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The Influence of Knowledge, Skills, Attitudes, and Behavior on the Sustainable Performance of Vegetable Farmers from the Perspective of Sustainable Development Goals (SDGs) (A Study of Vegetable Farmers in Napu, North Lore District Poso Regency)

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Abstract: This study aims to analyze the influence of knowledge, skills, attitudes, and behaviors on the sustainable performance of vegetable farmers from the perspective of the Sustainable Development Goals (SDGs) in Napu, North Lore District, Poso Regency. Farmers' sustainable performance is a crucial indicator in supporting agricultural development oriented toward economic, social, and environmental sustainability. The research method employed was a quantitative approach using a survey technique. Data were collected by distributing questionnaires to vegetable farmers. The data analysis technique used was multiple linear regression to determine the influence of independent variables (knowledge, skills, attitudes, and behavior) on the dependent variable (sustainable performance). The results of the study indicate that knowledge, skills, attitudes, and behavior simultaneously have a significant influence on the sustainable performance of vegetable farmers. Partially, knowledge and skills have a positive and significant effect, while attitudes and behavior also positively influence sustainable performance. These findings indicate that enhancing farmers' capacity through education, training, and behavioral change is crucial to achieving SDG goals, particularly in food security, sustainable agriculture, and farmer well-being. The implication of this research is the need to strengthen extension and mentoring programs for farmers to improve human resource quality and encourage the adoption of sustainable agricultural practices.

Keywords: Attitudes; Behavior; Knowledge; SDGs; Skills; Sustainable performance; Vegetable farmers

Introduction

The agricultural sector plays a strategic role in supporting food security, labor absorption, and increasing rural communities' incomes. However, the success of farming is not solely determined by the availability of land, capital, and technology; it also depends heavily on the quality of human resources as the primary managers of production. Farmers' competencies in the form of knowledge, skills, and managerial capacity have been proven to enhance work efficiency, productivity, and market access (Priambodo, 2025). The process of changing the agricultural sector for the better is known as agricultural development (Soekartawi, 2005; Mukhlis et al., 2019). Such capacity development also significantly influences improvements in agricultural yields and quality, particularly through participatory extension that encourages the adoption of innovations and the modernization of cultivation practices (Ibrahim et al.,

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2022; Purdawan et al., 2025). From the perspective of human capital theory, farmers' literacy and education are even the primary determinants of improved performance and participation in a more competitive agribusiness system (Dogeje et al., 2024). Therefore, strengthening individual farmers' capacities is key to sustainably enhancing agricultural productivity and competitiveness.

The quality of agricultural human resources—reflected in education, technical and managerial skills, and adaptive capacity—determines farmers' ability to adopt innovations, manage inputs efficiently, and respond to market dynamics, technological developments, and climate change. Strengthening training, technology adoption, and community-based learning has been proven to increase farmers' productivity and income. At the same time, innovation-driven approaches and multi-stakeholder collaboration reinforce the self-reliance and competitiveness of farming enterprises (Harudin, 2025; Kurdi et al., 2023). Policy support through vocational education, labor protection, and agribusiness digitalization also plays a crucial role in transforming the agricultural sector (Yudianto & Soedarto, 2025). At the individual level, the synergy of technical, managerial, and social competencies drives the sustainability of people–profit–planet-based enterprises, in line with the use of smart farming as an engine of innovation toward productive and sustainable agriculture (Barroso-barroso et al., 2026; Sudarmanto et al., 2024). Thus, farmers' performance must be comprehensively understood across economic, social, and environmental dimensions, in line with the Sustainable Development Goals (SDGs), particularly Goals 2, 8, 12, and 13.

Vegetables are a strategic horticultural subsector that underpins food security and farmers' household income. In the Lore Utara Subdistrict, Napu, Poso Regency, vegetable farming is the primary livelihood. Yet, it is vulnerable to risks such as crop damage, climate uncertainty, and price fluctuations, thereby demanding high technical and managerial efficiency. Empirical evidence indicates that limited access to information, extension services, credit, and market infrastructure reduces the profitability of vegetable farming, while farmer characteristics and capacities—such as education, experience, and technology adoption ability—determine the success of productivity improvements (Firdaus et al., 2023; Shrestha et al., 2022). Thus, strengthening farmers' knowledge, skills, attitudes, and behaviors is key to achieving productive, adaptive, and sustainable farming.

