

Farm Mechanization Among Tenant Farmers in Northern Philippines: Implications to Cultural Practices, Gender Roles, Household Food Security, and Socioeconomic Status

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Abstract

Nueva Vizcaya is an agricultural province and could be one of the top rice producers in Region 2, Northern Philippines. The province introduced mechanized farming as part of the government's attempt to improve food security. Most studies on farm mechanization focused on its effect on productivity; this study explored its effect on cultural practices, gender roles, household food security, and socio-economic setup amidst the mechanization of farming materials viz-a-viz tenant farmers' lives using a qualitative design. The study found that there is low mechanization of farming in the province. Tenant farmers engage in small-scale farming that does not guarantee high profits. Gender roles were affected differently as mechanization was utilized. Traditional cultural practices such as bayanihan (mutual help) and ammuyo (free service) were lessened due to mechanization. The farmers recommended intensified government programs to promote progress in farm mechanization.

Keywords: agricultural machinery, landless farming, commercial agriculture, subsistence farming, gender

1. Introduction

It is not hidden that the Philippines is an agricultural country. The Philippine national hero, Dr. Jose Rizal himself, envisioned the educational system focusing on agriculture and trade. Former Senator Pangilinan (2017) expressed that Jose Rizal was aware that science and technology, when combined, can improve the lives of farmers. However, history tells that the Philippine government could hardly improve its agricultural output. Today, the Philippines is left behind by its ASEAN neighbors in raising agricultural products. Historians have accounted that one failure on the part of farmers of the agricultural industry in the Philippines was the control of land as well as trade by a few rich families. According to Jandoc (2011), speaking about the sugar plantation industry, there is a vast army of unemployed workers and little incentive to invest in more efficient and labor-saving technology. This makes the Philippine plantations inferior to those in other countries. He cited that Jamaica already used a sugar processing technology in

the 1700s, but the Philippines started using it only in the middle of the 1890s. These were some of the seen problems that the Philippines had in the past. But, notably, even our national hero had envisioned the need of technology for our agricultural activities.

A century later, Philippine Agriculture is still in the same situation. In the Philippines, agriculture is an important part of the economy, with crops like rice, coconut, banana, and sugar dominating the production of crops and exports. According to Tacio (2022), the World Bank reported that in the Philippines, the country's workforce as of 2021 from the agricultural sector comprises about 23% of the total workforce. And agriculture seems not to be moving forward as expected, since Filipino farmers do not make farming competitive by the use of machinery. The Philippine Department of Agriculture recognized that to catch up with other countries, the use of machinery is inevitable. Irrigation is being developed continuously, but production seems not to be improving based on news that the Philippine government is regularly importing rice, not only to balance the prices but to make sure that there is enough rice for the lean months of rice production. The Duterte administration has recognized the need for increasing agricultural production, but the traditional way of farming has to be replaced.

Emmanuel Pinol (2019), the Secretary of the Department of Agriculture, responding to problems on rice production, expressed that rice farming must be continued and pursued despite many challenges. He further stressed that with the rate of 1.7% growth of the Philippine population, with the increase in population also in the neighboring countries, there will not be enough rice in 5 to 10 years from now. Thus, he concludes that abandoning rice farming is also abandoning, for the next generation, food security. This is why during the beginning of the Duterte administration, to achieve food sufficiency and maximum productivity in the country, the Department of Agriculture had intensified technology updating and sharing, modernization, and mechanization. One of the major developmental moves by the Department of Agriculture is to adapt the mechanization of farming in the Philippines to be at par or even more than its ASEAN neighbors in agricultural production, particularly rice.

According to Tacio (2022) the use of machines is very promising. It eases farming, making farming faster with better results compared with traditional farming. Farm machinery can offer a combination of processes like harvesting and threshing, which make farming less tedious. It could even provide a business venture to provide farm machinery services. Furthermore, a complete mechanized farming system can achieve higher production among farmers, which could lead to national food security. He claimed further that machines could significantly change the future of farming in the country. This is why the Department of Agriculture aims to maintain food security with farm mechanization and infrastructure investments as its core programs (Department of Agriculture, 2016).

