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The Effect of Extension on The Production of Green Feed for Livestock Using Fodder Media on The Independence and Decision-Making of Livestock Farmers in Providing Feed

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ABSTRACT

This study aims to determine the effectiveness level of the extension program and analyze the effect of knowledge, attitudes, and skills on the self-reliance and decision-making of sheep farmers, including examining the role of self-reliance as a mediating variable. This research employed a quantitative descriptive method with a one-group pre-test–post-test pre-experimental design. The sample consisted of 37 active sheep farmers affiliated with farmer groups, selected through purposive sampling. Data were collected using observations, interviews, and Likert scale questionnaires, and subsequently analyzed using path analysis via the SPSS program. The results indicated that the extension activities were highly effective, achieving an Extension Effectiveness value of 88.95% and a Behavior Change Effectiveness of 80.61%. The variables of knowledge and skills were proven to have a positive and significant effect on self-reliance and decision-making, whereas attitude showed no significant effect. The self-reliance variable was also proven to have a positive and highly significant effect on decision-making. In conclusion, knowledge and skills significantly influence decision-making, both directly and indirectly. Self-reliance can effectively mediate the impact of these knowledge and skills, thereby enhancing the sheep farmers' ability to make decisions regarding the adoption of corn fodder innovation as forage.

Keywords: *Corn Fodder, Decision-Making, Extension Effect, Self-Reliance, Livestock Farmers*

1. INTRODUCTION

Livestock is a crucial sector in agricultural and food development in Indonesia. In the process of developing ruminant livestock, farmers often face challenges in feed availability. Green fodder is a primary requirement because it serves as a source of nutrition that influences livestock productivity. Generally, sheep farmers still raise livestock traditionally, feeding them from grazing [1]. However, forage availability is often hampered by the dry season and land conversion. This problem is also experienced by sheep farmers in Tampirwetan Village, Candimulyo District.

The need for a practical and efficient feed supply system is crucial. One alternative solution is corn fodder cultivation using hydroponic methods. This innovation can produce feed quickly on limited land. The success of fodder technology implementation is influenced not only by the availability of innovation but also by changes in farmer behavior, as measured by knowledge, attitudes, and skills.

Good knowledge, attitudes, and skills are expected to foster farmer independence in managing resources and planning feed supply without relying on external factors. This independence will ultimately influence farmers' decision-making abilities in rationally selecting the best feed supply alternatives [2].

Based on these problems, this study aims to determine: the effectiveness of changes in the behavior of sheep farmers in corn fodder extension activities; the influence of knowledge, attitudes, and skills on independence; the influence of knowledge, attitudes, and skills on decision-making; and the indirect influence through independence as a mediating variable.

2. METHODS

2.1 Time and place

This research was conducted in Tampirwetan Village, Candimulyo District, Magelang Regency. Data collection and outreach activities were conducted over a two-month period, from April 6, 2026, to June 4, 2026.

2.2 Research Design and Sample

The study used a quantitative descriptive approach with a pre-experimental one-group pre-test–post-test design. The study population was all 90 sheep farmers in Tampirwetan Village. Sampling was conducted using a purposive sampling technique with the following criteria: active farmer group members (at least 3 meetings in the last 5 months), owning at least 2 sheep, and having at least 3 years of livestock farming experience. A sample of 37 respondents was obtained.

2.3 Data Collection and Analysis

Primary data collection was conducted through observation, interviews, and distribution of Likert-scale questionnaires (1-5) before (pre-test) and after (post-test) the extension activities. The instruments have undergone validity and reliability tests.

Data analysis used descriptive statistics to measure Extension Effectiveness (EP) and Behavior Change Effectiveness (EPP). To test the hypothesis of relationships between variables, ordinal data were transformed into intervals using the Method of Successive Intervals (MSI). After classical assumptions (normality, multicollinearity, and heteroscedasticity) were met, Path Analysis was performed using SPSS software.

