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The Influence of Agricultural Extension Agents on Pest Management and Farmer Capability for Enhance Productivity in Asahan Regency

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Abstract This research examines the influence of agricultural extension agents on pest management and farmer capability in Asahan Regency. The study highlights the importance of extension workers in developing agricultural culture and improving the welfare of farmers. By aligning with local indigenous cultures, extension workers can effectively engage with the community and facilitate two-way knowledge exchange. The study uses primary data obtained from direct surveys and secondary data as supporting data using the Stratified Proportional Random Sampling method. The respondents were farmers from 3 sub-districts: Rawang Panca Arga, Sei Kepayang, and Meranti districts. Partial Least Square (PLS) is used for data analysis. The research contributes to the field by emphasizing the role of agricultural extension agents in empowering farmers and enhancing their pest management capabilities. While the research provides valuable insights into the influence of extension activities, it is important to acknowledge its limitations. The study focuses on a specific region, Asahan Regency, and may not capture the diversity of challenges faced by farmers in other areas. However, the findings have practical implications for agricultural development, offering guidance on how extension workers can effectively support farmers and contribute to sustainable agricultural practices. In conclusion, this research emphasizes the vital role of agricultural extension agents in pest management and farmer capability. By implementing extension activities and fostering collaboration between farmers and extension workers, it is possible to enhance productivity, overcome challenges, and improve the overall welfare of farmers in Asahan Regency and beyond.

Keywords Empowering Farmer, Agricultural Development, Sustainable Agricultural, Enhance Productivity

1. Introduction

Productivity in agriculture refers to a production factor's capacity to produce output per unit area of land. Many factors influence production and productivity, including soil fertility, variety of planted seedlings, use of adequate fertilizers (both type and dose), availability of sufficient amounts of water, proper farming techniques, use of adequate agricultural tools, and labor availability [1]-[3].

Law Number 18 of 2012 concerning Food, the achievement of food security is directed by increasing the production of agricultural commodities for diverse foods by applying the principles of comparative and competitive advantage, efficiency and competitiveness. The progress of the agricultural sector is marked by increasing production and productivity of food commodities in the end to be able to increase farmers' incomes (Indonesian Ministry of Agriculture, 2021). Based on this, it is known that the development of the agricultural sector, especially rice productivity, has a very important role and strategy in supporting the lives of most of the Indonesian population. However, in increasing rice production, farmers often face problems such as erratic rain patterns and attacks by Plant Disturbing Organism. The lack of knowledge of farmers in dealing with the above problems results in a decrease in production due to crop failure. One way that is considered effective is to use an extension approach by streamlining the role of agricultural extension workers.

An effort to achieve independence and also improve the welfare of farmers, extension activities are very effective to help farmers achieve their desired goals. With agricultural extension, agricultural development will increase which is directly related to increasing human resources, especially the farmers themselves, because in the process of cultivation, farmers are the ones who regulate their growth and farming business [4]-[6].

The executors of this counseling activity are the so-called extension workers. Extension workers are expected to be able to act as agents who are able to increase the effectiveness and empowerment of farmers. Haryanto [7] stated that extension workers are very much needed in empowering and bathing farmers both independently and institutionally. The role of extension workers as educators, leaders, and advisors is very necessary in order to be able to identify and solve problems. Extension workers will guide, and motivate farmers so that they are able to change the way of thinking and how to act to be more independent and efficient [8].

The role of extension workers in this case is supported and strengthened by the existence of Republic Indonesian Law No. 16 of 2006 related to the function of agricultural extension workers as facilitators of learning activities, facilitating access to information and technology, developing leadership capabilities, growing awareness of the sustainability of environmental functions, and developing their organizations so that they have competitiveness. Farmers' perception of the role of extension workers can be seen through the participation of farmers in an activity, it is suspected that if the farmer's perception of the role of extension workers is good, farmers will participate in activities held and attended by extension workers.

Counseling is supposed to educate and enable farmer groups in developing an awareness of attitudes about the implementation of modern agriculture technology from government program regulations [9].

