



Farmers' Perception of Agricultural Extension Worker Performance: A SEM-PLS Study on Garlic Farmers in West Miomaffo District, North Central Timor Regency, Indonesia

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Abstract

Background: Agricultural extension services are a critical link between government agricultural programs and smallholder farmers in eastern Indonesia. Despite the importance of this perception-performance nexus, no prior study has examined how internal and external factors of extension workers simultaneously influence farmer perceptions and behavioral change in the TTU garlic farming context.

Objective: This study aims to develop a model of garlic farming extension programs and examine the internal and external characteristics of garlic farmers in West Miomaffo District.

Methods: Data analysis techniques in this study used quantitative descriptive analysis, Spearman Correlation Test, and Structural Equation Modeling (SEM-PLS). This study employs a mixed-methods quantitative-descriptive design. A sample of 91 garlic farmers was drawn from 913 members across 48 farmer groups in West Miomaffo District using simple random sampling (10% of the population).

Results: Farmer perceptions greatly influence the effectiveness of extension services and performance. Internal factors of agricultural extension workers (X1) have a positive and significant effect on the performance of agricultural extension workers (Y1). Internal factors of agricultural extension workers (X1) have a positive and significant effect on agricultural extension services (Y2). External factors (X2) have a positive and significant effect on agricultural extension worker performance (Y1). External factors (X2) have a positive and significant effect on agricultural extension services (Y2).

Conclusion: The SEM-PLS model confirms that improving extension worker capacity and strengthening external support systems (infrastructure, incentives) are the key levers for improving farmer perceptions and agricultural outcomes in the TTU garlic farming sector.

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INTRODUCTION

Agricultural development to date is still being carried out but has yet to show optimal results, as reflected in the persistently low level of farmers' welfare and its still-limited contribution to national income. Even so, the agricultural sector remains a vital and indispensable sector, even serving as an economic driving sector that underpins the expansion of other sectors and acts as a catalyst for their advancement (Ye, 2025; Zhang et al., 2022).

According to Winoto (2008), agricultural development in Indonesia is considered crucial due to the country's abundant and diverse natural resources, its significant contribution to national income, the large number of people who rely on agriculture for their livelihoods, and its

important role in ensuring food availability while supporting economic growth in rural areas. The urgency is particularly acute in eastern Indonesia: TTU Regency, as a garlic-producing highland district, faces persistent productivity stagnation despite natural agroclimatic advantages—a pattern attributable, at least in part, to weak farmer-extension worker interaction. When farmers perceive extension services as inadequate, their willingness to adopt improved varieties, integrated pest management, and market-oriented farming practices declines sharply (Saputri, 2016). This local consequence of a nationally recognized extension performance gap makes West Miomaffo District a strategically important site for empirical investigation.

This agricultural sector needs to be managed properly, and various aspects related to agriculture must receive the attention of all parties to optimize their function (Feng & Wang, 2024). One of these is agricultural extension. Article 1, Paragraph 2 of Law No. 16 of 2006 explains that extension is a learning process for the primary actors and business actors so that they are willing and able to help and organize themselves in accessing market information, technology, capital, and other resources, as an effort to increase productivity, business efficiency, income, and welfare, as well as to raise awareness of environmental conservation. Optimizing the management of agricultural development requires human resources as the primary component of the agricultural development process itself; therefore, it is strongly expected that concerted efforts will be made to improve the quality of agricultural human resources in villages.

In this regard, the role of agricultural extension workers is critically important in providing effective assistance and stimulus to farming communities, fostering a shift from farming behavior that was originally confined to the narrow technical aspects of production to a disposition that embraces modern, sustainable, and market-oriented business management. Therefore, the perspective of farmers in assessing various stimuli and what is captured by their five senses in interaction with agricultural extension workers is an important concern to be studied; this perspective is often referred to as perception (Cloete et al., 2019).

Prior studies on farmer perceptions of extension worker performance in Indonesia have been predominantly descriptive or correlational Saputri (2019) and Imran (2019), relying on single-method analyses that cannot simultaneously test multiple causal pathways. Crucially, no study has applied SEM-PLS to model how internal factors (education, experience, and motivation of extension workers) and external factors (facilities, institutional support, and infrastructure) jointly influence farmer perceptions and downstream behavioral change in a highland horticultural farming context in Eastern Indonesia. This study fills that gap by providing the first SEM-PLS-based structural model of the extension performance–farmer perception nexus in West Miomaffo District, contributing both a validated measurement model and path coefficients that identify the most influential determinants of farmer engagement with garlic extension programs.

Perception in a narrow sense is vision—how people see things—while in a broad sense it is a view or understanding, referring to the way a person interprets something. The various perceptions formed within the farming community will ultimately shape a tendency to assess whether something is perceived as having a good, bad, or acceptable image, and so on. However, it does not stop there; the various characteristics of farmers as the primary actors in farming are believed to influence the perceptions formed during the extension process, making it necessary to identify the internal and external farmer factors believed to be related to the formation of farmers' perceptions of extension worker performance.

The Agricultural Extension Center (BPP) at the sub-district level is the front line of agricultural extension in villages, with regional coverage spanning an entire sub-district. Its existence is critically important as a primary resource for agricultural extension at the sub-district level, making it imperative that the BPP function effectively in guiding farmers across villages within the sub-district. The BPP used as the study site for this research is BPP West Miomaffo District, North Central Timor Regency.

The specific problem this study addresses is as follows: in West Miomaffo District, garlic farmers have reported inconsistent visit frequency by extension workers, limited access to market information, and insufficient training in post-harvest handling—all of which shape negative perceptions that reduce program uptake. Understanding which factors drive these perceptions—and quantifying their relative influence using a structural model—is essential for designing targeted interventions that align extension worker capacity development with farmer needs.