The structural equations used are:

Equation I: $Y1 = \varrho Y1X1 + \varrho Y1X2 + \varrho Y1X3 + €1$

Equation II: $Y2 = \varrho Y2X1 + \varrho Y2X2 + \varrho Y2X3 + \varrho Y2Y1 + €2$

3. RESULTS AND DISCUSSION

3.1 Respondent Characteristics

The 37 respondents were predominantly farmers with a high school education (35%) and elementary school education (27%). All respondents were active in farmer group meetings. The majority had more than 18 years of livestock farming experience (35%) and owned small-scale livestock of between 3 and 8 sheep (51%).

3.2 Effectiveness of Counseling and Behavior Change

Based on pre-test and post-test evaluations, there was a significant improvement in all aspects of farmer behavior after participating in the corn fodder training. The following are the results of the training evaluation for each aspect.

3.2.1 Knowledge

The results of the knowledge analysis showed an increase in knowledge after the corn fodder counseling session for sheep farmers in Tampirwetan Village. Thirty people (30%) were in the "Don't know" category before the counseling (pre-test), and this increased after the counseling (post-test) to 31 people (84%) in the "Very knowledgeable" category. The results of the knowledge aspect analysis are presented in a continuum line in Figure 1.



Figure 1. Continuum line of knowledge aspects

The continuum line shows that there was an increase in knowledge, namely from a score of 412 to 1,155. The percentage increase in knowledge was 57.37% with a score difference of 743. The increase in knowledge was because respondents had received information through extension activities. The initial condition was dominated by the "Don't know" category at 81% indicating that previously respondents did not have adequate information or basic understanding regarding corn fodder. The total change in the post-test showed that 84% of respondents were in the "Very knowledgeable" category, proving that the material presented was very easy for respondents to understand.

This indicates that the information delivered was on target and able to address respondents' previous knowledge gaps. The results of the knowledge aspect can be attributed to the appropriateness of the extension materials provided to the target audience. This is in accordance with the statement of [3] that through an individual approach with lectures, discussions, demonstrations, and aids in the form of printed or visual media. In addition to relevant material, the delivery or extension method used successfully attracted attention, thereby increasing respondents' knowledge and understanding. This is in accordance with the statement of [4], namely that easy access to information through extension can help someone acquire and improve new knowledge.

3.2.2 Attitude

The results of the attitude analysis showed an improvement in respondents' attitudes. The increase in respondents' attitudes increased from the "Undecided" category in the pre-test of 21 people (57%) to the "Strongly agree" category of 23 people (62%) in the post-test. The results of the attitude analysis are presented as a continuum in Figure 2.

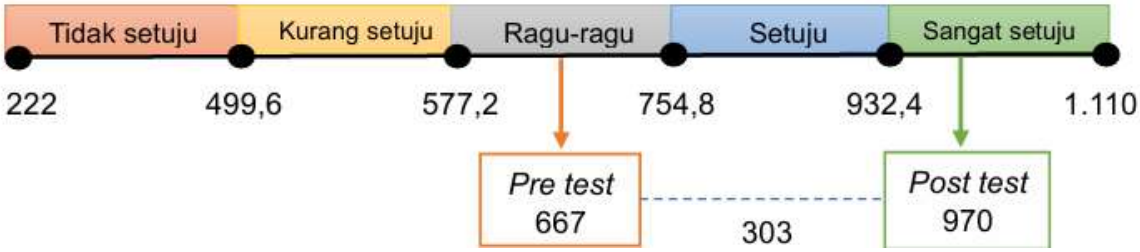


Figure 2. Continuum line of attitude aspects

Based on the continuum line, respondents' attitudes increased in value or score from 667 to 970. The increase in respondents' attitudes was 27.30% with a score of 303, this result was due to the existence of targeted extension activities with methods and tools that suited the target's needs. The post-test results showed positive acceptance and agreement. Respondents' previously hesitant attitudes indicate they had not received persuasive information to convince them to adopt corn fodder. Respondents showed positive acceptance after receiving counseling on corn fodder.