Although various studies have examined the determinants of agricultural performance, most continue to focus on physical and economic factors such as land area, input use, and capital, without comprehensively examining the role of farmers' behavioral and psychological dimensions as part of human capital. On the other hand, studies that integrate knowledge, skills, attitudes, and behavior into a single, comprehensive analytical framework for sustainable performance remain relatively limited, particularly within the horticulture subsector in rural areas. Furthermore, SDG-based approaches at the micro level, particularly in the context of vegetable-farming households, have not been widely utilized as a multidimensional performance evaluation framework. This situation highlights a research gap in understanding how individual farmer competencies simultaneously influence farming performance—that is, not only productivity but also economic, social, and environmental sustainability.

Based on the above description, this study aims to analyze the simultaneous and partial effects of knowledge, skills, attitudes, and behavior on the sustainable performance of vegetable farmers in Napu, Lore Utara Subdistrict, Poso Regency. This study is expected to provide a theoretical contribution to the development of the concept of human capital-based agricultural performance, as well as a practical contribution to the formulation of policies for enhancing farmers' capacity in support of achieving sustainable development goals.

Method

This study was conducted in Napu, Lore Utara Subdistrict, Poso Regency, Central Sulawesi Province, selected through purposive method (Mukhlis et al., 2023; Mukhlis et al., 2024; Asgaf et al., 2025), based on the consideration that the area serves as a vegetable production hub and constitutes the primary livelihood of the community, while also functioning as a supplier of vegetable needs across Central Sulawesi and beyond the island, particularly to East Kalimantan. The research was conducted in May–June 2025. Data collection was carried out through field surveys using structured questionnaires, interviews, and direct observation of respondent farmers.

The variables in this study include independent and dependent variables. The independent variables include knowledge (X1), skills (X2), attitudes (X3), and behavior (X4), while the dependent variable is vegetable farmers' performance (Y). Knowledge (X1) is measured using indicators such as educational level, experience, technical training, habits, and the ability to understand information related to farming. Skills (X2) encompass technical and managerial abilities, such as innovation, efficiency, collaboration, communication, and decision-making, in farming. Attitude (X3) reflects farmers'

psychological tendencies in receiving information, willingness to take risks, profit orientation, and readiness to adopt innovations. Meanwhile, behavior (X4) describes farmers' actual actions in running their farming operations, such as discipline, cooperation, motivation to achieve, and a focus on business improvement. Vegetable farmers' performance (Y) is measured through indicators of work completion ability, responsibility, discipline, technical proficiency, and work ethic in managing farming operations.

All variables were measured using a Likert scale from 1 to 5, indicating respondents' level of agreement with each statement, from strongly disagree to strongly agree. The research instrument consisted of 58 questions organized according to the indicators for each variable. This scale was used to quantify respondents' perceptions and evaluations of the aspects under study, thereby enabling further statistical analysis.

Before data analysis, the research instrument was tested for validity and reliability to ensure the measurement tool accurately and consistently captured the variables. The validity test was conducted using Pearson's Product-Moment correlation, which involves correlating each item's score with the total score of the variable. A statement item is considered valid if the correlation coefficient (calculated r) is greater than the table r at a 5% significance level ($\alpha = 0.05$). This validity test aims to ensure that each question item in the questionnaire represents the construct being measured.

Next, a reliability test was conducted to assess the consistency of the research instrument in measuring the variables. The reliability test was conducted using Cronbach's Alpha coefficient. A variable is considered reliable if it has a Cronbach's Alpha value greater than 0.60, indicating that the instrument has a good level of internal consistency. Thus, instruments that have met the validity and reliability criteria can be used in further analysis.

Data analysis in this study employed both descriptive and inferential methods. Descriptive analysis was conducted using frequency distributions to characterize the respondents and the level of assessment for each research variable. Meanwhile, inferential analysis used multiple linear regression to test the influence of the variables knowledge (X1), skills (X2), attitude (X3), and behavior (X4) on vegetable farmers' performance (Y). The regression model used in this study is formulated as follows:

$$Y = \alpha + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \varepsilon \quad (1)$$

Before conducting the regression analysis, classical assumption tests were performed, including tests for normality, multicollinearity, and heteroscedasticity, to ensure that the regression model used meets the BLUE (Best Linear Unbiased Estimator) assumptions.

