



## Effectiveness of Application of Knowledge of Agricultural Training Among Farmer-Scientist Training Participants in the Philippines

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## Abstract

*This study examined the results of the Farmer-Scientists Training Program in two Luzon municipalities using a qualitative multiple-case study design and Kirkpatrick's Training Evaluation Model (1998). The research analysed the effectiveness of the application of knowledge of agricultural training and identified challenges in applying post-training knowledge. Data collection involved a complete enumeration (n=43) among training participants. Semi-structured interviews were conducted along with Focus Group Discussions (FGDs), and Key Informant Interviews (KIIs). The analysis combined percentages and means with qualitative excerpts. The participants' reactions revealed that 88.4% considered the program relevant and were satisfied with its implementation (9.3 mean satisfaction). All participants could enumerate and explain the topics covered. However, only 76.7% applied their learnings, suggesting barriers to practical implementation. The application of knowledge was reported to enhance productivity, farm efficiency, and social relationships. The FSTP has effectively facilitated the application of knowledge gained by its participants. Key challenges identified include insufficient farm inputs, infrastructure, and market linkages. To overcome*

*these challenges, it is recommended to include processing value-added products in the training curriculum and provide farm inputs. Government support is also needed to provide the necessary irrigation infrastructure and market linkages for the benefit of the farmers.*

## **Introduction**

Agricultural training programs are interventions designed to deliver agricultural knowledge through innovations, such as technologies and farming practices, that aim to empower farmers and improve their productivity (Mariyono et al., 2022). These programs involve both formal and informal education, and activities designed to foster human resource development (Wonde et al., 2022), particularly to promote development in knowledge, skills, and attitudes (KSA), leading to the adoption of technology and practices that, in turn, enhance farmers' efficiency and the agricultural productivity of the country (Declaro-Ruedas, 2019; Okonta et al., 2023). Additionally, training programs serve as a platform to bridge the gap between different stakeholders by enabling knowledge sharing through continuous interaction throughout the training proper (Fadairo et al., 2023).

Over the years, problems such as climate change have gravely affected the farming sector, resulting in soil degradation and disruptions to farming productivity due to changing weather patterns (Alalade et al., 2021). In addition, new emerging pests and diseases, such as the fall armyworm, continue to cause economic losses (Ojumoola, 2022). These challenges necessitate changes in farm production to cope and maintain productivity. While advancements in agriculture have led to the development of new practices, seed varieties, and farming technologies, the limited technical know-how and lack of exposure to these innovations hinder farmers' adoption (Reddy & Kumar, 2020). In the light of this, there is a need to sustainably promote technology transfer for farmers to acquire both "material and knowledge-based technologies" and leverage potential gains in production (Adzenga & Dalap, 2023).

Training programs in developing countries have been conducted to transfer relevant innovations using theoretical and practical methods to target clients (Rasanjali et al., 2021; Wonde et al., 2022). Reddy and Kumar (2020) summarized the main objectives of farmer training to include improving agricultural knowledge by exposing farmers to innovations, developing skills to enhance their farming practices, persuading for a change in perception regarding scientific farming, and fostering receptivity towards the adoption of agricultural innovations.

In the Philippines, the delivery of agricultural extension services is fragmented, as different government (national and local) institutions, non-government organizations (NGOs), state universities and colleges (SUCs), and the private sector comprise the National Extension System for Agriculture and Fisheries (NESAF) (Bacongus, 2022). Under Republic Act 8435, or the Agriculture and Fisheries Modernization Act (AFMA) of 1997, extension services are delivered in partnership with farmers and other stakeholders to transform Philippine agriculture into a technology-driven industry. The Agricultural Training Institute (ATI) of the Department of Agriculture (DA) serves as the leading agency for providing non-formal education through training programs for agricultural extension workers (AEWs). It also collaborates with local government units and various agencies to deliver training programs for farmers (Bacongus, 2022). These interventions are implemented through commodity-based banner programs

focusing on rice, corn, high-value crops, livestock, organic agriculture, and halal food, all initiated by the DA (World Bank, 2020).