This is because respondents have received information through extension services with appropriate materials, methods, and tools, thus successfully building respondents' interest in the application of corn fodder. In accordance with the opinion of [5], who stated that farmers' attitudes can be improved through targeted extension services with relevant materials, lecture methods,

discussions, and demonstrations, as well as aids in the form of folders. Respondents' attitudes in extension activities indicate the potential for success in the application of corn fodder forage technology. This is supported by research by [6] which confirms that success in the implementation of feed technology is supported by continuous extension and mentoring. Most respondents showed a positive attitude towards the production of corn fodder as an alternative forage.

3.2.3 Skills

The analysis of the skills aspect showed an increase in respondents' skills. Respondents' attitudes increased from the "Unskilled" category in the pre-test (24 respondents (65%) to the "Very Skilled" category (33 respondents (89%) in the post-test). The analysis results are presented as a continuum in Figure 3.

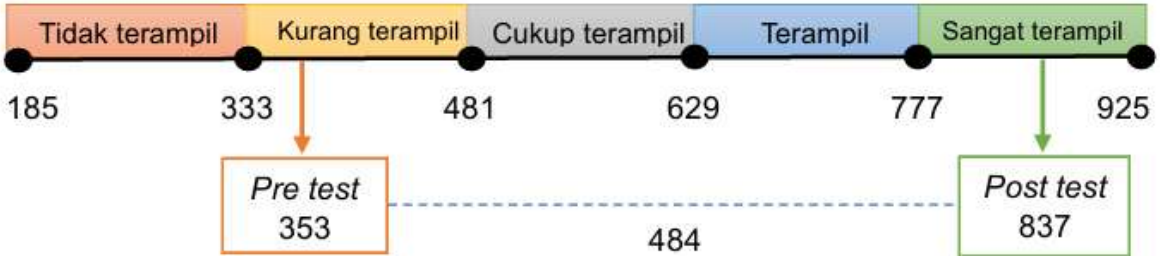


Figure 3. Continuum line of skill aspects

Respondents' skills based on the continuum line showed an increase in value or score from 353 to 837. Respondents' skills increased by 52.32% with a score difference of 484, this result is due to the extension method used, namely the demonstration method. This method can improve skills through respondent participation. Respondents' skills in making corn fodder are due to their experience and the participation of farmers through discussions with extension workers. In accordance with research conducted by [7] which confirms that skills are acquired by farmers through a process of self-learning and experience, as well as consultation between farmers and extension workers. Most respondents experienced an increase in skills after the extension.

The respondents' initial skills were classified as less skilled due to a lack of direct experience, technical mastery, and adequate familiarization with alternative forage preparation skills. Changes in respondents' skills after the training indicated that the instructors delivered theory and simulations or demonstrations effectively, enabling participants to practice accuracy and skills. The training method, which included Focus Group Discussions (FGDs) and demonstrations, was proven to improve participants' skills in making corn fodder. This is in line with [8] research, which found that FGDs and demonstrations can improve skill effectiveness.

3.2.4 Effectiveness Behavioral Change

Behavioral analysis was conducted to determine the level of behavioral change in target or respondent participants after participating in the extension activities. Behavioral change was assessed using a combination of three aspects: knowledge, attitudes, and skills, through participant involvement in the application or practice of corn fodder production, resulting in a value for the effectiveness of the extension and behavioral change. The results of the analysis are presented as a continuum in Figure 4.