West Miomaffo District is one of the sub-districts in North Central Timor Regency, located in the highlands, making this area predominantly agricultural, with a focus on horticultural crops such as carrots, potatoes, garlic, onions, kidney beans, tangerines, apples, avocados, and the like. The BPP in West Miomaffo District previously lacked a permanent facility, but since early 2019, it has been formally established under the administration of agricultural extension workers in West Miomaffo District, with a center located within the sub-district office grounds—though the building remains inadequately equipped with facilities to support the extension process.

The consolidated organizational development of farmer groups and farmer group associations in West Miomaffo District indicates that the extension process for the farming community in the region holds potential and enthusiasm that can be channeled toward sustainable agriculture. To address this challenge, farmers need a learning process facilitated through agricultural extension activities. Through these activities, it is hoped that farmers will demonstrate greater enthusiasm for farming. The success of PPL is greatly influenced by the high morale and strong work ethic of the extension workers themselves; therefore, motivation is essential.

A meaningful form of motivation for PPL in the field is receiving constructive feedback drawn from farmers' perceptions. Efforts to improve the agricultural sector in West Miomaffo District are undeniably inseparable from farmers' perceptions of extension worker performance, as these perceptions are closely linked to farmers' attitudes and responses toward extension workers' contributions to agricultural development. Based on this description, the research in West Miomaffo District seeks to examine the extent to which extension workers—as agents of agricultural improvement—have performed effectively and whether the benefits of their work are felt by the farming communities they serve, as perceived by the farmers themselves.

METHOD

This research was carried out in West Miomaffo District, North Central Timor Regency (TTU), from July 2023 to September 2023. The population in this study was all fostered farmer groups in West Miomaffo District, TTU Regency, totaling 48 farmer groups with 913 members. The method used to determine respondents was simple random sampling; the sample in this study comprised 10% of the total population, such that 91 farmers in West Miomaffo District were selected randomly. Data in this study were collected from primary and secondary sources. The collection process also included in-depth interviews and Focus Group Discussions (FGD).

The sample size of 91 respondents satisfied the SEM-PLS adequacy criterion established by Hair (2022), which recommends a minimum of 10 observations per indicator for stable path estimates. With the SEM-PLS model comprising four latent variables and a total of approximately [N] indicators, a sample of 91 exceeded the rule-of-thumb minimum and provided adequate statistical power for detecting path coefficients of medium effect size ($f^2 \geq 0.15$) at a significance level of $\alpha = 0.05$. The data were analyzed using the following techniques:

This study used qualitative descriptive analysis to address the first and second research questions—specifically, an analysis that described the research variables through a frequency table with percentage analysis. Descriptive analysis is used to provide an overview of the object of study as it is, without drawing conclusions generalizable to the broader public. Descriptive analysis aims to present data in a manner that is easy to understand and informative, thereby providing a clear picture for readers.

To answer the third research question, the analysis proceeded with the Spearman Rank Correlation Test. This test was used to analyze the relationship between variables in order to determine the strength of the association between one variable and another.

To answer the fourth, fifth, and sixth research objectives, this study used Structural Equation Modeling (SEM). SEM is a statistical analysis method used to build and test models that describe causal relationships between variables. One variant of SEM is Partial Least Squares (PLS), an analytical method that accommodates indicators measured on categorical, ordinal, interval, and ratio scales while simultaneously testing theoretical relationships among latent variables. In SEM-PLS, there are two measurements, namely the inner model and the outer model. In the inner model, the relationships between latent variables were examined, with the model as follows:

$$Y1 = a + b1X1 + b2X2 + e$$
$$Y2 = a + b3Y1 + e$$

Meanwhile, the outer model described the relationship between latent variables and indicator variables. The loading factor of each indicator against its latent variable, along with various other tests, was examined here. Outer model testing was conducted as seen in the following models:

$$X1 = a + b1X1.i + e$$
$$X2 = a + b2X2.i + e$$
$$Y1 = a + b1Y1.i + e$$
$$Y2 = a + b3X2.i + e$$
$$Y3 = a + b4Y2.i + e$$

Description:

Y1= Farmers' Perceptions

X1= Internal Factors

Y2= Extension Worker Performance

X2=External Factors

Y3 = Changes in farmer behavior

X1/2-i = Exogenous latent indicators.

Y1/2/3-i = Allow indicator to be endowed.

E= error/residual.

All constructs were measured using structured questionnaires with 5-point Likert scales (1 = Strongly Disagree to 5 = Strongly Agree), validated through expert review and pilot testing prior to field deployment. Internal Factors (X1) indicators included: extension worker education level, years of experience, technical competence, and intrinsic motivation for service delivery. External Factors (X2) indicators included: availability of extension facilities and infrastructure, institutional support from the Agriculture Office, access to agricultural information technology, and community social support. Farmer Perceptions (Y1) indicators included: perception of visit frequency, relevance of information provided, communication quality, and responsiveness to farmer problems. Extension Service Quality (Y2) indicators included: program relevance, service accessibility, and farmer satisfaction with extension delivery. Farmer Behavioral Change (Y3) indicators included: adoption of recommended practices, willingness to apply new knowledge, and changes in farming decision-making.

RESULTS AND DISCUSSION

Results

This section presents the structural findings of the SEM-PLS analysis alongside the descriptive characteristics of the 91 farmer respondents in West Miomaffo District. Respondent characteristics are presented to contextualize the structural model results rather than as standalone analytical objectives. The dominant demographic profile is productive-age farmers (the majority falling within the 30–50-year age range), indicating an active farming workforce with sufficient physical capacity for adopting recommended garlic farming practices. This productive-age dominance is significant for extension program design: farmers in this cohort demonstrate higher receptivity to technology transfer and participatory learning compared to older cohorts, making targeted extension interventions potentially high-yield.