Result and Discussion

The analyses used in this study are: (1) Frequency Distribution Analysis: to achieve the first objective, (2) Multiple Linear Regression Analysis, to achieve the second objective.

Frequency distribution analysis was conducted after all research data had been collected; the next step was to tabulate the data to determine the rankings of respondents' responses to the variables, whether they were Y variables or X variables. In this study, the variables in question are Knowledge (X1), Skills (X2), Attitude (X3), and Behavior (X4), with Vegetable Farmers' Performance as the dependent variable (Y). A total of 58 survey items were administered to 64 vegetable farmers. Respondents' responses to each question item can be explained as follows:

Frequency Distribution of the Knowledge Variable (X1)

Respondents' answers to each question will determine the decisions made for further analysis. The frequency distribution of the knowledge variable is shown in Table 1. Based on the analysis results in Table 1, the knowledge variable (X1) has an average value of 3.89, which falls into the "good" category. This indicates that vegetable farmers possess an adequate level of knowledge to support their farming activities, as reflected in their education, training, experience, and practices. From a human capital perspective, this knowledge plays a crucial role in enhancing agricultural productivity and efficiency (Djomo & Sikod, 2012; Saha et al., 2025). Additionally, capacity building through extension services and skill enhancement helps improve farmers' decision-making abilities (Tamsan & Yusriadi, 2022), and supports agricultural adaptation and modernization through increased business specialization (Jin & Liu, 2025).

More specifically, the habit indicator (X1.7) showed the highest mean value of 4.25, indicating that farmers' knowledge formation depends not only on formal education but is also significantly influenced by experiential learning (learning by doing) in daily farming practices. This suggests that empirical experience is a dominant factor in building farmers' cognitive capacity, particularly in technical and managerial decision-making. From a human capital theory perspective, knowledge accumulation is not only acquired through formal education but also through practical, continuous learning processes. These findings align with research results showing that training and practical experience can enhance the accumulation of human capital—both technical and digital—in

agricultural activities (Zeng et al., 2026), as well as strengthen farmers' capacity and livelihood capital through skill enhancement and practice-based learning (Zhang & Yang, 2025).

Table 1. Frequency Distribution of the Knowledge Variable (X1)

Indicator	Respondent Responses										Total Score	Mean
	SB		B		CB		TB		STB			
	∑	%	∑	%	∑	%	∑	%	∑	%		
Public schools	23	35.9	34	53.1	6	10.9	1	3.1	0	0	271	4.23
Agricultural Vocational School	24	37.5	28	43.8	12	18.8	0	0	0	0	268	4.19
Non-Agricultural Vocational Schools	12	18.8	24	37.5	22	34.4	6	9.4	0	0	234	3.66
Agricultural Technical Training	23	35.9	30	46.9	11	17.2	0	0	0	0	268	4.19
Non-Agricultural Technical Training	6	9.4	37	57.8	15	23.4	6	9.4	0	0	235	3.67
Experience	19	29.7	38	59.4	6	9.4	1	1.6	0	0	267	4.17
Habits	28	43.8	26	40.6	8	12.5	2	3.1	0	0	272	4.25
Culture	13	18,8	30	46.9	13	20.3	7	10.9	1	1.6	239	3.73
Intellect	10	15.6	21	32.8	21	32.8	11	17.2	1	1.6	220	3.44
Vision	5	7.8	27	42.2	17	26.6	14	21.9	1	1.6	213	3.33
Average												3.89

Source: Primary data processed, 2025

Conversely, the visual observation indicator (X1.10) has the lowest average value of 3.33, indicating that visual observation is not a primary determinant in the formation of farmers' knowledge. Knowledge tends to be cumulative through repeated experience, making participatory and experience-based learning approaches more effective than one-way knowledge transfer. This aligns with findings that active engagement and continuous training enhance farmers' technical capacity (Arsyad et al., 2025), as well as that human capital—through experience, education, and extension services—plays a crucial role in agricultural decision-making (To-The et al., 2025). Furthermore, continuous learning supported by social interaction strengthens the sustainability of agribusiness operations (Syamsiah et al., 2025).