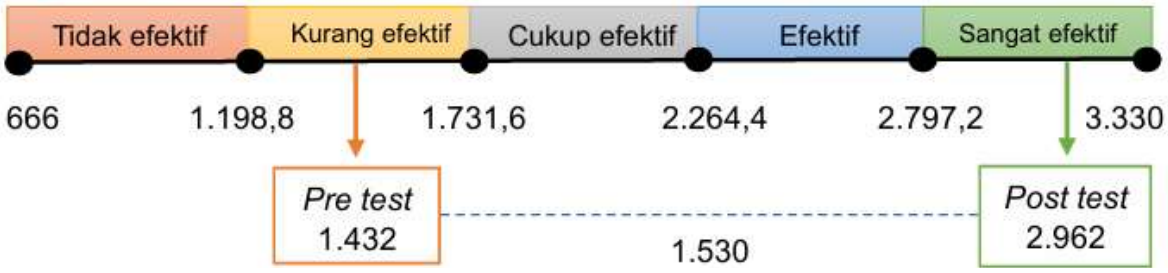


Figure 4. Continuum of behavior change

Based on the results of the behavioral change analysis, the extension of corn fodder as an alternative green fodder for sheep achieved the criteria of "Very effective." This was demonstrated by an extension effectiveness score of 88.95% and a behavioral change score of 80.61%. Effectiveness was also demonstrated by a more than twofold increase in the score, from 1,432 to 2,962.

The majority of respondents who were categorized as less effective during the pre-test indicated that their basic understanding of alternative forage supply materials was still limited. Through extension activities, it was proven that this program was able to raise awareness, change doubts, and improve respondents' skills in alternative forage supply. The extension activities that were implemented reached the very effective category, possibly due to several supporting factors, one of which was the level of education of the respondents, the majority of whom were high school/senior high school graduates. These results are supported by research stating that the higher the level of formal education (elementary, middle, high school, and university), the easier it is to accept and implement technological innovations in developing farming businesses [9]

3.3 The Effect of Extension on Independence (Equation I)

The data analysis technique used to calculate the magnitude of the influence of counseling (knowledge, attitudes, and skills) on independence and decision-making is path analysis. Path analysis is used to determine the relationship between exogenous variables and endogenous variables. The exogenous variables used are knowledge, attitudes, and skills. In equation I, the endogenous variable used is independence.

3.3.1 Determination test (R2)

This test was conducted to determine the model's ability to explain the independent variable (Y1). The results of the determination test (R2) are presented in Table 1.

Table 1. Determination test (*R2) Equation I*

R	R Square	Adjusted R Square	Standard Error of the Estimate
0.900a	0.809	0.792	0.175513

Source: Processed Data 2026

Based on Table 1 above, the correlation coefficient value shows a figure of 0.900, which is close to 1. This result indicates a very strong and positive relationship between knowledge, attitudes, and skills on independence. The coefficient of determination value shows a figure of 79.2% (Adjusted R Square = 0.792). These results indicate that the variation of the independence variable can be explained by knowledge, attitudes, and skills by 79.2%, while 20.8% is explained by other factors or variables outside the research model. Based on field conditions, factors outside the model that may influence independence come from the availability of capital and the adaptation process in implementing the innovation (corn fodder) provided. In line with research stating that factors outside the model that explain independence can be environmental conditions, internal motivation or available facilities [10].

Based on these results, it can be concluded that the independent variable's ability to explain the dependent variable is strong or very good. This research demonstrates that knowledge, attitudes,

and skills play a significant role in shaping independence. As stated, an R2 value approaching 1 indicates a stronger ability of the independent variable to explain the dependent variable. An R2 value (0.801–0.999) falls into the very good category [11].

3.3.2 Simultaneous influence test (F test)

Simultaneous influence testing is performed by reading the significance column (Sig.) in the ANOVA column. The results of the simultaneous influence test (F Test) are presented in Table 2.

