make the flow of food in and out more orderly, and ensure distribution to members is more regular. However, these group activities do not directly improve the food security of farming households; they only have an impact when the granary, as a food reserve management institution, is functioning well. This means that households benefit not only from the number of group activities but also from the granary's ability to ensure that stocks are always available, distributed evenly, and easily accessible to members. These findings align with Sartikasari & Purnomo (2023), who emphasize that stock availability (e.g., rice stocks) has a significant effect on food security, and with Sari & Purnomo (2018), who show that granary storage activities can increase the food security of farming households when managed effectively. A similar pattern was also observed in Afriyie et al.'s (2023) research in Ghana, which found that food storage can indeed increase food security by increasing availability and reducing waste. However, its effectiveness is highly dependent on intermediary factors such as income and household socio-economic status. Thus, both in the context of food barns and households, new storage capacity contributes to food security only if it is mediated by the performance of food barns and members' ability to access managed stocks.

2. The Influence of Food Barn Institutions on Food Barn Performance and Household Food Security

The results of the study show that food barn institutionalism has a positive and significant effect on food barn performance, but not directly on the food security of farming households, with food barn performance serving as a mediating variable. This means that strengthening institutional aspects such as clear organizational rules, a well-organized management structure, a clear division of roles among members, and participatory decision-making mechanisms can significantly improve the operational performance of food barns. Good performance is reflected in the granary's ability to

provide stocks on time, maintain grain quality, distribute yields fairly, and expand food access for members. This improvement in performance quality then has a significant impact on the food security of farming households.

These findings reinforce the idea that institutional improvements yield tangible benefits for households only when accompanied by effective management and implementation of granary activities. These results align with various national studies that emphasize the importance of participation, trust, transparency, and deliberation for the success of community food institutions (Dzarroh, 2016; Faqih & Rohayati, 2015; Rachmat et al., 2011; Ramdan et al., 2024; Suek et al., 2022). International support also emerged from Sharma's (2024) research on grain bank communities across various countries, which showed that communities with strong institutions and leadership maintained food availability, provided grain loans, and strengthened local economies. However, weak institutions often lead to functional failures and declining member trust. Thus, both national and international evidence indicate that the operational performance of food barns is the main link between institutional strength and increased household food security for farmers.

3. Technical and Production Influences on Food Barn Performance and Household Food Security

The analysis results show that Technical and Production variables have a significant positive effect on Food Barn Performance, confirming the importance of technical aspects such as land area and storage capacity in improving the operational effectiveness of food barns. This confirms that the application of sound technical practices in food barn management, including controlled land and adequate storage warehouses for storing grain, plays an essential role in improving the operational effectiveness of institutions, including stock stability and distribution. Indirectly, technical and production variables contribute to improving the food security of member farmer households. In line with the findings of Agustian et al. (2022), adequate land area and warehouse capacity significantly impact food barn performance. A study by Mariyani et al. (2017) states that land area plays an important role in ensuring food availability for barn members. In the context of Pajeng Village, the challenge of land conversion from rice to shallots, which caused a decline in rice production, was responded to through institutional innovation in the form of a cash-paid grain loan system, as a practical effort to maintain the scarcity of food supplies for members even though technical production conditions had weakened.

However, the direct influence of technical and production variables on household food security proved insignificant, indicating that the technical impact on food security operates more strongly through the mediation of granary performance. This pattern is in line with the research by Roche et al. (2017) on CGBs in Ethiopia, which shows that local food banks can improve child feeding practices and support household food security through more stable stocks, better food quality, and easier access, but technical storage capabilities and effective stock management and distribution as an institution highly determine this success. It is also in line with Chen et al. (2022), who found that storage technology and facilities primarily improve food security by reducing post-harvest losses and strengthening the performance of storage systems, while their impact on households is indirect. Overall, both in the national and international contexts, technical and production factors serve as the foundation that ensures stock availability and quality. At the same time, the operational performance of granaries or storage institutions is the main link that transforms these technical advantages into concrete improvements in the food security of farming households.

4. The Influence of Food Barn Performance on Household Food Security

The analysis finds that Food Barn Performance (KILP) has a positive and significant effect on Household Food Security (KPRT), providing strong evidence of the strategic role of food barns in regional food reserve management. This shows that increasing group, institutional, technical, and production activities can strengthen family food security through this channel. Food barns perform the functions of reserve management, ensuring food availability, providing a mechanism for grain loans repayable in cash, and stabilizing local grain prices. This is by Nindi et al. (2024) in line with the research in Kamubekha Village, which proves that food barns that are well managed by farmer groups have a significant positive impact on household food security, so that the contribution of food barn performance is in accordance with the three pillars of food security, namely availability, accessibility, and utilization of food.

These results are in line with Jatta's (2016) research on Community Grain Banks in rural India, which shows a similar pattern. Community Grain Banks store grain during harvest and distribute it during famine, providing grain loan or purchase schemes with fairer terms, maintaining village food availability, and reducing the number of days without food for vulnerable tribal households. This success is primarily determined by management performance, including transparency, clear

repayment rules, member involvement, and grain quality. Thus, it is not merely the existence of a granary that matters, but how well the granary/grain bank functions as a link between grain reserves and the food security of farming households.

This study fills an important gap in the food security literature by emphasizing the role of food barn performance as a crucial mediator in the relationship between group activities and household food security. The SEM-PLS approach used provides a comprehensive understanding of complex influence mechanisms, showing that integrating social (group activities, institutions) and technical production aspects is essential to maintaining food security, especially at the village level. The theoretical implications of these findings reinforce the mediation model that combines these three aspects as the primary foundation for understanding the dynamics of household food security. This study closes the fragmentation in previous research by providing a foundation for household food security dynamics at the village level. This integrative approach also emphasizes the important role of food barns as drivers of food security at the village community level.

From a practical perspective, the research results recommend intensifying group activities, focusing on operational efficiency, and increasing the managerial capacity of food barns. Training programs and technical assistance are also crucial to improve stock management, distribution, and organizational governance capabilities. Food barn development policies should emphasize institutional aspects by strengthening organizational rules, member participation, and decision-making mechanisms to improve the effectiveness of food reserve management and local food price stability. The practical implications of these findings are that government policies and food barn managers need to focus on strengthening technical capacity, such as developing storage infrastructure and stock lending management systems that are adaptive to land and commodity dynamics. This support is vital in areas with changing land use patterns that affect food production.

CONCLUSION AND RECOMMENDATIONS

This study contributes significantly to the literature on food security through an SEM-PLS model that simultaneously integrates group activities, institutional factors, and technical aspects of production, filling a research gap by adopting an adaptive approach to the unique local conditions of Pajeng Village to understand its complex relationship with food barn performance and household resilience. Group activities, institutionalism, and technical production directly influence food barn performance but do not have a positive, significant impact on household food security. Theoretically, this study confirms the role of food barn performance as a key mediator linking various social and technical dimensions in improving community-based food security. However, this study has limitations in terms of sample size and specific geographical coverage. Further research is recommended to expand the variables, including environmental, socio-economic, and digital technology factors, and to use a longitudinal approach to obtain a dynamic picture of food barn management and household food security over time.

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