Overall, a high level of knowledge is a vital asset in improving the performance of sustainable farming operations. Knowledge enables farmers to be more adaptive to changes in technology, markets, and the environment, thereby enhancing the efficiency and competitiveness of farming enterprises. From a sustainable development perspective, strengthening knowledge capacity also plays a role in promoting efficient and environmentally friendly resource management, in line with the principles of the SDGs in supporting food security and agricultural sustainability (Chowdhuri & Pal, 2025). This is reinforced by findings that sustainable agriculture is key to maintaining ecological stability and global food security (Chen et al., 2025), and that the adoption of sustainable agricultural practices significantly increases productivity through improved knowledge and extension support (Ejeta & Bai, 2024).

Frequency Distribution of the Skill Variable (X_2)

Respondents' answers to each question will determine the decision made for further analysis in the form of the Skill variable (X_2). Based on the analysis results in Table 2, the skill variable (X2) has an average value of 3.96, which falls into the "good" category. This indicates that vegetable farmers possess adequate skill levels to support farming activities in both technical and managerial aspects. These skills are reflected in the ability to innovate, be efficient, cooperate, and make decisions, which contribute to improved agricultural business performance. This finding aligns with research showing that farmers' skills play a significant role in shaping decision-making and the success of agricultural business activities (Wasono et al., 2024).

More specifically, the imagination indicator (X2.3) had the highest mean value of 4.17, indicating that creative thinking ability is a key strength for farmers in developing their agricultural businesses. This suggests that farmers do not merely rely on conventional practices but also possess the capacity to explore new opportunities and adapt to the dynamics of agricultural business. This imaginative ability plays a crucial role in driving innovation, business diversification, and increased value added in production (Olawa Olatomide Waheed, Olawa Omowumi Ayodele, 2020; Parinsi et al., 2025). Within the context of the agricultural innovation system, creativity and innovation are key elements in supporting the transformation toward sustainable agriculture that is not only productivity-oriented but also focuses on environmental and social aspects (Daum et al., 2025). Additionally, innovation has been proven to significantly improve efficiency and productivity in agricultural businesses, further strengthened by the integration of technology and innovation systems that foster the development of more adaptive and modern

agricultural business models (Luo et al., 2025; Parikoglou et al., 2024).

On the other hand, the persuasive indicator (X2.8) has the lowest average value of 3.64, indicating that the ability to communicate and influence others remains relatively limited. This suggests that while farmers possess good technical skills, strengthening social skills—particularly in communication, negotiation, and business networking—is still necessary to improve market access and collaboration. These findings align with studies showing that business communication and social capital significantly influence farm business performance (Wunawarsih et al., 2026), as well as the fact that inclusive communication can expand farmers' access to information and economic opportunities (Budiwiranto et al., 2025). Additionally, effective interpersonal communication has been shown to strengthen coordination and collaboration within farmer groups (Hibban & Fajri, 2025).

Table 2. Frequency Distribution of the Skill Variable (X_2)

Indicator	Respondent Responses										Total Score	Mean
	SB		B		CB		TB		STB			
	∑	%	∑	%	∑	%	∑	%	∑	%		
Intuition	19	29.7	34	53.1	10	15.6	1	1.6	0	0.0	263	4.11
Innovation	14	21.9	36	56.3	14	21.9	0	0.0	0	0.0	256	4.00
Imagination	21	32.8	35	54.7	7	10.9	1	1.6	0	0.0	267	4.17
Inspiration	7	10.9	37	57.8	16	25	4	6.3	0	0.0	239	3.73
Positive behavior	24	37.5	26	40.6	11	17.2	3	4.7	0	0.0	263	4.11
Cooperative	18	28.1	33	51.6	12	18.8	1	1.6	0	0.0	260	4.06
Collaborative	10	15.6	36	56.3	16	25.0	2	3.1	0	0.0	246	3.84
Persuasive	13	20.3	22	34.4	22	34.3	7	10.9	0	0.0	233	3.64
Negotiating	19	29.7	29	45.3	13	20.3	3	4.7	0	0.0	256	4.00
Commitment	13	20.3	33	51.6	14	21.9	4	6.3	0	0.0	247	3.86
Consistent	18	28.1	29	45.3	14	21.9	3	4.7	0	0.0	254	3.97
Effective	15	23.4	33	51.6	14	21.9	2	3.1	0	0.0	253	3.95
Efficient	16	25	37	57.8	10	15.6	1	1.6	0	0.0	259	4.05
Average												3.96

Source: Primary data processed, 2025

Overall, a high level of skills contributes to improved farm performance by strengthening innovation capacity, efficiency, and adaptation to change. Therefore, the development of farmers' skills—both technical and non-technical—is a critical factor in supporting the sustainability of farming enterprises and enhancing the competitiveness of the agricultural sector.