The Farmer-Scientists Training Program (FSTP) is an example of a commodity-based training program that has been operating since 1993 and was adopted nationwide in 2008 under Executive Order No. 710 of the President of the Philippines. The FSTP is a three-phase agricultural training program designed to introduce corn production practices and technologies, benefiting corn farmers in different 4th to 6th class municipalities (Melodillar, 2021). The program employs different approaches for each phase to transform farmers into “Farmer-Scientists.” The first phase resembles the group-based adult learning approach of the farmer field school, involving an 18-week class and conducting on-farm group experiments. This phase promotes values formation, research exposure, and technical empowerment by introducing modern practices and technologies. The second phase focuses on individual on-farm experiments, allowing farmer participants to determine the suitable technologies and practices for their farms. Lastly, the third phase encourages farmer-to-farmer extension by having the Farmer-Scientists serve as lecturers/trainers for a new set of interested farmers.

The latest external review of the FSTP conducted in 2015 highlighted the program’s positive results in inducing the adoption of technologies and practices, leading to a 13% increase in technical efficiency and a 19% increase in the yield of corn farmers post-training. However, not all training participants could utilize what they learned from the program. In this regard, this study examined the program’s training results based on Kirkpatrick’s (1998) four levels of training evaluation model and determined the challenges in the practical application of knowledge gained post-training.

### **Objectives of the Study**

The study generally aimed to analyze the results of the Farmer-Scientists Training Program (FSTP) in the context of its implementation in two selected municipalities in Luzon, Philippines, from 2020 to 2022.

Specifically, the study aimed to:

1. Examine the result of the FSTP in the two selected municipalities in four levels of training evaluation model, namely; reaction, learning, behavior, and results.
2. Determine the challenges in the practical application of knowledge post-training.

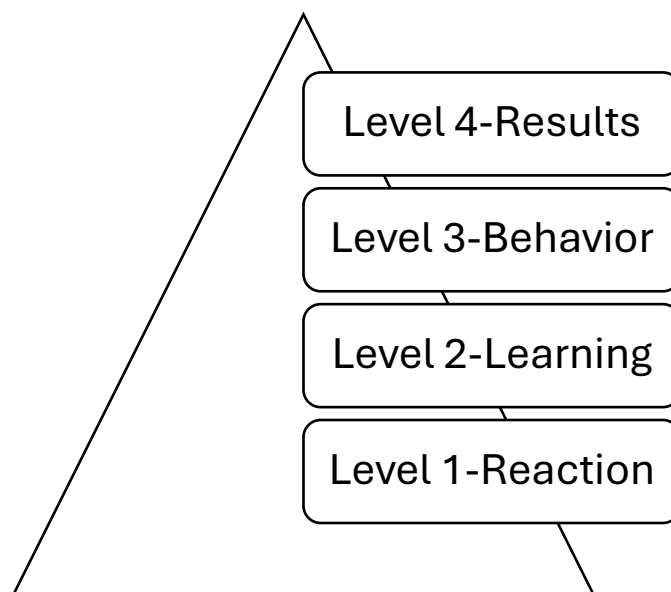
### **Methodology**

The study was conducted in two selected municipalities in Luzon, Philippines, where the Farmer-Scientists Training Program (FSTP) was implemented by the Department of Agriculture-Agricultural Training Institute (DA-ATI), the University of the Philippines Los Baños (UPLB), and local government units (LGUs) from 2020 to 2022. Site 1, a landlocked 4th-class municipality with hilly terrain, is known for its rice and corn production. Site 2, a 1st class partially urban municipality with plain terrain, primarily grows rice.

The study examined the FSTP implementation in these two sites. Both locations were chosen for their similar contexts during the COVID-19 pandemic. Primary data were

collected through semi-structured interviews, key informant interviews (KIIs), and focus group discussions (FGDs) to ensure comprehensive triangulation of findings. Due to the limited number of training participants, a complete enumeration was conducted. Forty-three (43) participants were interviewed: sixteen (16) from Site 1 and twenty-seven (27) from Site 2. FGDs involved six (6) participants from Site 1 and eight (8) from Site 2. Additionally, three (3) KIIs per site were conducted with representatives from the DA-ATI, UPLB, and LGUs involved in the FSTP.