Table 2. Simultaneous influence test (F test) of equation I

Model	Df	F	Sig.	Information
Regression	3	46,631	0.000b	Very significant influence
Residual	33			
Total	36			

Source: Processed Data 2026

Based on Table 2 above, a significance value of 0.000 (P<0.01) was obtained, so the decision is that H1 is accepted and H0rejected. These results indicate that the variables of knowledge, attitude, and skills simultaneously have a very significant influence on independence. The statistical analysis shows that independence is strongly influenced by the unity of three behavioral aspects: knowledge, attitude, and skills. Knowledge provides a foundation of information and understanding regarding the utilization of farmer potential in developing independence. Attitude acts as an internal motivation that can convince respondents to change. Skills are the technical means that demonstrate respondents' ability to take action toward independence. These results are supported by the opinion that behavior has a significant influence on the independence of broiler chicken farmers [12].

3.3.3 Partial influence test (t-test)

The t-test is used to determine the effect of each independent variable individually on the dependent variable. The magnitude of the effect is observed based on the Beta value and significance value in Table 3.

Table 3. The results of the partial test (t-test) of equation I

Variables	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Information
	B	Beta			
(Constant)	0.256		0.538	0.594	
Knowledge (X1)	0.478	0.512	2,185	0.036	Significant positive
Attitude (X2)	0.090	0.127	0.570	0.572	Positive not significant
Skills (X3)	0.324	0.322	2,788	0.009	Very significant positive

Source: Processed Data 2026

Based on the analysis in Table 3 above, knowledge is the most dominant variable in shaping independence. This is likely because respondents will make independent decisions if they have received theoretical and technical information or understanding. This is consistent with research showing that farmers who are able to acquire knowledge through formal and non-formal education have a high potential for achieving independence [13].

The results indicate that attitude is not a significant variable influencing independence. However, the positive regression coefficient indicates that the better the farmer's attitude toward the innovation, the greater the farmer's independence, although the increase is not statistically significant. This is because the level of attitude does not influence farmers' ability to utilize their potential to achieve independence. A positive attitude is not enough to make someone independent

if it is not accompanied by technical understanding and practical skills. This is in accordance with the opinion of [14] that attitude does not influence farmer independence in utilizing existing potential. Furthermore, the limitations of the pre-experimental design (one group) without a control group meant that external factors during the two-week period could not be fully controlled.

The skills results indicate that farmers' practical abilities in implementing innovations play a role in fostering independence. Essentially, independence is the ability to perform actions without relying on others. Respondents with technical skills were shown to be more independent in the field than those without practical skills. This aligns with research indicating that skills in PSK (knowledge, attitudes, and skills) are one aspect influencing farmers' independence in implementing new innovations in Wonorejo Village [15].

3.3.4 The influence of residual variables (€1)

The residual variable (€) is the difference between the predicted value and the actual observed value. The residual calculation results indicate the extent of the influence of external factors on farmer independence. The following are the residual variable values in this study.

$$€1 = \sqrt{1 - R^2}$$
$$= \sqrt{1 - 0{,}809}$$
$$= \sqrt{0{,}191}$$
$$= 0.437$$

Based on calculations, the residual path coefficient was 0.473. This result indicates that the structural model developed is excellent. Although the three main variables have significant contributions, the coefficient value of 0.437 demonstrates that independence does not solely depend on individual capacity.

3.4 Influence on Decision Making (Equation II)

Structural equation II was analyzed using the SPSS program by testing the coefficient of determination (R2 test), simultaneous influence (F test), and partial influence (t test). These tests were necessary to obtain path coefficients to describe the path analysis model in equation II.

3.4.1 Determination test (R2)

This test was conducted to determine the model's ability to explain the decision-making variable (Y2). The results of the determination test (R2) are presented in Table 4.

Table 4. Results of the determination test analysis*(R2)*

R	R Square	Adjusted R Square	Standard Error of the Estimate
0.966a	0.934	0.926	0.123513

Source: Processed Data 2026

Based on Table 4 above, the correlation coefficient value is 0.966, which is close to 1. This result indicates a very strong and positive relationship between knowledge, attitudes, skills, and independence in decision-making. The coefficient of determination value is 92.6% (Adjusted R Square = 0.926). These results indicate that 92.6% of the variation in decision-making variables can be explained by the four exogenous variables, while 7.4% is explained by other factors or variables outside the research model. Factors outside the model that explain decision-making can include information management within the organization [16].