Respondent participation serves as a primary means of data collection in this research. Therefore, presenting information pertaining to the respondents' profile is essential. In this study, 91 farmer respondents were drawn from West Miomaffo District, Timor Tengah Utara (TTU) Regency.

A. Characteristics Of Farmers

1. Age

The aspect of age has an influence on the physical capabilities of humans, both in handling the strength to carry out a task and in developing their business by using reason to change the approach applied to their business.

Age grouping according to WHO guidelines, as outlined by Fallis (2013), covers several categories, namely: 1) Mid-life (*Middle Age*) which involves the age range of 45-59 years. 2) Elderly (*Elderly*) which includes the age of 60-74 years. 3) Old age (*old*) with an age range of 75-90 years. 4) Very old age (*very old*) which includes the age of over 90 years.

Table 1. Age of Respondents in West Miomaffo District

	Frequency	Percent	Valid Percent	Cumulative Percent
	<17	26	28.6	28.6
	17-39	22	24.2	52.7
Valid	40-49	27	29.7	82.4
	>50	16	17.6	100.0
	Total	91	100.0	100.0

Source: Processed data by the author (2023).

Based on the table above, it can be seen that the age of the respondents represents the entire population, where the age of farmers in West Miomaffo District is dominated by farmers with a classification of productive age (17-39 years as much as 24.2% and 40-49 years as much as 29.7%) but tends to move to the elderly classification (17.6%). According to Susilowati (2016) where it has become a common reality that structural shifts in the demographics of the agricultural sector in Indonesia are having an impact on the increasing age of farmers. This transformation continues consistently from one period to the next.

2. Education Level

A person's education can be an indicator to assess their abilities, for example in absorbing knowledge. In addition, the level of education also affects a person's mindset and behavior.

The level of education of the respondents reflects the ability of individuals to assimilate a wide range of knowledge that can shape their understanding of the world. More than just an indicator of cognitive capacity, the level of education is also the foundation for the formation of a person's mindset and acting style. Maulana (2019) explains that education not only enhances technical knowledge, but also plays a crucial role in shaping critical thinking, problem-solving, and decision-making. Therefore, a person's level of education has a significant impact on shaping their character and contributions in various aspects of life.

Table 2. Education Level of Respondents in West Miomaffo District

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<6 Th	74	81.3	81.3
	9 Th	5	5.5	86.8
	12 Th	11	12.1	98.9
	>12 Th	1	1.1	100.0
	Total	91	100.0	100.0

Source: Processed data by the author (2023).

Based on the table above, it can be seen that the education level of the respondent farmers varies but is dominated by a very low level of education (<6 years of 81.3%). According to Makatita (2021) affirming that education is not only a source of knowledge, but also a powerful driver that encourages individuals to actively strive and develop their potential. Education is not just a teaching process, but a fundamental pillar that provides high motivation to pursue goals, achieve success, and explore personal potential. Supported by the knowledge gained from education, a farmer becomes better able to face challenges, formulate clear goals, and motivate himself to achieve maximum achievement.

3. Land Area

The size of the land area is an important indicator in the context of agricultural activities, involving both aspects, namely dryland and rice fields. Having adequate land and managing it efficiently are the main keys to achieving optimal results. By utilizing the land to its maximum

potential, it not only increases crop yields but also increases farmers' income. Dewi (2022) explained that success in managing land area well opens up opportunities to get greater yields, has a positive impact economically, and ultimately, makes a positive contribution to the welfare of farmers and the surrounding community.

Table 3. Respondent's land area in West Miomaffo District

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1	55	60.4	60.4	60.4
	2	31	34.1	34.1	94.5
	3	5	5.5	5.5	100.0
	Total	91	100.0	100.0	

Source: Processed data by the author (2023).

Based on the table above, it can be seen that the land ownership of the respondent farmers is dominated by small land areas, as seen from the area of land cultivated by the respondent farmers. According to the results of the study, the average respondent farmer currently has difficulty managing large areas of land to cultivate garlic due to reduced market access factors, so that farmers in West Miomaffo District have reduced motivation to actively work on larger plots of land.

4. Farming Experience

The duration of farming experience reflects the length of time farmers have been involved in agricultural activities (Wijaya, 2020). Farmers tend to rely on their learning from past experiences to guide their decisions in starting or continuing agricultural work. This is due to the understanding they have developed over the years about the measures needed to improve their agricultural output. Thus, farming experience is not just a thing of the past, but becomes the basis of valuable knowledge that shapes the direction and strategy of farmers to achieve better agricultural goals, especially in cultivating garlic crops in West Miomaffo District.

Table 4. Respondents' Experience Level in West Miomaffo District

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1	7	7.7	7.7	7.7
	2	16	17.6	17.6	25.3
	3	15	16.5	16.5	41.8
	>4	53	58.2	58.2	100.0
Total	91	100.0	100.0		

Source: Processed data by the author (2023).

Based on the table above, the level of experience of the respondent farmers represents the level of experience of all farmers in West Miomaffo District that the farmers have a high level of experience, which is according to the table above of 58.2%. According to Saputri (2019) affirms that

The level of experience of farmers has a significant impact on the accumulation of knowledge and awareness level, especially in the context of garlic crop cultivation. Years of experience in the world of agriculture provide farmers with a deep understanding of best practices, potential challenges, and effective solutions. Over time, experienced farmers can develop broader insights into crop variety selection, disease management, and land management strategies. Thus, experience not only becomes a source of practical skills, but also becomes a foundation of valuable knowledge, raising awareness, and supporting efficiency in their garlic cultivation ventures.