Percentages were employed to summarize some of the interview results. The results of the interviews, FGDs, and KIIs were subjected to thematic analysis based on Kirkpatrick's Training Evaluation Model (1998), as presented in Figure 1, to examine the results of the FSTP and determine the challenges in the practical application of knowledge post-training.



**Figure 1: Four levels of training evaluation model (Kirkpatrick, 1998)**

Kirkpatrick's Training Evaluation Model (1998) provides a framework for assessing the results of training programs through four outcome categories: reaction, learning, behaviour, and results. The reaction category centres on participants' feedback regarding the training program's relevance to their needs and overall satisfaction. The learning category involves assessing how well the participants have understood and internalized their lessons from the training. The behaviour category delves into how participants apply the acquired knowledge to their farms. Lastly, the results category examines the positive effects on the productivity and lives of the participants as a result of behavioural changes or the adoption of practices and technologies on their farms.

Due to the lack of available secondary data (pre-and post-test, baseline), the results of the FSTP were examined based on the gathered perceptions of the training participants from their responses to various questions in each outcome category, corroborated by insights from Key Informant Interviews (KII) and Focus Group Discussions (FGD).

**Reaction:** Participants were each asked whether they found the training relevant to their needs (with response options of yes, no, or neutral) and requested to rate their overall satisfaction on a scale from 1 to 10 (with 10 being the highest). They were also invited to elaborate on their answers, providing more detailed feedback about their experience. During the FGD, they were asked to share their thoughts; excerpts were collected and included in the discussion. Clarifications were made in consultation with KII.

**Learning:** Participants were each asked to enumerate and explain the 13 topics covered during the training. They were also encouraged to provide examples. Takeaways from the training program were collected from the FGD. Results were cross-referenced with records and KIIs.

**Behaviour:** Participants were each asked if they applied what they learned from their training (with response options of yes, no, or neutral) and which practices or technologies they adopted. Those who did not were asked to provide their feedback. In addition, direct observation through farm visits was conducted. Since the FGD, participants included both technology and non-adopters, general questions regarding which learnings they applied and why some found it hard to apply their learnings were asked. KIIs were also consulted to confirm the findings.

**Results:** FGD participants were asked about any observed changes in their production after they applied what they learned from their training, as well as the technologies and practices they adopted. KII results were integrated in the discussion to support the findings.

Finally, the responses regarding the challenges the participants faced were gathered by asking each participant, while KIIs and FGDs were used to cross-verify the findings.

## **Results and Discussion**

### **The Result of the FSTP**

#### ***Level 1: Reaction of the Training Participants***

Table 1 shows that the majority of participants (88.4%) affirmed the program as relevant to their needs. The FGD participants from Site 1 indicated that the program provided up-to-date knowledge, specifically focusing on various agricultural practices and technologies applicable to their production. Similarly, FGD participants from Site 2 agreed that the training program met their specific needs, mainly because corn production was relatively new to them as they are traditionally rice farmers. These sentiments align with the findings of Rasanjali et al. (2021), who found that farmers prioritize participation in agricultural training programs that offer both theoretical and practical knowledge useful and needed for their production.

Additionally, results of the key informant interviews reveal that the program provided a platform for farmers to engage with knowledgeable individuals, including LGU personnel and resource persons, to seek clarification, address queries, and express concerns. These findings are consistent with Fadaïro et al. (2023), who noted that training becomes an avenue for knowledge sharing.

In contrast, the remaining participants (11.6%), all of whom came from Site 1, were neutral. FGD results from Site 1 reveal that while the program could provide the necessary knowledge, there is also a need for additional incentives. A 61-year-old male participant from Site 1 shared his thoughts on the relevance of the program, stating:

*“The program provided necessary agricultural knowledge, specifically in corn production. However, as farmers, we have other needs beyond knowledge; we also need seeds, fertilizers, and pesticides, which we lack the most. Furthermore, increasing our yield does not necessarily mean increasing our income, as we find it hard to market our corn harvest.”*

According to the results of the KII, the program had some limitations, as it did not factor in the provision of tangible incentives such as inputs to training participants. However, they were able to distribute some of the remaining farm input supplies after the training. Similarly, Fadaïro et al. (2023) identified issues such as inadequate support and market access post-training as challenges for training implementers, which also limit the agricultural productivity of the program beneficiaries.