Based on these results, it can be concluded that the independent variable's ability to explain the dependent variable is strong or very good. This study proves that knowledge, attitudes, skills, and independence play a significant role in decision-making. As stated, an R2 value approaching 1 indicates a stronger ability of the independent variable to explain the dependent variable. The R2 value (0.801–0.999) is considered very good [11].

3.4.2 Simultaneous influence test (F test)

Simultaneous influence testing is performed by reading the significance column (Sig.) in the ANOVA column. The results of the simultaneous influence test (F Test) are presented in Table 5.

Table 5. Simultaneous influence test (F test) of equation II

Model	Df	F	Sig.	Information
Regression	4	113,429	0.000b	
Residual	32			Very significant influence
Total	36			

Source: Processed Data 2026

The results of the F-test analysis indicate that these four variables are strongly integrated in shaping livestock farmers' decisions. Behavior (knowledge, attitudes, and skills) serves as the basis for identifying problems, analyzing alternative solutions, and predicting the risks of each choice to form a decision. Independence demonstrates that respondents are not easily influenced by external parties and have confidence in their own abilities in determining alternative green fodder supply options. Farmers equipped with knowledge and skills in alternative green fodder supply will have a high degree of independence, enabling them to make strategic decisions when faced with limited or scarce green fodder. This is supported by research indicating that independent farmers can make decisions about implementing alternative green fodder supply technologies during conventional feed shortages [17].

3.4.3 Partial influence test (t-test)

The t-test is used to determine the effect of each independent variable individually on the dependent variable. The magnitude of the effect is observed based on the Beta value and significance value in Table 6.

Variables	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Information
	B	Beta			
(Constant)	-1,421		-4,300	0,000	
Knowledge (X1)	0.452	0.414	6,672	0,000	Very significant positive
Attitude (X2)	0.055	0.065	0.792	0.434	Positive not significant
Skills (X3)	0.332	0.280	3,802	0.001	Very significant positive
Independence (Y1)	0.439	0.404	6,656	0,000	Very significant positive

Source: Processed Data 2026

Based on the above results, it can be concluded that the level of knowledge of livestock farmers significantly influences decision-making in running a livestock business. In decision-making processes, such as selecting alternative forage supply technologies, respondents require information, understanding, and risk assessments. Without adequate knowledge, respondents' confidence in making decisions will be very low. This is in line with research that suggests that rational knowledge significantly influences sound managerial decision-making [18].

The results of the analysis of attitudes toward decision-making are similar to their impact on independence. This confirms that decision-making is a concrete action, not merely an opinion. Based on field conditions, this is because farmers' attitudes in decision-making generally rely on their previous experience. Although farmers' attitudes show a high level of positive response to innovation, decision-making remains based on existing experience. This is consistent with research that reveals that farmers' attitudes toward extension materials are positive, but they are still lacking in accepting and implementing the materials, arguing that they breed based on their experience [19].

The skills results indicate that farmers' practical abilities and technical understanding in implementing innovations influence decision-making. Skilled respondents are more confident because they know how to implement them. This technical ability reduces the fear of failure, thus accelerating the decision-making process. This is in line with research showing that farmers' skills, in the form of practical abilities and technical understanding, can improve decision-making regarding innovation [20].

The results of the independence analysis indicate that independent farmers are independent and able to formulate solutions to problems and make decisions. Independent respondents possess the managerial ability to make decisions based on their own internal analysis, rather than coercion or external influence. This aligns with research showing that independence directly influences farmers' ability to make critical decisions [21].

3.4.4 Influence of residual variable (€2)

The residual variable (€) is the difference between the predicted value and the actual observed value. The residual calculation results indicate the extent of the influence of external factors on farmer decision-making. The following are the residual variable values in this study.