However, it is clear that many of our tenant farmers are more connected and dependent on traditional farming. Their connection and dependence can be seen in songs like *magtanim ay di biro* (planting rice is not a joke), their socio-economic activities like *ammuyo*, a source of livelihood, a source of household food security, and the manifestation of gender sensitivity. The introduction of technology, particularly the introduction of farm machinery, affected the lives of our tenant farmers. This study aimed to look into the lives of people who are considered the last, the least, and the lowly in society. Most studies on the mechanization of farming focused on its impact on production, not so much on its effect on tenant

farmers whose family subsistence depends so much on traditional farming. Verma (2006) defined agricultural mechanization as the “use of various power sources and improved farm tools and equipment, to reduce the drudgery of human beings and draught animals, enhance the cropping intensity, precision and timelines of efficiency of utilization of various crop inputs and reduce the losses at different stages of crop production. The end objective of farm mechanization is to enhance overall productivity and production with the lowest cost of production.” This definition of farm mechanization implies the reduction of manpower and the use of the beast of burden in farming. It would further imply that those who can afford to have the machinery are the ones who will benefit from the program. While mechanization of farming may lead to increased production, the effect of mechanization may differ from country to country, especially between advanced countries and developing countries.

Emami et al. (2018) stated that “mechanization is a multi-dimensional concept and widely used in agriculture. There is, however, a major difference between the application of mechanization in developed and developing countries. The developing countries tend to design their own strategies in food security, given the challenges they face in all aspects of their economy, including feeding a growing population, reducing poverty, protecting the environment, managing the effects of climate change, and fighting malnutrition.” The goal of the strategies, with the help of appropriate technologies, is to lead to sustainable agricultural development and, ultimately, food security. Thus, for developing countries, unlike more advanced countries, mechanization is pursued for the sake of food security at the expense of some other factors like human labor, gender roles, and even the mechanization’s effect on the socio-cultural life and household food security of tenant farmers.

Studies have shown that changes in agricultural practice may have an effect on gender roles and household food security. In the study of Gurung et al. (2016), farm mechanization in aquaculture increased both farm income and income inequality, brought in new sources of employment, changed gender roles and relations, altered women’s access to and control of resources, altered household food consumption patterns, and increased market dependence for staple food. Commercial aquaculture not only decreased the workload of women but also weakened their access to and control over agricultural products. Women became more dependent on their husbands’ income and had less control over its use. Farm mechanization reduces women farmers’ drudgery and diversification of rice monoculture toward rice-based high-value crops.” Mechanization of farming has an effect on gender roles and income, which may affect household food security among tenant farmers in this developing country.

There is a scant of references to studies on the effect or impact of farming mechanization in the Philippines. This could be due to the fact that the Philippines has only recently started a full-blown farm mechanization through the introduction of farm machinery. However, there are more references from other countries since they are far ahead in applying technology and machinery in farming.

In South Africa, for example, what is being pushed is the concept of Sustainable Agricultural Practices (SAP). Just like the Philippines, South Africa may also be considered a developing country in terms of its agriculture due to its geographical location, where poor farmers are dependent on “sensitive rainfed agriculture” (Makate et al., 2017). But what is Sustainable Agricultural Practices? It is defined as “those practices enabling farmers to meet current and future societal needs for food, fibre, ecosystem

services, and healthy lives. Farmers achieve these goals by maximizing the net benefits to society when all costs and benefits (economic, social, and environmental) of the practices are considered (Tilman et al. 2002). What are the components of Sustainable Agricultural Practices (SAP)? For farmers, SAPs may include various soil, land, and water conservation practices, including integrated soil fertility management (ISFM) (Vanlauwe et al., 2010). These sustainable agricultural practices include crop rotation, conservation tillage, residue retention, organic inputs, improved crop varieties, complementary use of fertilizers, rainwater harvesting, irrigation, agroforestry, and soil and stone bunds for soil and water conservation (Branca et al., 2011).