The satisfaction of the participants regarding training implementation garnered a mean score of 9.3. The FGD results from Site 2 show that participants felt relieved of their stresses in life and enjoyed the company of their co-trainees and trainers. They also reiterated a “sense of happiness” during training. Participants shared that they only knew each other casually before the program because they belonged to the same association; however, their interactions and group work during the training strengthened their bond and created camaraderie. A 49-year-old female participant from Site 2 shared:

*“Despite being part of the same association, we usually only converse during our association meetings since we are too busy with each other’s farms. However, our participation in the program deepened our relationship and motivated us to continue our training together until the end.”*

On the other hand, FGD results from both sites revealed the participants’ desire for additional topics beyond the discussed modules and activities. They specifically mentioned interest in topics such as processing value-added products from corn, including cornmeal, cornflakes, and starch, which could generate extra income and address issues related to storage and overproduction. The KII results from both sites shared the same sentiment and suggested considering these additions in future implementations. Melembe et al. (2021) and Padilla-Fernandez et al. (2020) supported these findings and recommended that government programs promote value-adding activities in their curriculum. This approach not only promotes training participation and technology adoption but also encourages the diversification of agricultural activities to increase household income.

**Table 1: Reaction to the Relevance and Satisfaction with FSTP**

Variables	Percentage (n=43)	Mean
<b>Relevance with needs</b>		
Yes	88.4%	
No		
Neutral	11.6%	
<b>Satisfaction with the implementation</b>		9.3

**Level 2: Learning of the Training Participants**

Results of the personal interviews with the participants indicated that all of them acquired corn production knowledge from their training. The findings suggest that the training program achieved its objective by imparting technical knowledge to participants and honing both their technical and non-technical skills, which are valuable for decision-making in their production. A 48-year-old female participant from Site 2 mentioned that besides the technical topics, she also appreciated the non-technical ones, sharing that:

*“I have a newfound understanding of the importance of maintaining records, particularly the financial and production records that are useful in my production. Furthermore, the leadership management module taught me the significance, duties, and responsibilities of being a leader, especially as a Farmer-Scientist.”*

According to Okonta et al. (2023), farmers’ willingness to adopt practices is influenced by their knowledge and perception. Training programs benefit them by enhancing their knowledge and skills, thereby improving their decision-making in farm production.

Results of the FGDs at both sites reveal that the primary takeaway from the training program was the importance of experimenting and trying innovations applicable to their farm needs. Participants emphasized that their experiments, especially using different open-pollinated varieties (OPV) of seeds, broadened their perspective and made them realize the potential when applied in corn production. These findings are supported by the study of Padilla-Fernandez et al. (2020), which emphasizes that training programs utilizing experiential learning involving variety selection are crucial for improving production.

Based on the records obtained from the training implementers, participants were able to perform their duties and serve as resource persons to other farmers, fulfilling one of the requirements for completing their training. Additionally, according to KII results, farmers passed their refresher courses and tests prior to completing their training, indicating their learning.

**Level 3: Behaviour of the Training Participants**

Table 2 shows that the majority of participants (76.7%) applied the knowledge they gained in their corn production. The FGD results from Site 1 indicated that they adopted practices such as strip cropping and other multiple cropping systems to mitigate soil erosion in sloping areas. In flat areas, they practiced intercropping corn with leguminous plants, vegetables, and root crops, as well as embracing the principles of integrated nutrient management (INM) and integrated pest management (IPM). This demonstrates a change in their practices, as one of the KII interviewees

explained that prior to the FSTP, the common practices among farmers included mono-cropping, sole use of inorganic fertilizers, and conventional pest control methods relying on chemical pesticides.