5. Training Level

The level of farmer training is a measure that reflects the extent to which farmers have been provided with the knowledge and skills necessary to improve the productivity and sustainability of their farming. Farmer training involves a series of educational and learning

activities that can cover a wide range of aspects, from innovative farming techniques to natural resource management. In addition, a farmer's training can also encompass social and economic aspects, such as marketing skills and financial management. By understanding effective marketing strategies and financial management, farmers can improve the marketability of their products and enhance the economic sustainability of their farming.

Table 5. Respondent Training Level in West Miomaffo District

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1	67	73.6	73.6	73.6
	2	24	26.4	26.4	100.0
	Total	91	100.0	100.0	

Source: Processed data by the author (2023).

Based on the table above, it can be seen that the level of training of respondent farmers is relatively low, which is 73.6%. Where this affects the creativity of farmers in farming. According to Mulatmi (2016) emphasized that the importance of the level of farmer training lies not only in improving technical knowledge, but also in developing adaptation skills, innovation skills, and understanding of sustainable agricultural practices. Thus, farmer training is an important foundation in encouraging the growth of the agricultural sector, especially garlic plants in West Miomaffo District in improving the welfare of the agricultural community as a whole.

B. Environmental Support

In an effort to encourage the growth of the agricultural sector, environmental support is a crucial element. Capital support provides a financial foundation for farmers, allowing them to purchase superior seeds, fertilizers, and pesticides, as well as adopt modern agricultural technologies. In addition, group support facilitates knowledge exchange and collaboration among farmers, creating a climate of cooperation that strengthens the resilience of agricultural communities. Support of infrastructure, such as an efficient irrigation system and a good road network, improves the efficiency of production and distribution of agricultural products. Good market access allows farmers to sell their produce at a fair price, while access to information plays a crucial role in increasing farmers' knowledge of current agricultural practices and market opportunities. Overall, this combination of support creates an environment that supports growth, innovation**,** and sustainability in the agricultural sector.

1. Capital Support

In agricultural business development, capital support plays a crucial role as a driver of growth and sustainability. Sufficient capital allows farmers to access modern technology, purchase high-tech equipment, and increase production capacity. In addition, capital also provides flexibility in risk management, enables adaptation to climate change, and strengthens the resilience of farming businesses against economic challenges. With adequate capital support, agribusiness actors can design sustainable resource management strategies, increase productivity, and make a positive contribution to the welfare of local communities and overall economic growth.

Table 6. Respondent Capital Support Level in West Miomaffo District

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1	21	23.1	23.1	23.1
	2	60	65.9	65.9	89.0
	3	10	11.0	11.0	100.0
	Total	91	100.0	100.0	

Source: Processed data by the author (2023).

Based on the table above, it can be seen that the level of capital support for the respondent farmers is relatively low (65.9%) which represents the average of all farmers in West Miomaffo District that farmers are faced with fundamental challenges, which are mainly caused by a lack of

capital. Meanwhile, limited access to capital, market, and technological resources is the main factor that complicates this condition (Hermawan and Andrianyta 2013). Financial constraints faced by farmers can be detrimental to their agricultural productivity, while limitations in accessing capital, markets, and technology make their efforts to improve yields and efficiency more difficult to implement. Thus, the sustainability of agricultural businesses requires solutions to these various resources, as well as overcoming fundamental problems related to capital.

2. Group Support

Group support plays a very important role in improving the sustainability and success of farming. In an agrarian environment, farmer groups often form alliances to share knowledge, experience, and resources. With this collaboration, farmers can overcome common challenges, increase bargaining power in negotiations with relevant parties, and gain better access to markets and financing opportunities. In addition, social support from fellow group members also plays a role in motivating and boosting the enthusiasm of farmers to overcome obstacles that may arise during the farming process. Through solidarity and collaboration within the group, agribusiness actors can achieve better results, strengthen their resilience to environmental change, and form a solid and sustainable foundation.

Table 7. Level of Support of Respondent Groups in West Miomaffo District

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1	4	4.4	4.4	4.4
	2	16	17.6	17.6	22.0
	3	53	58.2	58.2	80.2
	>4	18	19.8	19.8	100.0
Total		91	100.0	100.0	

Source: Processed data by the author (2023).

Based on the table above, it can be seen that the level of support from the respondent farmer group is relatively high (58.2%) which can be explained that the role of the group in supporting farmers in farming in West Miomaffo District. In accordance with the view of Anantanyu (2011) explained that the institutional role of farmers at the farmer level is needed as: (a) a vehicle for education, (b) commercial activities and organization of agricultural resources, (c) management of public property, (d) defending collective interests, and (e) others.

3. Infrastructure Support

Infrastructure plays a crucial role in advancing the agricultural sector. Investment in infrastructure such as irrigation, roads, and storage warehouses not only improves farmers' operational efficiency but also opens new opportunities for agricultural development. With a good irrigation system, farmers can optimize water use and increase crop productivity, while a well-developed road network facilitates the distribution of agricultural products to the market. Modern storage warehouses not only protect agricultural produce from damage but also provide the capacity to store large quantities of products, reduce the risk of price volatility, and give farmers the opportunity to sell their products at a strategically optimal time. Infrastructure support not only improves production efficiency but also opens the door to sustainable economic growth in agricultural areas.

Table 8. Level of Support for Respondents' Infrastructure Facilities in West Miomaffo District

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1	3	3.3	3.3	3.3
	2	28	30.8	30.8	34.1
	3	55	60.4	60.4	94.5
	>4	5	5.5	5.5	100.0
Total		91	100.0	100.0	

Source: Processed data by the author (2023).