Frequency Distribution of the Attitude Variable (X3)

Respondents' answers to each question will determine the decision for further analysis in the form of the attitude variable (X3). Based on the analysis results in Table 3, the attitude variable (X3) has a mean value of 4.02, which falls into the "very good" category, indicating farmers' positive attitudes toward supporting agricultural enterprises, particularly regarding information reception and innovation adoption. This attitude is influenced by access to information, the role of groups, and communication media that reinforce decision-making. These findings align with research showing that learning attitudes and access to information influence technology adoption (Oli et al., 2025), supported by the use of information technology to enhance farmers' decision-making capacity (Sasmita, 2026), and influenced by socio-economic and institutional factors in the innovation adoption process (Adnan et al., 2025; Forero et al., 2025).

More specifically, the benefit indicator (X3.9) has the highest value, indicating that economic orientation is the primary factor in shaping farmers' attitudes, particularly in farming decisions aimed at income generation (Sarie et al., 2023). Conversely, low values for the risk indicator, satisfaction with traditional methods, and managerial ability suggest a tendency toward conservative attitudes. This aligns with findings that farmers tend to exhibit risk aversion, which influences innovation adoption (Patil & Veettil, 2024; Sulewski et al., 2020), and that the complexity of innovations poses a barrier to their implementation (Rizzo et al., 2024). Therefore, strengthening aspects of innovation, courage and business management remains necessary.

Overall, a positive attitude plays a crucial role in driving improvements in farming performance through openness to information, a profit-oriented mindset, and a willingness to adopt more efficient and productive practices. Therefore, fostering adaptive and progressive attitudes is a key factor in supporting the sustainability of farming operations and enhancing the competitiveness of the agricultural sector.

Table 3. Frequency Distribution of the Attitude Variable (X_3)

Indicator	Respondent Responses										Total Score	Mean
	SB		B		CB		TB		STB			
	∑∑	%	∑	%	∑	%	∑	%	∑	%		
Information source	23	35.9	27	42.2	13	20.3	1	1.6	0	0.0	264	4.13
Group	26	40.6	29	45.3	9	14.1	0	0.0	0	0.0	273	4.27
Communication media	27	42.2	31	48.4	5	7.8	1	1.6	0	0.0	276	4.31
Language and culture	16	25	37	57.8	10	15.6	1	1.6	0	0.0	260	4.06
Level of need	20	31.3	29	45.3	11	17.2	4	6.3	0	0.0	257	4.02
Searching for information	25	39.1	30	46.9	8	12.5	1	1.6	0	0.0	271	4.23
Detailed information	25	39.1	34	53.1	3	4.7	2	3.1	0	0.0	274	4.28
Community support	20	31.3	35	54.7	8	12.5	1	1.6	0	0.0	100	4.16
Profit	31	48.4	27	42.2	6	9.4	0	0.00	0	0.0	281	4.39
Business Objectives	16	25	27	42.2	21	32.8	0	0.00	0	0.0	251	3.92
Other people's experiences	12	18.8	36	56.3	16	25	0	0.00	0	0.0	252	3.94
Special Skills	21	32.8	35	54.7	6	9.4	2	3.1	0	0.0	267	4.17
Old-fashioned satisfaction	9	14.1	33	51.6	19	29.7	3	4.7	0	0.0	240	3.75
Willing to take risks	14	21.9	27	42.2	12	18.8	11	17.2	0	0.0	236	3.69
Practice	18	28.1	31	48.4	13	20.3	2	3.1	0	0.0	257	4.02
Price factor	15	23.4	23	35.9	18	28.1	8	12.5	0	0.0	237	3.70
Satisfied with the experience	11	17.2	31	48.4	18	28.1	4	6.3	0	0.0	241	3.77
Able to manage a business	3	4.7	42	65.6	14	21.9	5	7.8	0	0.0	235	3.67
Business Analysis	15	23.4	28	43.8	17	26.6	4	6.3	0	0.0	246	3.84
Average												4.02