On the other hand, FGD results from Site 2 indicate that the training participants were now implementing crucial practices such as maintaining the required planting distance, planting density, and row and relay planting. Additionally, they now apply proper fertilizer based on soil analysis or soil test kit results. A 48-year-old female participant mentioned that:

*“Before attending the training program, my standard practice was to solely apply fertilizer one month after planting; now, I recognize the importance of basal application, top dressing, and side dressing as part of integrated nutrient management to improve my production.”*

The farmers also utilize different varieties of corn seeds in their production. One 51-year-old female participant mentioned that she now uses a hybrid variety of corn called “purple magic,” which is gaining popularity in their municipality. Furthermore, one of the KIIs shared that aside from changes in production practices, the farmers are now diligent in recording different pests on their farms. Additionally, they now directly report to and consult regularly with the LGU, contributing to more organized and productive farming. These results are similar to the findings of Badiru et al. (2023), which show that participants’ post-training knowledge was enhanced, including farm record-keeping and overall farm management.

Meanwhile, the remaining (23.3%) participants answered that they were not able to utilize their learnings in their farm production. The FGD results from Site 1 indicate that some farmers transitioned from farming to business ventures outside their municipality. A 41-year-old male participant explained why he no longer applies the technical learnings from the training program, as he is now a full-time businessman with “limited time for farming.” Nevertheless, he found value in the non-technical aspects of the training, such as leadership management and record-keeping, which proved beneficial in his business endeavours. Another participant, a 52-year-old male, shared that although he applied what he learned, farming remains challenging due to practising rainfed agriculture, necessitated by inadequate irrigation infrastructure in their locale. The KII results from Site 1 show that some farmers in their municipality are engaged in different business ventures. While farming is their primary source of livelihood, it remains a challenging industry due to constraints such as pests, climatic conditions, and lack of infrastructure.

The FGD results from Site 2 reveal various reasons why participants could not utilize their learnings. They could not plant corn on their farms because the quality of their land was not suitable, often being submerged in water. They emphasized that although they wanted to apply what they had learned and venture into corn production, several factors such as varying weather conditions, typhoons, and pest occurrences limited their ability to do so. Some ageing participants stated that they were too old to continue farming and could no longer practice what they learned as they no longer operate their farms. However, they shared that they transferred and taught what they learned to their relatives and neighbouring farmers who did not have the opportunity to attend the training program. The KII results from Site 2 show that the municipality has been eager



to promote corn production; however, site-specific constraints hinder these efforts. Additionally, the ageing farmers and outmigration of their descendants threaten the continuity of their farming activities. According to Azumah et al. (2022), younger farmers, especially second-generation ones, are more inclined to migrate to places outside the agricultural sector that offer more favourable opportunities for them and their families.

**Table 2: Farmers’ application of learnings on their farms**

Variables	Percentage (n=43)
<b>Applied their learnings</b>	
Yes	76.7%
No	23.3%
Neutral	

**Level 4: Results of the FSTP**

The FGD results from Site 1 show how adopting different farming practices led to a general improvement in farm production among the training participants. For instance, utilizing various cropping systems made soil erosion more manageable. Additionally, adopting corn-based intercropping systems ensures a harvest of different crops even if typhoons or pests occur, which might otherwise decimate a mono-crop of corn. A 54-year-old female participant mentioned that intercropping legumes with corn improved the soil, increased yield, and provided a surplus of fresh farm produce, which they now sell in their local market. Moreover, integrating pest and nutrient management decreased pest damage and reduced the purchase and use of farm inputs such as inorganic fertilizers and pesticides, resulting in lower operational costs and increased income.

The FGD participants from Site 2 emphasized that the program transformed them into more progressive farmers and community members. They applied the practical knowledge from the training to their farms, resulting in a substantial increase in productivity. They now utilize open-pollinated varieties (OPV) and hybrid seeds, integrated nutrient management, and various cultural practices, which have led to a notable enlargement in the size and volume of their harvested corn, making it more marketable. Similar to Site 1, the application of Integrated Pest Management (IPM) was reported by the participants to have decreased the incidence and damage of insect pests. Moreover, minimal pesticide usage reduced costs and ensured their safety and that of consumers. In addition to the growth in corn production, they now consistently practice farm recordkeeping.