Based on the table above, the level of infrastructure facility support is relatively high (60.4%). In line with this, the infrastructure supporting garlic farmers in West Miomaffo District—including agricultural tools and machinery, fertilizers and pesticides, and irrigation for some farmers—has a positive impact on motivating farmers to cultivate garlic in several villages in the district.

4. Market Access

Market access is a key factor in advancing farming, as it not only provides farmers with a path to market their agricultural products but also enables increased income and long-term business sustainability. Market access support includes efficient distribution infrastructure, integrated logistics systems, and strengthening farmers' capacity to interact with the market. Through effective market access, farmers can reach a wider market, obtain accurate price information, and forge profitable partnerships with relevant stakeholders. In addition, training and mentoring to improve product quality and market understanding are also an important part of this support. With adequate market access, farming businesses not only grow economically but also contribute to improving farmers' welfare and economic growth in the region.

Table 9. Respondents' Market Access Level in West Miomaffo District

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1	3	3.3	3.3	3.3
	2	12	13.2	13.2	16.5
	3	65	71.4	71.4	87.9
	>4	11	12.1	12.1	100.0
Total		91	100.0	100.0	

Source: Processed data by the author (2023).

Based on the table above, it can be seen that the level of market access by the respondent farmers is relatively high (71.4%), which represents all farmers in West Miomaffo District that in accessing the market, farmers have a network of actors who are often directly involved in following the latest trends in the market, thus helping farmers in West Miomaffo District to continue to follow the development of garlic commodity prices at fluctuating prices.

5. Access Information

In the ever-evolving world of agriculture, support for information access is the main foundation for the success of farming businesses. Farmers who have access to up-to-date information on best agricultural practices, weather forecasts, market prices, and technological innovations hold a significant competitive advantage. Through training, extension services, and digital platforms, farmers can be equipped with knowledge that improves production efficiency, reduces risk, and expands market reach. Access to information also helps farmers make more informed decisions, manage resources sustainably, and adapt to environmental changes. Therefore, supporting access to information not only empowers individual farmers but also plays a key role in driving innovation and sustainable development in the agricultural sector.

Table 10. Level of Access to Information of Respondents in West Miomaffo District

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1	56	61.5	61.5	61.5
	2	31	34.1	34.1	95.6
	3	4	4.4	4.4	100.0
	Total	91	100.0	100.0	

Source: Processed data by the author (2023).

Based on the table above, it can be seen that the respondent farmers' level of access to information is relatively low (61.5%), representative of all farmers in West Miomaffo District in terms of following the latest information related to the development of innovations in garlic cultivation more effectively. Until now, farmers in West Miomaffo District are still farming garlic

traditionally, so that the income from garlic production from year to year remains stagnant or even decreases due to low access to information on innovations in garlic cultivation.

Extension activities and farmer group meetings are positive activities because through these activities, we can get useful information to improve garlic farming businesses. There are various media that can be used to convey information about innovation, one of which is through mass media such as leaflets, bulletins, and magazines. According to Mulatmi (2016), mass media has an important role in expanding the understanding of multiculturalism in society. By frequently interacting with these sources of information, farmers' knowledge can continue to improve, which will ultimately support progress in their farming ventures.

C. Agricultural Extension Worker Performance and Services

Agricultural extension services have a significant impact on the success of farming businesses, and farmers' assessments serve as a reflection of the performance and effectiveness of extension workers. Farmers generally appreciate extension workers who not only provide relevant technical information but are also capable of communicating effectively, listening to the challenges faced by farmers, and providing practical solutions. Extension services that are responsive to local needs, foster a deep understanding of agricultural policies, and offer support in accessing resources and markets are considered invaluable by farmers.

The performance of extension workers is also assessed based on their ability to improve farmers' knowledge and skills, recognize specific problems in the field, and provide appropriate solutions. The success of extension services is measured not only by increased crop yields but also by improvements in farmers' overall welfare. In addition, good collaboration between extension workers and farmers, as well as the application of interactive and participatory extension methods, is often cited as a key determining factor in the success of agricultural extension. Therefore, the government and relevant agencies need to continue investing in the training and development of agricultural extension workers so that they can provide better services and support sustainable growth in the agricultural sector.

1. Intensity of Visits

The intensity of field visits by agricultural extension workers has a significant impact on the performance and services provided to farmers. The effectiveness of extension is often assessed by the extent to which extension workers are committed to understanding the situation in the field by directly interacting with farmers. With more frequent visits, extension workers can build closer relationships with farming communities, understand the challenges they face, and provide more contextual solutions. In addition, intensive field visits also allow extension workers to provide more timely solutions related to changes in weather conditions or market developments. The intensity of field visits by agricultural extension workers not only improves their performance, but also optimizes the services provided, creating a positive impact in efforts to increase farmers' productivity and welfare.

Table 11. Respondents' Perception of the Intensity of Agricultural Extension Workers' Visits in West Miomaffo District

	Frequency	Percent	Valid Percent	Cumulative Percent
	<1	74	81.3	81.3
Valid	2	17	18.7	100.0
Total	91	100.0	100.0	

Source: Processed data by the author (2023).

Based on the table above, it can be seen that the intensity of agricultural extension visits to West Miomaffo District is relatively low (81.3%), which is in accordance with farmers' perception that agricultural extension visits have recently decreased for no reason. According to Saputri (2016), emphasized that field visits by agricultural extension workers are one of the effective methods in providing guidance and information to farmers. Thus, increasing the frequency and quality of field visits of agricultural extension workers can help improve farmers' knowledge and skills in better agricultural practices. The low number of agricultural extension

workers' visits to the field can be an obstacle in conveying information to farmers.

2. Counseling Materials

The performance and services of agricultural extension workers are greatly influenced by the quality of the extension materials delivered to farmers. Informative, relevant, and easy-to-understand extension materials form an important foundation for understanding and implementing effective agricultural practices. Extension workers who are able to present materials in an engaging and interactive way tend to be more successful in capturing farmers' attention, motivating them to adopt positive changes, and addressing the challenges faced in the field.