Agricultural extension employees, as change agents in development, constantly propose directions that might raise the consciousness of agricultural business players [6] [10]. Counseling is a type of non-formal education that farmers receive in order to boost their production in the agricultural industry.

Extension workers must pay attention to the following things in carrying out counseling activities:

1. Extension workers are the process of developing individuals and groups to improve the welfare of society so as to increase their dignity and dignity.
2. Extension workers are jobs that must be aligned with the indigenous culture of the local community.
3. Extension is a two-way process and should be continuing education, an example in terms of guiding.
4. Extension workers must live by being interconnected, respectful, and trusting each other.
5. Extension workers must be able to cultivate the underlying ideals of creative, dynamic, and innovative thinking.
6. The extension officer must refer to the realities and always be adapted to the circumstances at hand.

Based on recent data demonstrating that crop failure continues to affect a large number of farmers, as well as the wellbeing of the farmers themselves. this explains that agricultural extension still needs to develop its role as a solution or change that can help farmers to be more independent in facing problems that occur in complex farming businesses [3] [11].

According Gamage [12], extension activities are filled with the delivery of material by agricultural extension agents to assist farmers in overcoming pests of onion plant diseases, namely the use of organic matter, crop rotation in order to break the life cycle of onion plant disease pests, soil pH measurement and rice planting during the rainy season.

According to Chibanda [13], the farmer standard is a commonly used but little discussed benchmark idea that underpins agricultural experiment methodologies. It is not a one-size-fits-all standard, but rather the result of local and active engagement between farmers and agricultural extension workers. The grower's standards are analogous to several of the more well-known epistemic objects explored in philosophy of experimentation, such as control or background circumstances. The information obtained from farmers' standards, on the other hand, is epistemically novel because it was jointly created by farmers and agricultural extension specialists and it analyzes the contribution of extension activities to a broader development of agricultural culture.

Based on the above problems, the author aims to know and analyze the influence of the role of agricultural extension agents on the pest management and farmer capability in Asahan Regency.

2. Materials and Methods

The research was carried out in Asahan Regency, North

Sumatra Province. The selection of the research field was done on purpose (deliberately) with the consideration that the Asahan Regency area is one of the regencies in North Sumatra Province and has a relatively not ideal number of extension workers. The data collection technique chosen is to use Primary data obtained from direct surveys conducted at the research site and secondary data as supporting data.

The sampling method used is the Stratified Proportional Random Sampling method, where the population is divided into several levels (stratification) based on the inherent character of the farmers who are respondents from the 3 largest districts as rice production centers in Asahan Regency. The sub-districts that are the object of research are Rawang Panca Arga, Sei Kepayang and Meranti districts. The following is the distribution of research samples (Table 1).

Table 1. Distribution of Research Samples

No	District	Population	Sample
1	Rawang Panca Arga	3.308	145
2	Sei Kepayang	2.128	93
3	Meranti	2.977	130
	Total	8.413	368

Data analysis using the description method is by providing an overview of the research area and the characteristics of respondents in the form of graphs and tables accompanied by percentage numbers to make them easier to understand. Furthermore, it is explained in a narrative description descriptively.

3. Result and Discussion

3.1. Assessment of the Construct

Since the explanatory nature of the research was employed in this study, PLS-SEM was utilized (as discussed by Hair et al., 2017). In order to empirically validate the measurement instrument, an examination of the measurement model was conducted to assess the validity and reliability of the instruments. The data were analyzed using structural equation modeling (SEM) with the assistance of SmartPLS4.

Not all factor loadings are greater than the threshold value of 0.7 (range from 0.269 to 0.930, see Figure 1). Therefore, to meet the indicator's reliability test, indicators that do not meet the criteria need to be removed from the model (ER1, ER10, FC9, FC11, PM1, PM7, PM12, PM16).