$€2 = \sqrt{1 - R^2}$

$= \sqrt{1 - 0{,}934}$

$= \sqrt{0{,}066}$

$= 0.257$

Based on calculations, the residual path coefficient was 0.257. This result indicates that the structural model developed is excellent. It also indicates that this research model has exceptionally strong predictive power. Despite this excellent model, there are 6.6% external (residual) factors that influence decision-making in the field.

3.5 Analysis of Direct and Indirect Influences

The path analysis model with the overall path coefficients is designed into a path diagram. The overall path diagram is presented in Figure 5.

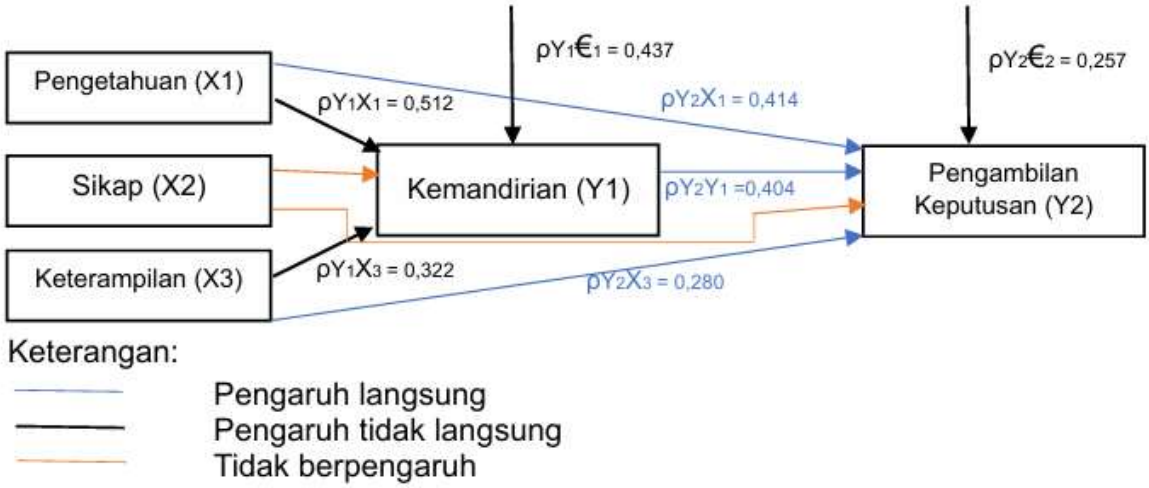


Figure 5. Path diagram

The figure above explains that the attitude variable (X2) has a red arrow, which means it does not have a significant effect on independence and decision-making. This indicates that a good farmer's attitude is not strong enough to directly increase independence and is not strong enough to significantly influence farmer decisions. In accordance with the opinion of [22] who stated that

independence and decision-making are not influenced by attitudes but rather by demands and work readiness in the form of thinking abilities and skills. The independence of sheep farmers in Tampirwetan Village is able to mediate knowledge (X1) and skills (X3) towards decision-making. In addition to being a link between other variables in decision-making, independence (Y1) also directly influences decision-making (Y2).

CONCLUSION

Based on the results of research conducted in Tampirwetan Village, Candimulyo District, Magelang Regency, it can be concluded that;

1) The effectiveness of changing the behavior of sheep farmers is in the "very effective" category..
2) The knowledge (X1) and skills (X3) variables have a significant positive effect on independence (P<0.05), while attitude (X2) has a positive but insignificant effect on independence (P>0.05).
3) The knowledge and skills variables (X3) have a very significant positive effect on decision making (P<0.01), while attitude (X2) has a positive but insignificant effect on decision making (P>0.05)..
4) The variables of knowledge (X1) and skills (X3) directly and indirectly have a significant effect on decision making, while attitude (X2) does not have a significant effect either directly or indirectly on decision making. Independence is able to mediate knowledge and skills on decision making, so that independence can improve the decision making of sheep farmers in providing green fodder in the form of corn fodder.

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