The above approach to farming is far different from the mechanization of farming using technological advancement. In the Philippines, David (1995) explained that agriculture covers at least 20% of the total workforce, where the poor usually belong. Newly elected president Ferdinand Marcos Jr in his inaugural message on June 30, 2022 has noted that the country's agriculture sector "cries for urgent attention" after years of neglect and misdirection. And on July 25, 2022, during his 1st State of the Nation address, he maintained that the agricultural sector remains one of the push factors for growth and development (DA Website, 2022). The Philippine government is really serious about its mechanization and other modernization programs of farming. The government expects that with modernization, there will be more jobs for farmers and food on the table. Among tenant farmers, is the promise of a better life realizable? Will tenant farmers be secured in terms of their household food security? According to Coleman-Jensen et al. (2019), "food insecurity means that households were, at times, unable to acquire adequate food for one or more household members because they had insufficient money and other resources for food. A majority of food-insecure households—those classified as having low food security (but not very low food security)—avoided substantial reductions or disruptions in food intake, in some cases by relying on a few basic foods and reducing variety in their diets. Very low food security means that households were food insecure to the extent that eating patterns of one or more household members were disrupted and their food intake reduced, at least some time during the year, because they could not afford enough food."

But with the introduction of farm machinery and the emergence of different farm technologies, employment may have been affected, especially among tenant farmers who are being replaced by farm machinery. Such a situation may have a further effect on gender roles, household food security, and even on the socio-cultural lives of tenant farmers. Farm mechanization may have increased productivity and has been advantageous to those who have access to farm machinery, but may not be on a small scale, and more so to tenant farmers. Thus, this research was undertaken to determine the effect of farm mechanization among tenant farmers in Nueva Vizcaya, Philippines to 1) describe the socio-demographic profile of the participants; 2) determine how farm mechanization started in selected towns of Nueva Vizcaya; 3) determine the effects of farm mechanization on a) Gender roles, b) Household food security, c) Socioeconomic status, and d) cultural practices of tenant farmers; 4) Determine the participants' reaction to the mechanization of farming by the government; and to Recommend possible Interventions if needed.

2. Theoretical Framework

Actor Network Theory will be used as the theoretical framework of the study. This theory was first introduced in the 1980s by Latour et al. to do away with essentialism or naturalism, which treats the subject or the actor from a human perspective. Actor Network Theory (ANT) is a “conceptual frame for exploring collective sociotechnical processes, whose spokespersons have paid particular attention to science and technological activity. ANT privileges neither natural (realism) nor cultural (social constructivism) accounts of scientific production, asserting instead that science is a process of heterogeneous engineering in which the social, technical, conceptual, and textual are puzzled together (or juxtaposed) and transformed (or translated) (Crawford, 2004). Actor Network Theory has two variables, which are non-human (farm machinery) and human (Agricultural land workers), which, by mechanization, may gain a new name. This theory explains the network or causal relation between science and technological development (non-human) and human beings. In short, technological advancement may affect human situatedness due to its network with technology. This theory would further explain that with the interaction or network between science and technology and human beings comes something to the fore – the new production of sociotechnical processes.

Furthermore, Bencherki (2018) explains that the concept from Actor Network Theory that organizational communication has put to the greatest use is that of the non-human agency. This has been done through an acknowledgment of the role of technology in organizational settings, but also through a broader recognition that agency is not limited to human beings, but is shared with, among others, documents and numbers. Furthermore, he claims that “more recently scholars have recognized actor-network theory as a candidate theory to account for technological change and its contribution to the constitution of organizations, as well as the role in coordination practices of technology’s and humans’ shared agency. In other words, Actor Network Theory allows accounting for the way the heterogeneity of information technology grants its homogeneity to organizations.”