In Partial Least Squares (PLS) Structural Equation Modeling (SEM) analysis, the typical minimum requirement for construct reliability coefficient (rho_a) and composite reliability (rho_c) is 0.7 or higher. This implies that the values of construct and composite reliability should reach at least 0.7 to be considered meeting acceptable standards in PLS-SEM analysis [14]. In Table 2, we can observe that both rho_a and rho_c have met the criteria. Equally important is the Cronbach's Alpha (CA) values for all constructs ranging from 0.940 to 0.970, which exceed the acceptable value of 0.60 [14]. Similarly, the actual AVE (Average Variance Extracted) values after using the SmartPLS4 software for all constructs range from 0.630 to 0.680, meeting the threshold value of 0.50 [14]. In conclusion, factor loadings, CRs, and AVEs indicate that convergent validity has been achieved.

Furthermore, it's important to assess discriminant validity using cross-loading values, which involves examining the extent, to which indicators of a particular construct relate to that construct compared to other constructs. In other words, it evaluates whether an indicator primarily connects with its intended construct rather than unrelated constructs. Lower cross-loading values indicate a stronger connection with the intended construct and weaker connections with other constructs. This contributes as evidence that these indicators are distinct from one another.

In the context of structural equation modeling (SEM) or partial least squares (PLS) analysis, cross-loading values are evaluated within the measurement model. If an indicator's cross-loadings on its own construct are significantly higher than its cross-loadings on other constructs, it indicates that discriminant validity is satisfied [14]. The complete cross-loading values can be found in Table 3.

