

Advantages and Disadvantages of Implementing Modern Agricultural Technology and Development Initiatives on Climate Change and Financial Support for Small-Scale Farmers in Nueva Ecija

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Received: 08 Nov 2023; Received in revised form: 15 Dec 2023; Accepted: 21 Dec 2023; Available online: 28 Dec 2023

Abstract— This study explores the complex and diverse field of modern agricultural technology and development programs, uncovering a contrast between advantages and disadvantages. The responders' wholehearted adoption of sophisticated methods highlights the favorable influence on agricultural output, efficient use of resources, and economic sustainability, demonstrating a shared commitment to sustainability and higher yields. Nevertheless, the utilization of these technologies presents notable challenges, such as concerns regarding the quality of the products, increased vulnerability to pest infestations, and financial constraints on agricultural practitioners. To address these issues, it is crucial to adopt a comprehensive approach that encompasses not only the integration of technology but also the mitigation of related difficulties. When considering the particular situation in Nueva Ecija, the implementation of innovative agricultural technology shows potential for small-scale farmers. This is evident in the establishment of strong agreements about empowerment, market-oriented financial services, equitable pricing, and superior productivity. In contrast, the New Agricultural Technology and Development Program in Nueva Ecija has financial drawbacks, highlighting the limitations of the biosphere, the necessity for cutting-edge technologies, heightened financial burdens, and difficulties in fulfilling program requirements. These issues raise concerns about accessibility and financial stress among members of the agricultural community.

Keywords— Agricultural technologies, Climate change, Farmers, Financial program, Nueva Ecija

I. INTRODUCTION

There has been a drastic transformation in agriculture over the past 40 years. The practices are evolving to embrace new technology. The agricultural sector is one of the mainstays of every economy in the world. There is a high demand for food which is a challenge because there are constraints in supply due to climate change and high labor costs. Every decade, there is a continuous revolution of technology in the agricultural industry. Modern agricultural technology increases

employment and food production efficiency, saving time and cost reduction. Farmers gain significant benefits from high innovation of technology. Farming is part of entrepreneurship and a business that depends on nature. However, agriculture is not all about success; farmers are also faced with challenges that are unavoidable like typhoons, el niño, and pests. These problems are caused by enormous changes in climate because of the increase in greenhouse emissions that lead to global warming, the use of fossil fuels, deforestation, and other factors (Foster &

Heeks, 2019). The Philippines is notoriously vulnerable to natural disasters, facing around 20 typhoons each year. For farmers, one typhoon or tropical storm could be enough to wipe out the entire crop. Starting over with the work can be expensive and time-consuming. As a result, 57 percent of agricultural households are impoverished. In comparison, non-agricultural households are three times less impoverished (Thelwell, 2019).

Nevertheless, challenges may limit gains as the digital divide in agriculture is also characterized by ineffective knowledge exchange, management of information content as well and limited human and institutional capacity. Many promising examples of positive digital impacts on small-scale agriculture development have often yet to scale up (Deichmann et al., 2019). New government policies could address inequality and social exclusion by reducing structural roadblocks to drive inclusive innovation. A strong political will is needed to develop small-scale agriculture that involves family farmers, rural women, indigenous communities, youth, and other valuable or marginalized people in rural areas. ICT and agricultural sector policymakers need to support this new technology revolution using digital development, as many social implications have been ignored.

Digital development is described by Heeks 2020 as a socio-technical system where digital technology and society are interrelated as they shape each other. Heeks 2018 further describes these socio-technical systems as of an economic, political, and social nature that are involved in the design use, and governance of digital development.

Discussions about digital technology adoption by small-scale farmers related to the global role of digital technology adoption to exploring the part of digital technology adoption at the farmer level. To start this discussion, a need to capture the economic, political, and social factors affecting these socio-technical systems. This reinforces the requirement to understand the current state of research identifying knowledge gaps, similarities, and differences. Digital technology and innovations will be leveraged throughout the food value chain and logistics, starting with the efficient distribution of inputs to farmers enrolled in the Registry System for Basic Sectors in Agriculture (RSBSA). The automated system will improve farm productivity and cut waste by using analytics to facilitate data-driven farming practices for small farmers (Technology and Innovation Including Digital Agriculture-Official Portal of the Department of Agriculture, 2021).