Source: Processed primary data, 2025

Frequency Distribution of the Behavioral Variable (X4)

Respondents' responses will determine the decisions made for further analysis in the form of behavioral variables (X4). Based on the analysis results in Table 4, the behavioral variable (X4) has a mean of 3.96 (good category), indicating that farmers exhibit behaviors that support agricultural activities, particularly in collaboration, motivation, and competence. This finding aligns with studies confirming that collaboration and group learning enhance farmers' behavior and productivity (Dalmiyatun et al., 2025; Milliet et al., 2024). It is reinforced by the role of extension services and social support in shaping adaptive and entrepreneurial behavior (Qonita et al., 2025; Tambipessy, n.d.). Additionally, motivation and the work environment contribute to improved farmer performance (Irhamni et al., 2024; Wisnujati et al., 2025).

Table 4. Frequency Distribution of Behavioral Variables (X_4)

Indicator	Respondent Responses										Total Score	Mean
	SB		B		CB		TB		STB			
	∑	%	∑	%	∑	%	∑	%	∑	%		
1. Achievements	6	9.4	32	50	18	28.1	7	10.9	1	1.6	227	3.55
2. Affiliates	33	51.6	26	40.6	5	7.8	0	0.0	0	0.0	284	4.44
3. Competencies	28	43.8	28	43.8	8	12.5	0	0.0	0	0.0	276	4.31
4. In Power	8	12.5	23	35.9	12	18.8	20	31.3	1	1.6	209	3.27
5. Physiology	19	29.7	27	42.2	16	25	2	3.1	0	0.0	255	3.98
6. Safety	35	54.7	18	28.1	11	17.2	0	0.0	0	0.0	280	4.38
7. Grouping	36	56.3	20	31.3	5	7.8	3	4.7	0	0.0	281	4.39
8. Awards	9	14.1	20	31.3	20	31.3	14	21.9	1	1.6	214	3.34
Average												3.96

Source: Processed primary data, 2025

Furthermore, the affiliation indicator (X4.2) has the highest value of 4.44, indicating that social interaction and group cooperation are dominant factors in farmers' behavior. This underscores the importance of social capital in fostering participation, collaboration, and the success of farming enterprises (Zhou et al., 2025). These findings align with research showing that social capital enhances farmers' productivity and well-being (Arum et al., 2023; Kehinde et al., 2021), as well as influencing production behavior and the adoption of agricultural practices (Doğan et al., 2025). The high values of the group-related and safety indicators further reinforce the collective aspects of sustainable farming.

The indicators for power (X4.4) and recognition (X4.8) have relatively lower values, indicating that power-based motivation and external recognition have not yet become the primary drivers of farmers' behavior. This suggests that farmers' behavior is driven more by social needs and business sustainability than by individual orientation. Overall, the resulting behavior reflects a strong collective character, yet still requires reinforcement in aspects of achievement motivation and recognition to sustainably improve farming performance.

Frequency Distribution of the Variable "" of Vegetable Farmers' Performance (Y)

Respondents' answers to each question will determine the decisions made for further analysis in the form of the vegetable farmer performance variable (Y).

Table 5. Frequency Distribution of the Performance Variables for Vegetable Farmer Performance, 2025

Indicator	Respondent Responses										Total Score	Mean
	SB		B		CB		TB		STB			
	∑	%	∑	%	∑	%	∑	%	∑	%		
Duties and functions	15	23.4	45	70.3	4	6.3	0	0.0	0	0.0	267	4.17
Master	14	21.9	42	65.6	8	12.5	0	0.0	0	0.0	262	4.09
Solve	14	21.9	40	62.5	8	12.5	2	3.1	0	0.0	258	4.03
Procedure	13	20.3	27	42.2	22	34.4	2	3.1	0	0.0	243	3.80
Discipline	17	26.6	35	54.7	10	15.6	2	3.1	0	0.0	259	4.05
Enthusiastic	26	40.6	27	42.2	9	14.1	2	3.1	0	0.0	269	4.20
Selfless	26	40.6	30	46.9	8	12.5	0	0.0	0	0.0	274	4.28
Responsible	24	37.5	30	46.9	7	10.9	3	4.7	0	0.0	267	4.17
Average												4.10