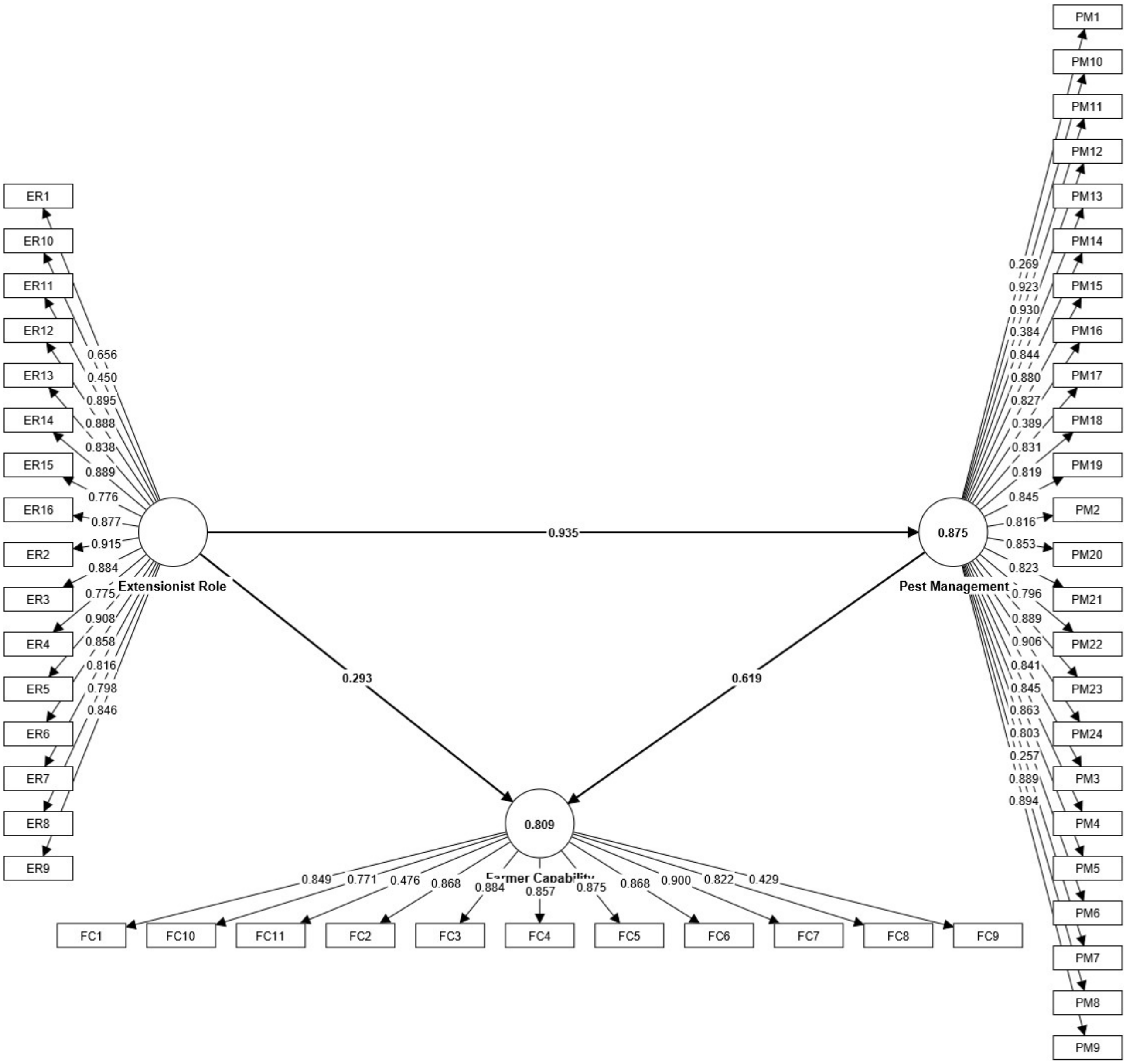

Figure 1. Factor Loading for each measurement

Table 2. Construct reliability and validity

	CA	rho_a	rho_c	AVE
Extensionist Role	0.967	0.973	0.971	0.680
Farmer Capability	0.940	0.959	0.949	0.636
Pest Management	0.970	0.981	0.974	0.630

Table 3. Cross Loading

Item	ER	FC	PM	Decision
ER1	0.656	0.520	0.567	Not Valid (< 0.7)
ER10	0.450	0.393	0.399	Not Valid (< 0.7)
ER11	0.895	0.771	0.822	Valid
ER12	0.888	0.804	0.835	Valid
ER13	0.838	0.740	0.818	Valid
ER14	0.889	0.777	0.855	Valid
ER15	0.776	0.728	0.742	Valid
ER16	0.877	0.806	0.836	Valid
ER2	0.915	0.797	0.860	Valid
ER3	0.884	0.729	0.839	Valid
ER4	0.775	0.689	0.717	Valid
ER5	0.908	0.808	0.836	Valid
ER6	0.858	0.731	0.805	Valid
ER7	0.816	0.625	0.733	Valid
ER8	0.798	0.666	0.708	Valid
ER9	0.846	0.783	0.815	Valid
FC1	0.835	0.849	0.801	Valid
FC10	0.575	0.771	0.632	Valid
FC11	0.276	0.476	0.360	Not Valid (< 0.7)
FC2	0.831	0.868	0.848	Valid
FC3	0.827	0.884	0.814	Valid
FC4	0.752	0.857	0.807	Valid
FC5	0.742	0.875	0.753	Valid
FC6	0.807	0.868	0.808	Valid
FC7	0.754	0.900	0.768	Valid
FC8	0.644	0.822	0.658	Valid
FC9	0.256	0.429	0.320	Not Valid (< 0.7)
PM1	0.278	0.203	0.269	Not Valid (< 0.7)
PM10	0.873	0.825	0.923	Valid
PM11	0.871	0.815	0.930	Valid
PM12	0.318	0.414	0.384	Not Valid (< 0.7)
PM13	0.788	0.721	0.844	Valid
PM14	0.818	0.785	0.880	Valid
PM15	0.773	0.701	0.827	Valid
PM16	0.340	0.448	0.389	Not Valid (< 0.7)
PM17	0.790	0.818	0.831	Valid
PM18	0.762	0.752	0.819	Valid
PM19	0.788	0.729	0.845	Valid
PM2	0.767	0.707	0.816	Valid
PM20	0.785	0.764	0.853	Valid
PM21	0.736	0.722	0.823	Valid
PM22	0.790	0.788	0.796	Valid
PM23	0.843	0.823	0.889	Valid
PM24	0.856	0.788	0.906	Valid
PM3	0.802	0.746	0.841	Valid
PM4	0.791	0.768	0.845	Valid
PM5	0.807	0.736	0.863	Valid
PM6	0.756	0.663	0.803	Valid
PM7	0.195	0.236	0.257	Not Valid (< 0.7)
PM8	0.813	0.757	0.889	Valid
PM9	0.828	0.796	0.894	Valid

3.2. Hypothesis Testing

The statistical method that aims to perform the correlation between a group of independent variables and a set of dependent variables is Partial Least Squares (PLS). Hypothesis testing can be used in PLS analysis to decide whether there is any significant effect between independent variables and the dependent variables.