Digital innovation is vital in improving agricultural production and the value chain, such as post-harvest, transport, and storage (Corallo et al., 2018). Food traceability systems using digital platforms have become

vital risk management tools to contain food safety problems and promote consumer confidence. Digital-enabled marketing helps to increase intra-company efficiency and competitiveness in markets. Microfinance institutions (MFI) are formal institutions whose primary business is providing financial services to low-income persons under various institutions, traditional forms, and small informal interactions in developing and newly industrialized countries that are economically excluded from the conventional banking sector. Digital technologies can support trade in agriculture and food products, by connecting private sector suppliers to new markets and enabling new ways for governments to monitor and ensure compliance with standards and to provide faster and more efficient border procedures that are essential for perishable products (Technology and digital in agriculture – OECD). Financial services provided by MFIs include uncollateralized microloans or micro-loans with unconventional collateral through standard micro-lending technology. Agriculture is an important sector of the economy, employing about 70% of the total active labor force and contributing about 40% of the Gross Domestic Product (GDP). Farmers have been described as being very poor with low income, especially in rural areas where the farmers are facing low agricultural production (Juma, C. (2019). For this reason, they are unable to provide enough funds for agrarian activities. Though not visible, welfare could represent the people's standard of living. In theory, a household's consumption expenditure on food and education is used as an alternative welfare indicator. Large household size contributes to poor productivity, affecting farmer's welfare status, reducing household income generation, and reducing household development level. Many households' especially in rural areas which cannot afford to purchase necessary farm inputs or implement such as fertilizer, pesticides, and improved seeds, bring about productivity increases and hence, increase household income which will proactively affect the socio-economic well-being of household positively.

II. METHODOLOGY

The researchers employed a descriptive research method to investigate the impact of the New Agricultural Technology and Development program on Climate Change and Finance for Small-Scale Farmers in Nueva Ecija. The study aimed to determine the effects of these programs on climate change mitigation and adaptation, as well as the financial implications for small-scale farmers. Descriptive research is suitable for such studies, as it provides general information without influencing the data collected, making it appropriate for exploring these phenomena.

The study used descriptive statistics, including frequency count, weighted mean, and percentage, to analyze the impact of the New Agricultural Technology and Development program on Climate Change and Finance for Small-Scale Farmers. Frequency count determined how often each variable occurred, while central tendency measures, such as the mean, summarized the data. The percentage formula was employed to calculate the frequency and percentage based on responses from the participants.

The analysis aimed to understand the advantages and disadvantages of the New Agricultural Technology and Development Program on Climate Change and Finance, particularly concerning consumption and farmers. To achieve this, the researchers used the weighted mean formula, which involves multiplying each data point by a

value determined by some characteristic relevant to that data point. This approach helped in assessing the different aspects of the program's impact on small-scale farmers and generating possible recommendations for addressing any encountered disadvantages related to consumption and farming.

III. RESULTS AND DISCUSSION

1. The Advantage of the New Agricultural Technology and Development Program on Climate Change;

Table 1 presents the advantages of the New Agricultural Technology and Development Program on Climate Change. It determines the factors in terms of consumption and farmers.

Table 1. The Advantage of New Agricultural Technology and Development Program on Climate Change

STATEMENT	WEIGHTED MEAN	ADJECTIVAL RATING
A. CONSUMPTION		
a. Higher crop productivity	3.55	Strongly Agree
b. Decreased use of water, fertilizer, and pesticides, which in turn keeps food prices down	3.05	Agree
General Weighted Mean	3.30	Agree
B. FARMERS		
a. More farmers are engaged in buying agricultural technology	3.67	Strongly Agree
b. More farmers are highly encouraged to participate in the development program	3.25	Strongly Agree
General Weighted Mean	3.46	Strongly Agree
Overall General Weighted Mean	3.38	Strongly Agree

In terms of consumption, the affirmation of "The Advantage of New Agricultural Technology and Development Program on Climate Change" is underscored by the respondents' strong agreement (3.55) with the proposition that it leads to higher crop productivity. This suggests a widespread acknowledgement of the positive impact of modern agricultural advancements on output. Moreover, the consensus (3.05) in agreement with the statement about decreased use of water, fertilizer, and pesticides reflects an understanding of the broader implications, as it not only contributes to environmental sustainability but also has economic ramifications by keeping food prices down.