According to one key informant interviewed, the farmers who participated in the program now consult regularly, seeking recommendations and assistance for their production. Additionally, the program strengthened the participants’ relationships with their fellow farmers. They now collaborate by exchanging diverse ideas and learnings, contributing to the success of their association, which recently received awards from the Agricultural Training Institute for being model farmers in their municipality.

Participants who applied their learnings improved their production in several ways: decreased costs, reduced pest incidence and damage, increased yield and income, more organized farming, strengthened relationships with fellow farmers, and improved linkage between farmers and the LGU. According to Rasanjali et al. (2021), the adoption of practices/technologies learned from a training program, particularly

improved varieties of seeds, proper pesticide usage, and innovations, translates into increased yield. These results also agree with the findings of Tamako et al. (2022) that technical knowledge disseminated through training programs, when utilized, results in improvements in agricultural production. In addition, social interaction among farmers and different stakeholders can help motivate them to adopt innovative practices and technologies, thereby enhancing overall productivity and sustainability in the agricultural sector.

### **Challenges in the Practical Application of Training Knowledge**

As demonstrated in the case of Site 1, a shift from farming to business ventures limits the application of technical knowledge in agriculture. A similar situation was observed in Site 2, where some elderly farmers ceased farming and transferred their farms to relatives. A 73-year-old female participant expressed:

*“I would love to practice what I learned from the training, especially since I am a dedicated farmer. However, due to my age and fragility, farming is unbearable. Nonetheless, I will continue to guide my children, grandchildren, and neighbours in their future endeavours.”*

The FGD results from both sites reveal that despite farmers’ willingness to apply their knowledge of corn production, challenges such as land suitability, lack of irrigation infrastructure, insufficient farm inputs, unfavourable weather conditions, and severe pest occurrences remain significant obstacles, as the applicability of some practices depends on specific conditions. According to Ruzzanta et al. (2021), the adoption of practices and technologies faces various impediments that are situation- and site-specific, such as lack of financial assistance and the emergence of pests and diseases.

Additionally, prerequisites such as market access, technology, and capital are essential for translating the knowledge and skills gained from training programs into practice. One participant explained that increasing production does not automatically lead to increased income, as marketing their produce remains problematic, especially for farmers located far from their municipality’s centre. These findings are supported by Fadairo et al. (2023), whose study indicated that market access remains the primary issue post-training, exacerbated by inadequate infrastructure and loss of funding support. Even if farmers succeed in increasing their yield, they struggle to market their produce, resulting in economic losses.

The KII results from both sites reveal that the local government unit and partner agencies made efforts to support farmers after training; however, they were constrained by the limited budget provided by the national government. In this regard, Fadairo et al. (2023) and Akinbile et al. (2023) suggest seeking assistance from various organizations and establishing more partnerships with agencies capable of providing the necessary support to empower farmers.

### **Conclusion and Recommendations**

The Farmer-Scientists Training Program (FSTP) remains relevant by providing up-to-date knowledge in corn production, especially for farmers with limited access to knowledge and innovations. However, farmers require farm inputs, infrastructure, and

market linkages, which they deem essential but currently lack. Additionally, there is an aspiration for more topics related to processing value-added products, expanding beyond the mere marketing of corn cobs and grains. The study demonstrated that knowledge transfer through the training program is effective; however, it does not always lead to technology adoption and the application of practices.

Those who had the opportunity to apply what they learned experienced notable improvements, including increased productivity, enhanced farm efficiency, better organization of farming activities, and improved relationships between stakeholders. On the other hand, transitioning from farming to business ventures, as well as their advancing age, prevents some farmers from continuing farming, thereby limiting the application of their knowledge. Meanwhile, situation-specific factors and a lack of essential support remain challenges for applying the knowledge gained from the training.

An expansion of the training curriculum is suggested, specifically to include the processing of value-added products. Likewise, provisioning of inputs as a support for the program and building of irrigation infrastructures is a must. It is also recommended to address farmers' difficulties in marketing their produce by enhancing market linkage through collaboration with different stakeholders.

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