According to Hair [14], the process of hypothesis testing in PLS involves the following steps:

1. Decide the hypotheses of null and alternative: assumption that is declared in null hypothesis (H0) is that no significant results were found in the mids of the predictor variables and the response variables, but the opposite statement is declared in hypothesis of alternative (Ha).
2. The determination of alpha as significance level: the rejecting probability of null hypothesis when it is right is called the alpha (significance level). 0.05 or 5% is the commonly used alpha value, meaning the rejecting of null hypothesis is 5%.
3. Calculate the t-value: the t-value is a measure of how different the estimated path coefficients are from zero, expressed in standard errors. The estimated path coefficients are obtained through the PLS analysis. The t-value can be calculated by dividing the estimated path coefficient by its standard error.
4. Calculate the p-value: the null hypothesis is assumed to be true when the p-value is equal or greater than real value. The p-value can be calculated using statistical tool or t-table distribution.
5. Compare the significance level to p-value: the null hypothesis can be rejected is that the value of significance level is higher than p value, and alternative hypothesis is accepted. The null hypothesis is not rejected if significance level is lower than p-value.

In summary, the process of hypothesis testing in PLS involves calculating both T and P values to decide whether there is a significant relationship between the predictor variables and the response variables. The estimated path coefficients obtained through the PLS analysis are used to calculate the t-value, and the calculation of p value is based on the assumption that hypothesis null is true. The level of significance is used to determine the threshold for accepting or rejecting the null hypothesis. T table value is used to test hypothesis, based on alpha 5% a value of 1.96 is obtained. When t-table < t-statistics, the hypothesis will be accepted, but it will be rejected if table > t-statistics.

The hypothesis stating that there is a direct impact of Pest Management on Farmer Capabilities and Extensionist Role on Pest Management is approved based on the results of hypothesis testing shown in Table 4. While in Table 4, it shows the testing result of the indirect effect hypothesis, in which the hypothesis is declared accepted. Figure 2 shows the result testing with path analysis.

Table 4. PLS Output

Path	Std Beta	Std Error	t-value	p-value	Effect	Decision
PM-> FC	0.544	0.112	4.843	0.000	Direct Effect	Accepted
ER-> PM	0.937	0.012	80.402	0.000	Direct Effect	Accepted
ER-> FC	0.374	0.108	3.483	0.001	Direct Effect	Accepted
ER-> FC	0.510	0.106	4.806	0.000	Indirect Effect	Accepted