For the farmers, the assertion that "The Advantage of New Agricultural Technology and Development

Program on Climate Change" resonates strongly with respondents, as evidenced by the robust agreement scores of 3.67 and 3.25 for the statements indicating that more farmers are engaged in buying agricultural technology and are highly encouraged to participate in the development program, respectively. These results suggest a widespread enthusiasm among farmers for adopting new agricultural technologies and participating in climate change-focused development programs.

With technology, farmers can put in less physical effort, at times even less investment, and still see bigger crop yields at the end of the year. For example, one acre that once yielded 125 bushels of corn may get analyzed, irrigated, and fertilized so precisely that the same acre can yield 150 bushels or more. With technology, producing

everything from livestock to vegetables is a data-driven, scientific process with substantial gains involved.

2. The Disadvantages of New Agricultural Technology and Development Program on Climate Change;

Table 2. The Disadvantages of New Agricultural Technology and Development Program on Climate Change

STATEMENT	WEIGHTED MEAN	ADJECTIVAL RATING
A. CONSUMPTION		
a. Harder for farmers to yield a better product	2.65	Agree
b. Armyworm attack (Pest)	3.52	Strongly Agree
General Weighted Mean	3.08	Agree
B. FARMERS		
a. More farmers are engaged in buying expensive agricultural technology	3.67	Strongly Agree
b. More farmers are highly encouraged to participate in the development program which entails additional cost	3.47	Strongly Agree
General Weighted Mean	3.57	Strongly Agree
Overall General Weighted Mean	3.32	Strongly Agree

As to consumption, the implementation of new agricultural technology and development programs to address climate change presents certain drawbacks, as highlighted by the findings. Firstly, there is a concerning impact on consumption, with farmers facing increased challenges in yielding superior products. This could be attributed to the complexity and adjustment period associated with adopting advanced agricultural technologies. Moreover, the study reveals a noteworthy issue of armyworm attacks, signalling a strong agreement among participants. The prevalence of pests like armyworms poses a significant threat to crops, undermining the intended benefits of technological advancements. As such, these disadvantages underscore the need for a comprehensive approach that not only integrates innovative technologies but also considers strategies to mitigate associated challenges, particularly in the realm of pest control,

Table 2 discusses the Disadvantages of the New Agricultural Technology and Development Programs on Climate Change. It determines the factors in terms of consumption and farmers.

The findings reveal significant drawbacks of modern agricultural technology adoption, as farmers strongly agree that it involves buying expensive equipment. This financial burden may limit accessibility, exacerbating economic disparities. Additionally, the high encouragement for participation in costly development programs adds financial strain, emphasizing the need for equitable and affordable technology integration to support widespread agricultural advancement.

3. Advantages of New Agricultural Technology and Development program on Finance and Financing of Small-Scale Farmers of Nueva Ecija.

Table 3 presents the Advantages of the New Agricultural Technology and Development program on Finance and Financing of Small-Scale Farmers of Talavera, Nueva Ecija. It determines the factors in terms of consumption and farmers.

Table 3. Advantages of New Agricultural Technology and Development Program on Finance and Financing of Small-Scale Farmers of Nueva Ecija

STATEMENT	WEIGHTED MEAN	ADJECTIVAL RATING
A. CONSUMPTION		
a. Empower poor farmers to increase their wealth and facilities for the development of the value chain	3.45	Strongly Agree
b. Provide market-based financial services and fund long-term and green investments to support sustainable agriculture and agri-food value chains.	3.20	Agree
General Weighted Mean	3.32	Strongly Agree
B. FARMERS		
a. Farmers can sell their products at the right price.	3.05	Agree
b. Farmers can produce high-quality products	3.47	Strongly Agree
General Weighted Mean	3.36	Strongly Agree

Table 3 shows the adoption of new agricultural technology and development programs in Nueva Ecija yields promising financial advantages for small-scale farmers. Strongly agreeing that these initiatives empower impoverished farmers to enhance their wealth and contribute to value chain development, it reflects a potential uplift in economic conditions (WM=3.45). Moreover, the agreement on providing market-based financial services and funding for long-term, green investments signifies a commitment to sustainable agriculture (WM=3.20).

The endorsement of farmers being able to sell products at fair prices (WM=3.05) and produce high-quality

goods (WM=3.47) reinforces the positive impact of technology, fostering economic viability and elevating the overall agricultural landscape in Nueva Ecija.