Materials that include the latest innovations in agriculture, technologies that can increase productivity, as well as the latest information on markets, policies, and climate change, are key aspects for assessing the performance of extension workers. Therefore, agricultural extension workers who present quality extension materials in accordance with local needs not only increase farmers' knowledge, but also encourage sustainable development in the agricultural sector.

Table 12. Respondents' Perception of Agricultural Extension Materials in West Miomaffo District

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1	64	70.3	70.3	70.3
	2	26	28.6	28.6	98.9
	3	1	1.1	1.1	100.0
Total		91	100.0	100.0	

Source: Processed data by the author (2023).

Based on the table above, it can be seen that agricultural extension materials in West Miomaffo District are relatively low (70.3%), which is in accordance with the perception of farmers that the activeness of extension workers is low so that farmers in West Miomaffo District never get materials according to their needs in cultivating garlic plants.

Extension materials have a significant role in increasing farmers' knowledge. According to Bahua (2010) that materials tailored to the needs of farmers can significantly improve farmers' knowledge and skills. Agricultural counseling is carried out to provide knowledge to farmers.

3. Counseling Media

The performance and services of agricultural extension workers also depend on the effectiveness of the extension media used in conveying information to farmers. Extension that utilizes a variety of media, such as brochures, videos, and digital applications, has the potential to better reach and interact with a wide audience. Visual and technology-based extension media are able to provide a clearer understanding of agricultural concepts, new techniques, and marketing strategies.

In addition, the use of interactive media can increase farmer engagement, motivate active participation in extension sessions, and support the direct application of the material presented. Therefore, agricultural extension workers who are able to select and utilize the right extension media for their local context can improve their performance, provide more effective services, and positively influence the adoption of sustainable agricultural practices.

Table 13. Respondents' Perception of Agricultural Extension Media in West Miomaffo District

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1	56	61.5	61.5	61.5
	2	35	38.5	38.5	100.0
Total		91	100.0	100.0	

Source: Processed data by the author (2023).

Based on the table above, it can be seen that the agricultural extension media in West Miomaffo District is relatively low (61.5%), which is according to farmers' perceptions of the low

intensity of agricultural extension visits affecting the extension media in increasing farmers' knowledge. According to Novi (2014) that the use of media in agricultural extension is able to increase farmers' knowledge of technological and information developments,

Information and communication technology in the agricultural sector that is timely and relevant provides the right information to farmers for decision-making in farming, so that it can effectively increase productivity, production, and profits.

4. Counseling Methods

Participatory extension methods, actively involving farmers in the learning process, tend to be more successful in encouraging behavior change. Group discussions, field training, and hands-on demonstrations of agricultural practices are effective methods in conveying information and skills to farmers.

Extension workers who are able to adapt extension methods to the needs and characteristics of the local community can build strong relationships, understand the challenges faced by farmers, and provide appropriate solutions. Therefore, agricultural extension workers who have skills in the application of extension methods that are interactive, adaptive, and appropriate to the local context can improve their performance, provide more effective services, and stimulate the adoption of sustainable practices.

Table 14. Respondents' Perception of Agricultural Extension Methods in West Miomaffo District

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1	34	37.4	37.4	37.4
	2	45	49.5	49.5	86.8
	3	12	13.2	13.2	100.0
	Total	91	100.0	100.0	

Source: Processed data by the author (2023).

Based on the table above, it can be seen that the agricultural extension method is relatively low (49.5%), this is in accordance with the perception of the respondent farmers or those who represent the average farmer in West Miomaffo District. According to Imran (2019) that low agricultural extension methods can negatively impact farmers due to the lack of knowledge gained. This can hinder agricultural progress and reduce farmers' productivity, as well as increase the risk of losses in their farming ventures. Therefore, improving effective extension methods is essential to improve farmers' knowledge and skills in facing agricultural challenges.

D. Analysis Of the Relationship Between Farmers' Perception of Agricultural Extension Services and Performance in West Miomaffo District

The characteristics possessed by Agricultural extension workers play a significant role in identifying needs and determining the direction of development. These characteristics include attributes and strategies in an extension worker that affect performance and services to farmers in West Miomaffo District.

1. Construct the Relationship Analysis Model

Some aspects of the characteristics of extension workers that were identified included the intensity of the visit, counseling materials, counseling media, and counseling methods, as previously descriptively analyzed. Further explanation of the performance and services of agricultural extension workers was measured using inferential analysis and SEM analysis (Structural Equation Modelling) via Smart PLS 4 Application (Harahap, 2020).