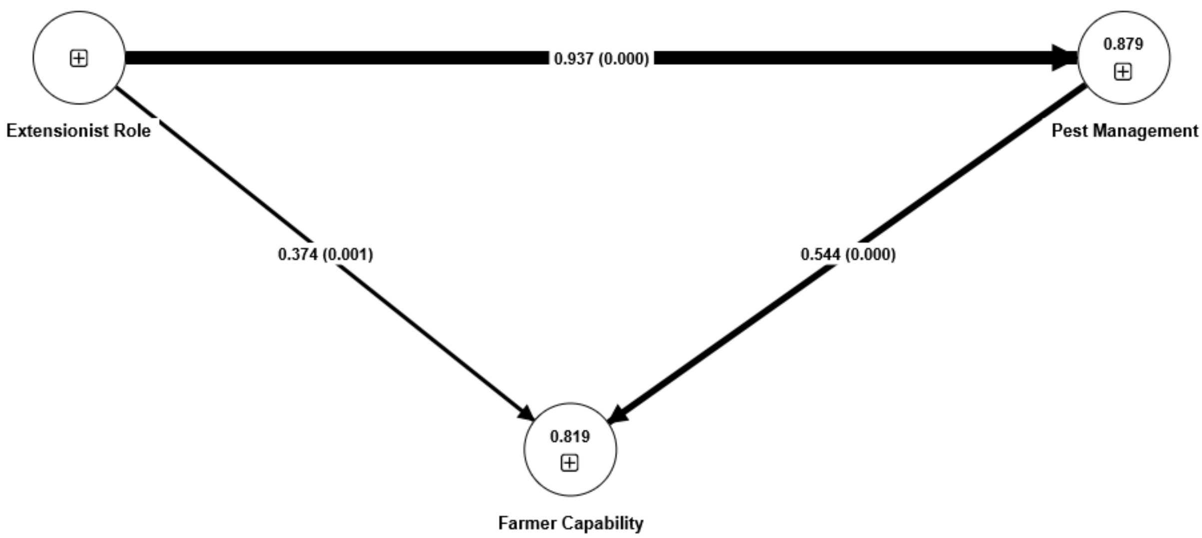

Figure 2. Path Analysis

3.3. Pest Management on Farmer Capabilities

The significant positive relationship between Pest Management and Farmer Capabilities in the research findings indicates that the implementation of effective pest management practices has a substantial impact on enhancing farmers' abilities. This implication arises from the observation that when farmers adopt successful pest management techniques, such as integrated pest management or sustainable pest control methods, they tend to experience improvements in their capabilities. These capabilities encompass various skills, knowledge, and resources that farmers possess to manage their agricultural activities effectively.

This positive relationship suggests that, in parallel with the enhancement in the quality and effectiveness of pest management practices, farmers' capabilities also witness corresponding improvements. This enhancement may involve a better comprehension of pest behavior, improved decision-making skills regarding pest control measures, greater resource allocation for pest management, and an overall higher efficiency in their agricultural operations.

Such findings carry practical implications for agricultural practices and policies. Governments, agricultural organizations, and extension services can focus on providing training, education, and resources to aid farmers in implementing efficient pest management practices. In turn, this could lead to heightened farmer capabilities, increased agricultural productivity, reduced crop losses, and ultimately contribute to a more sustainable and resilient agricultural system.

Pest management is the process of controlling and managing pests that damage crops, reduce yields, and threaten food security. Effective pest management is essential for farmers to protect their crops and ensure a stable food supply. However, pest management can be challenging, especially for small-scale farmers who may lack the resources and knowledge needed to implement effective pest control strategies. Pest will greatly threat crop production and its changes along with management practices used in agro-ecosystem [15] [33].

Farmer capabilities refer to the knowledge, skills, and resources that farmers possess or have access to and farmer capabilities play an important role in managing the pest, as farmers who have the required knowledge and resources are better equipped to control pests and mitigate their impact on crops [16].

Research has shown that farmer capabilities are a key factor in the success of pest management strategies. Farmers who had a better understanding of pest management practices were more successful in controlling pests and increasing crop yields. Good decisions can be better made by experienced farmers than unexperienced farmers in riskier production [12] [13].

This study found that farmers who had access to training and information on pest management were better able to control pests and reduce crop losses [17]. Pest control and planting determination are the problem currently faced by farmers [18]. Farmers will experience the high crop failure when the plants are attacked by severe pests, lowering rice yield [19]. So, in addition to knowledge and training, access to resources such as pesticides, crop varieties, and tools is also important for effective pest management. However, it must be careful in using pesticides and managing it properly to ensure that they are used safely and effectively, and do not have negative impacts on human and environment. Farmer capabilities are essential for effective pest management, and efforts to improve farmer capabilities through training, education, and access to resources can help to ensure a stable and sustainable food supply.

3.4. Extensionist Role on Pest Management

The research findings indicate a significant positive relationship between Extensionist Role and Pest Management, with the Extensionist Role having the strongest influence among the relationships involving other variables.

This implies that the involvement and role of extensionists, who are experts or advisors in the agricultural field, have a substantial impact on the implementation of effective pest management practices. When extensionists play an active role in providing guidance, information, and support to farmers regarding pest management techniques, it contributes significantly to the adoption and successful execution of these practices [20].

The strong influence of Extensionist Role on Pest Management suggests that extensionists can play a pivotal role in disseminating knowledge about pest management strategies and assisting farmers in their implementation. They can offer insights into the latest advancements in pest control methods, recommend tailored approaches based on specific conditions, and aid in addressing challenges that farmers may encounter.