4. The Disadvantages of New Agricultural Technology and Development Program on Finance and Financing of Small-Scale Farmers of Talavera, Nueva Ecija;

Table 4 presents the Disadvantages of the New Agricultural Technology and Development program on Finance and Financing of Small-Scale Farmers of Talavera, Nueva Ecija. It determines the factors in terms of consumption and farmers.

Table 4. The Disadvantages of New Agricultural Technology and Development Program on Finance and Financing of Small-Scale Farmers of Talavera, Nueva Ecija

STATEMENT	WEIGHTED MEAN	ADJECTIVAL RATING
A. CONSUMPTION		
a. Limits of the biosphere today are much more pressing compared to the resources available during the green revolution	3.45	Strongly Agree
b. Production of more and better-quality food with a lower impact on the environment will require the use of new agricultural technologies, new varieties of crop and animal stock	2.27	Agree
General Weighted Mean	3.11	Agree
B. FARMERS		
a. More farmers will need technology for farming	3.76	Strongly Agree
b. Farmers need to complete all the requirements in programs in agriculture.	3.45	Strongly Agree
General Weighted Mean	3.60	Strongly Agree
Overall General Weighted Mean	3.35	Strongly Agree

Table 4 shows the New Agricultural Technology and Development Program in Nueva Ecija face notable financial disadvantages for small-scale farmers. Strong agreement on the pressing limits of the biosphere (WM = 3.45) and the need for advanced technologies reflects challenges in balancing resource constraints (WM=2.27). While acknowledging the necessity of new technologies for sustainable, quality food production, the overall agreement remains at a moderate level.

Furthermore, the strong agreement that more farmers will require technology underscores potential financial burdens (WM=3.76). Completing program requirements, strongly agreed upon (WM=3.45), adds another layer of complexity, raising concerns about accessibility and the financial strain on small-scale farmers in Nueva Ecija.

IV. CONCLUSIONS

The following conclusions were recommended based on the findings of this study:

1. Modern agricultural technology has advantages on crop productivity, resource efficiency, and economic viability, highlighting the enthusiasm of the respondents for adopting advanced techniques that contribute to environmental sustainability and increased yields.

2. While the implementation of new agricultural technology and development programs aimed at addressing climate change offers promising benefits, the study underscores the presence of significant drawbacks, including challenges in product quality, increased susceptibility to pest attacks, and financial burdens on farmers emphasizing the imperative for a holistic approach that addresses not only technological integration but also mitigates (Subia, Jocson, & Florencondia, 2019) associated challenges to ensure sustainable and equitable agricultural advancement.

3. The adoption of new agricultural technology and development programs in Nueva Ecija holds promising financial advantages for small-scale farmers, as evidenced by strong agreements on empowerment, market-based financial services, fair pricing, and high-quality production, reflecting a potential uplift in economic conditions and a commitment to sustainable agriculture.

4. The New Agricultural Technology and Development Program in Nueva Ecija poses notable financial disadvantages for small-scale Novo Ecijano farmers (Subia, Mangiduyos, & Turgano, 2020), as indicated by strong agreements on biosphere limits, the need for advanced technologies, the anticipation of increased financial burdens, and the challenges associated

with meeting program requirements, emphasizing concerns about accessibility and financial strain within the agricultural community.

RECOMMENDATIONS

The following were recommended based on the conclusion and findings of the study:

1. For consumption-related challenges, it is highly recommended to develop and implement agriculture finance strategies and instruments that attract private capital, thereby deepening resilient agriculture finance markets.

2. To address financial constraints, conducting diagnostic studies, including the Financial Sector Assessment Program (FSAP), is highly recommended to reform public policies and regulations, creating an enabling environment for mobilizing agricultural finance.

3. Regarding farmers, a highly recommended initiative involves operating a specific program and community of practice focused on financial cooperatives, recognizing their crucial role as providers of financial services to smallholder farmers, rural MSMEs, and households.

4. Farmers' successful participation in agriculture programs is highly recommended, emphasizing the importance of completing all program requirements to maximize the benefits for both farmers and the agricultural sector.

5. Overall, it is highly recommended to prioritize and implement the suggested strategies across consumption and farmer-focused initiatives to achieve a comprehensive and impactful improvement in the agricultural sector.

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