Source: Processed primary data, 2025

Based on the data in Table 5, it is evident that the respondents' responses to each indicator of the vegetable farmer performance variable (Y) havean average total score (mean) of 5. This indicates that the respondents' responses to each item regarding vegetable farmer performance (Y) fell into the "very good" category. The highest response from respondents was for the "Selfless" indicator (Y7), which was 4.28 out of a maximum score of 5, indicating that the response aligns with the intended objective.

Classical Assumption Tests

Results of the Normality Test

The results of the research data testing using the SPSS Release 21.0 statistical software program indicate that the research data points are scattered and form a diagonal line following a straight line, so the classical assumption of normality can be considered met for further research. Figure 1 shows the graph of the results of the normality test for the dependent variable.

Based on the figure above from the assumption test results, it can be seen that the research instrument distribution follows a normal distribution along a diagonal straight line from the lower left corner toward the upper right. The closer the data distribution aligns with a straight line, the better the data quality, and a regular distribution forming a specific pattern indicates that the data in this regression model can be considered normally distributed.

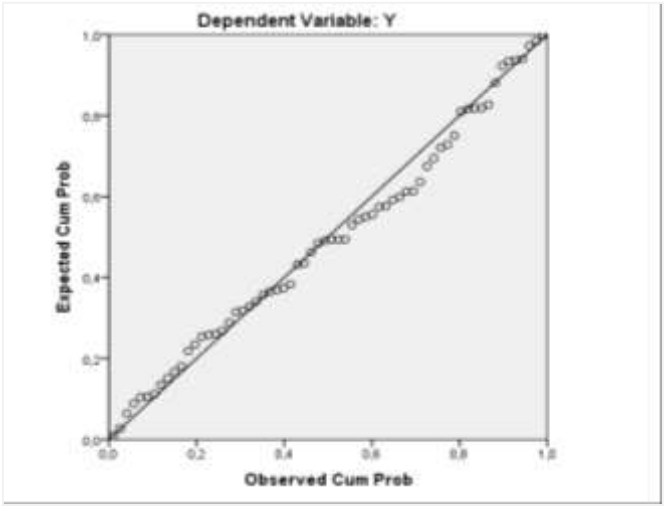

Figure 1. Normality Test

Multicollinearity Test

The multicollinearity test aims to determine whether there is a correlation between variable Y and variable X. The multicollinearity test can be conducted by examining its indicators; for example, if the tolerance value is close to 1, there is no multicollinearity issue, whereas if the tolerance value is not close to 1, a multicollinearity issue exists. The details regarding the multicollinearity test using the SPSS Release 21.0 software are shown in Table 6 as follows.

Table 6. Results of the Multicollinearity Test

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.508	.522		-0.974	.334		
	Knowledge (X1)	.423	.118	.371	3.586	.001	.655	1.527
	Skills (X2)	.235	.114	.203	2.062	.044	.723	1.384
	Attitude (X3)	.312	.121	.266	2.566	.013	.655	1.527
	Behavior (X4)	.197	.093	.192	2.117	.038	.850	1.176

a. Dependent Variable: Y

Source: Processed primary data, 2025

Based on the data in Table 6, it can be concluded that there is no multicollinearity in the regression model obtained, since the correlations between the variables do not exceed the required correlation threshold (α) of 0.05 at a 95% significance level. Thus, the four independent variables—Knowledge (X1), Skills (X2), Attitude (X3), and Behavior (X4) studied are suitable for measuring the influence on the dependent variable (Y), namely the Performance of Vegetable Farmers in Napu, Lore Utara Subdistrict, Poso Regency.

Heteroscedasticity Test

The heteroscedasticity test aims to determine the presence of deviations in the regression model from one observation to another. The heteroscedasticity test was conducted using the Spearman Rank test with the SPSS Release 21.0 software; the estimates obtained indicate that the population is unbiased and the sample used is consistent with the actual population. Information regarding the heteroscedasticity of the regression model is shown in Figure 2.