By establishing a positive and effective relationship between extensionists and farmers, extensionists can facilitate the transfer of valuable information, technological know-how, and best practices related to pest management. This, in turn, leads to improved pest control efforts, reduced crop losses, and enhanced overall agricultural productivity.

The extensionist role is a key component of pest management, as extensionists play an important role in providing farmers with the knowledge, resources, and support needed to effectively control and manage pests. Although there is a growing amount of work examining farmer perceptions of pesticide danger, considerably less attention has been paid to discrepancies in risk perception between farmers and technical specialists. Furthermore, discrepancies in understanding have been too readily interpreted as a result of a lack of information rather than investigating the underlying causes for specific ways of thinking about pesticide hazards [21]. By doing so, the gap between expert and lay knowledge has been widened rather than bridged.

Extensionists are trained professionals who work with farmers to provide them with information and support on a wide range of agricultural issues, including pest management. They work closely with farmers to understand their needs and constraints, and provide them with tailored recommendations and solutions to address pest problems. Recent case studies on technology adoption uniformly support the use of integrated farm management systems to boost agricultural yields and preserve yield increases.

Extensionists play a critical role in pest management by providing farmers with information on pest identification, monitoring, and control strategies. They can help farmers to identify pest species, assess their impact on crops, and develop effective pest control plans. Agricultural extension workers are Awarded Civil Servants duties, responsibilities and authorities and full rights by officials authorized in organizational units scope of agriculture to provide encouragement to farmers to want to change the way of thinking, the way of working, and his old way of life with a way that is more in line with the development of the times and the development of agricultural technology more advanced [22].

Extensionists can also provide farmers with information on the safe and effective use of pesticides, and help them to develop integrated pest management (IPM) strategies that incorporate a range of pest control measures, including chemical, biological and cultural control. The meaning of integrated pest management is to carefully consider all means of protecting crops to prevent the development of pest and to use crop protection products within an ecologically and economically reasonable limit in order to prevent risk to environment and human health [23].

In addition to providing information and support on pest management, extensionists can also play a role in monitoring and evaluating pest management programs. They can help to assess the effectiveness of pest control measures, identify areas for improvement, and provide feedback to farmers and other stakeholders. Farm managers are unable to make appropriate decisions to avert crop loss in the absence of sufficient insect pest and plant disease information [24]. A system known as Intelligent and Integrated Pest and Disease Management (I2PDM) was created. Edge computing devices have been created to detect and recognize significant greenhouse insect pests such as thrips (Frankliniella intonsa) and others. It was found that adopting an intelligent IPM system allows for the development of unique and efficient tactics, opening up IPM to possible advantages that would not be easily realized with a typical IPM program. This is the first paper to describe the creation of an intelligent strategy model for IPM based on real-world, autonomously acquired long-term data. The work described here can serve to encourage farm managers, researchers, specialists, and industries to collaborate in the implementation of sustainable and data-driven practices.

The extensionist role is essential for effective pest management, as it provides farmers with the knowledge, resources, and support needed to control and manage pests in a sustainable and effective way. By working closely with farmers, extensionists can help to improve pest management practices, increase crop yields, and promote sustainable agriculture. The importance of extension services in assisting smallholder farmers to meet the numerous obstacles of agricultural production cannot be overstated, and the study area's agricultural extension officers have extensive knowledge [25] [32].

3.5. Extensionist Role on Farmer Capabilities (Direct and Indirect)

The direct influence implies that when extensionists actively engage with farmers, providing guidance, knowledge, and support, it positively affects the enhancement of farmer capabilities. Extensionists play a crucial role in imparting valuable information, innovative techniques, and practical insights to farmers, thereby contributing to their skill development, knowledge acquisition, and resource optimization. This engagement can empower farmers to make informed decisions, adopt advanced farming practices, and effectively manage their agricultural activities [26].

The indirect influence highlights that Extensionist Role also has a positive impact on Farmer Capabilities through another variable or set of variables. This suggests that the positive effects of extensionist involvement ripple through the system, possibly by influencing intermediate factors that subsequently contribute to the development of farmer capabilities.