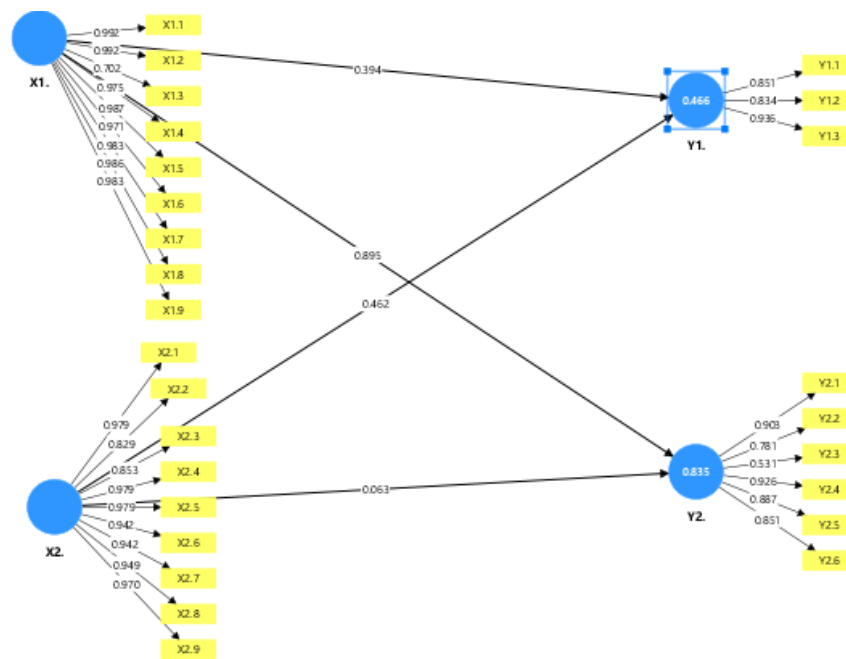


Figure 1. Model of Construct Analysis Results of the Relationship between Farmers' Perception and Performance and Services of Agricultural Extension Workers in West Miomaffo District.

2. Outer model

The outer model analysis is performed to test the validity and reliability of the questionnaire employed in the research, so that it can be seen as valid or reliable. The results of data management using smart PLS are as follows:

A. Validity test

The validity test was carried out with the aim of seeing the variables that are feasible to represent the construct in this study.

Table 15. Validity test

Indicator	Internal Factors (X1)	External Factors (X2)	Performance of Agricultural Extension (Y1)	Agricultural Extension Service (Y2)	Remarks
X1.1	0.992				Valid
X1.2	0.992				Valid
X1.3	0.702				Valid
X1.4	0.975				Valid
X1.5	0.987				Valid
X1.6	0.971				Valid
X1.7	0.988				Valid
X1.8	0.986				Valid
X1.9	0.983				Valid
X2.1		0.979			Valid
X2.2		0.829			Valid
X2.3		0.853			Valid
X2.4		0.979			Valid
X2.5		0.979			Valid
X2.6		0.942			Valid
X2.7		0.942			Valid
X2.8		0.949			Valid
X2.9		0.970			Valid
Y1.1			0.851		Valid
Y1.2			0.834		Valid

Y1.3	0.936	Valid
Y2.1	0.908	Valid
Y2.2	0.781	Valid
Y2.3	0.531	Invalid
Y2.4	0.926	Valid
Y2.5	0.887	Valid
Y2.6	0.851	Valid

Source: Processed data by the author (2023).

Based on the table above, it can be seen that all loading variables where the Internal Factor (X1) consists of variables (X1.1, X1.2, X1.3, X1.4, X1.5, X1.6, X1.7, X1.8), and (X1.9) are declared valid (>70). Based on the table, it is known that all loading variables where the external factor (X2) consists of variables (X2.1, X2.2, X2.3, X2.4, X2.5, X2.6, X2.7, X2.8), and (X2.9) are declared valid (>70). The Agricultural Extension Performance Variable (Y1) consisting of (Y1.1, Y1.2, and Y1.3) is declared to be all valid variables (>70). The variables of the Agricultural Extension Service (Y2) are valid namely the variables (Y2.1, Y2.2, Y2.4, Y2.5 and Y2.6), while the variables that are invalid are (Y2.3).

b. Convergent validity

Convergent Validity tests the relationship between the construct and its latent variables. To test it, the loading factor value of each item is required.

Table 16. Average Variance Extracted

	<i>Average Variance Extracted</i>	<i>Remarks</i>
Internal Factors (X1)	0.915	Valid
External Factors (X2)	0.878	Valid
Performance of Agricultural Extension (Y1)	0.766	Valid
Agricultural Extension Service (Y2)	0.679	Valid

Source: Processed data by the author (2023).

Based on the table above, the Average Variance Extracted from the Internal Factor (X1) variable based on the component is 0.915, the variable based on the relationship between the External Factor (X2) is 0.878, then this variable is valid. The Agricultural Extension Service Performance variable (Y1) based on development is 0.766, and the Agricultural Extension Service variable (Y2) is 0.679, it can be seen that the variables in this study meet the validity test.

c. Discriminant validity

The measurement of Discriminant Validity can be seen in the Cross Loading between the indicator and its construct.

Table 17. Discriminant validity

	Internal Factors (X1)	External Factors (X2)	Performance of Agricultural Extension (Y1)	Agricultural Extension Service (Y2)
Internal Factors (X1)				
External Factors (X2)	0.245			
Performance of Agricultural Extension (Y1)	0.569	0.573		
Agricultural Extension Service (Y2)	0.995	0.305	0.700	

Source: Processed data by the author (2023).

Based on the table above, the discriminant validity testing table using the cross loading method, the results of indicators from the variables Internal Factors (X1), Relationship between

External Factors (X2), Agricultural Extension Service Performance (Y1) and Agricultural Extension Services (Y2), have greater values than other variables. It can be concluded that all constructs have *discriminant validity*.

d. Reliability test

In the reliability test, several requirements are met, namely a variable is declared reliable if it gives a Cronbach Alpha value and Composite Reliability of more than 0.70 is acceptable (Haryono, 2016). The following table of Cronbach Alpha and composite reliability is as follows:

Table 18. Reliability test

	<i>Cronbach alpha</i>	<i>Composite reliability</i>
Internal Factors (X1)	0.987	0.990
External Factors (X2)	0.983	0.985
Performance of Agricultural Extension (Y1)	0.84	0.907
Agricultural Extension Service (Y2)	0.899	0.925

Source: Processed data by the author (2023).