Based on the figure 2, it can be seen that the residuals are scattered irregularly and do not form a specific pattern; thus, it can be concluded that there is no heteroscedasticity or that the regression equation satisfies the assumption of homoscedasticity.

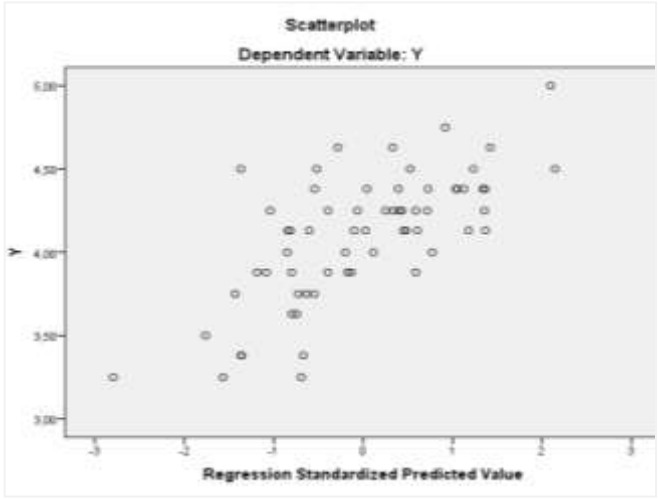

Figure 2. Heteroscedasticity test of vegetable farmers' performance variables

Multiple Linear Regression Analysis

Multiple linear regression analysis aims to determine the influence of the independent variables (X), namely: Knowledge (X1), Skills (X2), Attitude (X3), and Behavior (X4), on the dependent variable (Y), namely the performance of vegetable farmers in Napu, Lore Utara Subdistrict, Poso Regency. The results of the quantitative analysis are shown in Table 7.

Table 7. Results of Multiple Linear Regression Analysis

Dependent Variable (Y)	Independent Variables (X)	Coefficient Regression	$t_{calculated}$	Sig	Notes
Performance of Vegetable Farmers (Y)	Constant (α)	-0.508	-0.974	0.33	Significant
	Knowledge (X_1)	0.423	3.586	0.00	Significant
	Skills (X_2)	0.235	2.062	0.04	Significant
	Attitude (X_3)	0.312	2.566	0.01	Significant
	Behavior (X_4)	0.197	2.117	0.03	Significant
R			= 0.765	$F_{calculated}$	= 0 20.863
Adjusted R-Square			= 0.558	Sig	= 0.000
R^2					= 0.586

Source: Processed primary data 2025

Based on the data in Table 7 regarding the results of the multiple linear regression calculation, the regression equation that can be constructed using these values is as follows:

$$Y = -0.508 + 0.423X_1 + 0.235X_2 + 0.312X_3 + 0.197X_4$$

Based on this multiple linear regression equation, the constant (intercept) of the unstandardized coefficient of -0.508 can be explained as follows: (a) The constant value of -0.508 indicates that knowledge, skills, attitudes, and behavior can improve vegetable farmers' performance; (b) An increase in knowledge will affect farmers' performance; (c) If there is an improvement in skills, it will affect the farmers' performance; (d) A change in attitude, it will affect vegetable farmers' performance; (e) A change in behavior, it will affect farmers' performance.

Conclusion

Based on the research results and discussion, the following conclusions can be drawn: (1) Knowledge, skills, attitudes, and behavior simultaneously have a significant effect on the performance of vegetable farmers in Napu, Lore Utara Subdistrict, Poso Regency; (2) Knowledge has a positive and significant effect on the performance of vegetable farmers in Napu, Lore Utara Subdistrict, Poso Regency; (3) Skills have a positive and significant effect on the performance of vegetable farmers in Napu, North Lore District, Poso Regency; (4) Attitude has a positive and significant effect on the performance of vegetable farmers in Napu, North Lore District, Poso Regency; (5) Behavior has a positive and significant effect on the performance of vegetable farmers in Napu, Lore Utara Subdistrict, Poso Regency.

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Author Contributions
A.A.: Conceptualization, developing ideas, analyzing, writing, reviewing, responding to reviewers' comments; W.P.: analyzing data, overseeing data collection, reviewing scripts, and writing.

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Conflicts of Interest
The authors declare no conflict of interest.

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