Both the direct and indirect effects underscore the pivotal role of extensionists in nurturing the capabilities of farmers. By acting as conduits of knowledge, experience, and expertise, extensionists bridge the gap between research and practical implementation, empowering farmers to enhance their skills, adopt modern practices, and optimize their agricultural operations.

The extensionist role is critical to improving farmer capabilities, as extensionists work directly with farmers to provide them with the knowledge, skills, and resources needed to improve their agricultural practices and increase their productivity. Another way to improving capability is by using internet. Whether used superficially or deeply will have a significant impact on efforts to minimize the use of pesticied on farmers [3] [27]. The information obtained, awareness about organic products, knowledge of online commerce, play a significant role in reducing the use of pesticides. However, if internet used superficially in its impact on pesticide reduction, the only significant effect is on awareness to product of organic crops. Compared to the use of internet in depth, it will have a significant positive impact to rural society.

Extensionists are trained professionals who work in partnership with farmers to provide them with information and advice on a wide range of agricultural issues, including crop production, pest management, soil fertility, and irrigation. They work closely with farmers to understand their needs and constraints, and provide them with tailored recommendations and solutions to improve their farming practices [28].

Extensionists play a critical role in improving farmer capabilities by providing farmers with access to information and training on the latest agricultural practices and technologies. They can help farmers to adopt new farming techniques, such as conservation agriculture or integrated pest management, and provide them with information on the safe and effective use of fertilizers, pesticides, and other inputs. As a result, providing an example of practical and real-time agroecological agricultural approaches that are able to encourage the application of sustainable agriculture, able to solve challenges in a timely manner in its application. So this is better than the top-down method demonstrated by experts in general because of its abstrack nature [29].

In addition to providing information and training, extensionists can also help to build the capacity of farmers by providing them with access to resources and technologies that can improve their productivity. For example, extensionists can help farmers to access high-quality seeds, irrigation systems, and other inputs that can improve crop yields and reduce production costs [28].

Extensionists can also play a critical role in building networks and linkages between farmers, research institutions, and other stakeholders. By facilitating knowledge-sharing and collaboration, extensionists can help to ensure that farmers have access to the latest research and information on agricultural practices, and can connect farmers with markets and other opportunities [30]. It also demonstrates that private agricultural consultants trust extension as climate information provider. This implies that extension should continue to strengthen its relationships with private information providers, since partnering with them will give the most effective approach and finally farmers know the climate change that happen. Extension workers, also have to give training and information in better way about climate changing; researcher can also take part in this important activity.

The extensionist role is essential for improving farmer capabilities and promoting sustainable agriculture. Especially the experienced extensionist working closely with farmers so will provide them many information like training, and resources, meanwhile extensionists can help to improve agricultural practices, increase productivity, and promote food security and rural development. That experience may also help farmers manage better with unforeseen circumstances [31]. In summary, the risk-related factors that we included in the model, which we thought would impact farmer behavior, are as follows: differences in risk attitudes, perceptions of risk, management skills, and uncontrollable factors.

4. Conclusions

In conclusion, the interrelated nature of farmer capabilities, pest management, and the extensionist role is critical for achieving sustainable and effective agriculture. Farmer capabilities are essential for effective pest management, as farmers need the knowledge and skills to manage pests in a sustainable and efficient way. The extensionist role plays a crucial part in improving farmer capabilities and providing farmers with the necessary resources and support to effectively control and manage pests. By working together, farmers and extensionists can create more sustainable and productive farming systems that promote food security and rural development.

5. Recommendations

Recommendations for improving farmer capabilities and pest management include investing in education and training programs that provide farmers with the knowledge and skills needed to adopt sustainable agricultural practices. Additionally, providing farmers with access to resources such as high-quality seeds, irrigation systems, and other inputs can help to improve their productivity and reduce their reliance on chemical pesticides. Finally, promoting integrated pest management strategies that incorporate a range of pest control measures, including cultural, biological, and chemical control methods, can help to reduce pesticide use and promote more sustainable pest management practices.

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