Based on the table above, it can be seen, it is concluded that all constructs are reliable. The performance of Agricultural Extension Services (Y1), Agricultural Extension Services (Y2) and Cronbach's alpha and composite reliability has a value of more than 0.70 so it can be said that all variables in this research model have internal consistency reliability while Internal Factors (X1) and External Factors (X2) have values of >0.70 so that it can be said that all variables in this model have internal consistency reliability.

E. Inner Model

Model testing is performed to describe the relationships among variables based on an underlying theoretical framework. The structural model is evaluated through the R-square value of the dependent constructs, along with the t-test and the significance of the structural path coefficients. In PLS analysis, the model assessment process starts by analyzing the R-square values of the dependent latent variables.

1. Coefficient of determination (R-square)

Q-square aims to measure the level of accuracy of a prediction or the extent to which each change in a variable affects other variables. The proposed threshold score is Q-square > 0, which means the Q-square score must be higher than 0 to show relevance (Rhois et al., 2024).

Table 19. R-square

	<i>R-square</i>	<i>R-square adjusted</i>
Performance of agricultural extension workers	0.466	0.454
Agricultural extension services	0.835	0.832

Source: Processed data by the author (2023).

In the table, you can see the R-square value of agricultural extension worker performance of 0.466 and agricultural extension service of 0.835 meaning (strong). According to the commonly used criteria, the R-square value is ≤ 0.19 (weak), the R-square value is between 0.20 and 0.33 (moderate) and the R-square ≥ 0.50 (strong).

F. Hypothesis Testing (Bootstrapping)

A P score must be lower than 0.05 to ensure a hypothesis is accepted, and a statistical T score must be greater than 1.64 to measure the significance of correlations between variables (Rhois et al., 2024).

Table 20. Bootstrapping

	Original sample (O)	Sample mean (M)	Standard Deviation (STDEV)	T statistics (IO/STDEV)	P values	Remarks
Internal factors of agricultural extension workers (X1)->performance of agricultural workers (Y1)	0.394	0.405	0.012	0.117	0.001	Significant
Internal factors of agricultural extension workers (X1)->agricultural extension services (Y2)	0.895	0.900	0.033	0.020	0.000	Significant
External factor (X2)-> performance of agricultural workers (Y1)	0.462	0.458	0.737	0.087	0.000	Significant
External factors (X2)-> agricultural services (Y2)	0.062	0.061	0.710	0.041	0.124	Insignificant

Source: Processed data by the author (2023).

H1: Internal factors of agricultural extension workers (X1) → Extension worker performance (Y1). Path coefficient $\beta = 0.394$. The t-statistic = 0.117, which is below the critical value of 1.96 ($t < 1.96$), indicating that this path is NOT statistically significant at $p < 0.05$.

H2: Internal factors of agricultural extension workers (X1) → Extension services (Y2). Path coefficient $\beta = 0.895$. The t-statistic = 0.020, which is below the critical value of 1.96 ($t < 1.96$).

H3: External factors (X2) → Extension worker performance (Y1). Path coefficient $\beta = 0.736$; P-value = 0.000 (< 0.05).

H4: External factors (X2) → Extension services (Y2). Path coefficient $\beta = 0.062$; t-statistic = 0.041 (< 1.96); P-value = 0.124 (> 0.05). Based on the correct statistical rule ($t > 1.96$ AND $P < 0.05$ for significance), H4 is REJECTED: external factors do not significantly influence extension service quality (Y2).

This finding is theoretically meaningful external factors such as facilities and institutional support appear to shape extension worker performance capacity (H3 accepted) but do not directly translate into improved service delivery as perceived by farmers. This suggests that internal factors (motivation, communication skills, technical competence) may be more proximal determinants of service quality than resource provision alone.

CONCLUSION

Based on research examining farmers' perceptions of the services and performance of agricultural extension workers in West Miomaffo District, the findings indicate a strong need to improve communication between extension workers and farmers. Farmers' perceptions play an important role in influencing the effectiveness of services and the performance of extension workers. The internal factors of agricultural extension workers (X1) show a positive and significant influence on the performance of agricultural extension workers (Y1). Furthermore, these internal factors (X1) also have a positive and significant effect on agricultural extension services (Y2). External factors (X2) have a positive and significant effect on the performance of agricultural extension workers (Y1).

External factors (X2) have a positive and significant effect on agricultural extension services (Y2). Therefore, it is necessary to make efforts to improve communication involving

increasing the intensity of meetings between agricultural extension workers and farmers. Transparent visit scheduling can be a concrete step to build trust and ensure that the information conveyed by extension workers is well received by farmers. This will help strengthen cooperation between the two parties, increase farmers' understanding of new agricultural technologies, and ultimately support increased agricultural productivity in West Miomaffo District.

This study is limited in its generalizability to other garlic-producing areas in TTU Regency and beyond. As a suggestion, relevant parties, including the Agriculture Office and agricultural extension workers, can implement a structured and transparent visit scheduling system. Efforts are needed to understand the needs and preferences of farmers in terms of the frequency and type of information they require. Additional training for agricultural extension workers in interpersonal communication and effective information delivery can also be a positive step. In addition, the use of information technology, such as mobile applications or short message services (SMS), can help facilitate coordination and communication between extension workers and farmers. Thus, this improvement in communication can have a positive impact on increasing agricultural productivity and farmers' welfare in West Miomaffo District.

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AUTHOR CONTRIBUTION STATEMENT

Marsianus Falo: Conceptualization, Methodology, Data Collection, Formal Analysis, Writing – Original Draft, Writing – Review & Editing, Project Administration, and Corresponding Author. Ody Wolfrit Matoneng: Methodology, Data Collection, Formal Analysis (SEM-PLS), Visualization, and Writing – Review & Editing. Oktovianus Tabenu: Data Collection, Field Survey Coordination, Validation, and Writing – Review & Editing. All authors have read and agreed to the published version of the manuscript.

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