3. Methodology

Design

This study used a phenomenological qualitative design. Donalek (2004) explained that phenomenological studies examine lived experiences through the descriptions provided by the people involved. This type of research is used to study areas in which there is little knowledge. In phenomenological research, respondents are asked to describe their experiences as they perceive them. They may write about their experiences, but the information is generally obtained through interviews and focus group discussions. To understand the lived experience from the vantage point of the subject, the researcher must consider her or his own beliefs and feelings. The researcher must first identify what she or he expects to discover and then deliberately put aside these ideas; this process is called bracketing. Only when the researcher puts aside her or his own ideas about the phenomenon is it possible to see the experience from the eyes of the person who has lived the experience (Qualitative Research Designs, 2005).

4. Research Locale

The study was conducted in four agricultural towns of Nueva Vizcaya, particularly Bagabag, Bayombong, Solano, and Villaverde. These are considered agricultural centers in the province because of their substantially higher degree of rice production than other towns. The following specific barangays were selected because of observed farm mechanization processes in these areas: Barangays Tuao North & Brgy. Tuao South in Bagabag; Barangays Magapuy and Paitan, Bayombong; Barangays PD Galima and Wacal, Solano, and Poblacion, Villaverde.

5. Participants

The study's participants are 129 tenant farmers in the agricultural centers of Nueva Vizcaya. The sample represents 42.72% of the population of tenant farmers in the sampled towns. The farmers do not own the land they are cultivating and are either in a tenancy agreement with the land owner or cultivating the land with permission from the land owner. All participants engage in small-scale farming, cultivating one to two hectares of rice farmland. To be considered as a participant, the farmer should have declared that their main source of family income is farming. Participants were identified with the help of the Department of Agrarian Reform. Table 1 shows the percentage distribution by barangay.

Table 1

Frequent and percent distribution by barangay									
Barangay	Frequency	Percent by Total Sample	Percent based on Population	Population of Tenant Farmers*					
Tuao North	21	16.28	37.50	56					
Tuao South	24	18.60	33.33	72					
Villaverde	43	33.33	64.18	67					
Wacal	9	6.98	47.37	19					
PD Galima	9	6.98	33.33	27					
Magapuy	8	6.20	38.10	21					
Paitan	15	11.63	14.02	107					
Total	129	100	42.72	302					

*Source: Department of Agrarian Reform (2023)

Instrument

This study used a researcher-made interview guide that elicited the data needed for the research. The researcher-made interview guide helped the research team made phenomenological observations that may add more to the information gathered through the in-depth semi-structured interview.

Data Gathering Procedures

The research team communicated the purpose and conduct of the research to the different municipalities or Barangay LGUS. Then it coordinated with the same Municipal LGUs or the Barangay LGUs to identify participants. Once the participants were identified, we scheduled a visit to their homes and explained the study's purpose. Once informed, the research team would ask if they would like to participate in the study. Participants willing to participate in the study will be provided the informed consent form for their signature after a thorough explanation of the content of the form. After getting their consent, the research team will schedule an in-depth semi-structured interview during the most convenient time for the participants. Once the interview with all participants is completed, the data will be encoded, decoded, and qualitatively analyzed using thematic analysis. The interviews were conducted in seven focus groups between January and February 2023.

Treatment of Data

The qualitative data gathered was subjected to thematic analysis. According to Caulfield (2022), **thematic analysis** is a method of analyzing qualitative data. It is usually applied to a set of texts, such as an interview or transcripts. Using this method, the researchers examined common themes – topics, ideas, and patterns of meaning - that came up repeatedly. There are various approaches to conducting thematic analysis, but the most common form follows a six-step process: familiarization, coding, generating themes, reviewing themes, defining and naming themes, and writing up.

After encoding the data, the research team generated initial codes and then generated themes. The themes formulated from the data were interpreted further using the research team's observations.

Ethical Consideration

The study was submitted for ethics review to Saint Mary's University Research Ethics Board (SMUREB) with the following address and contact information: A218, Second Floor, Fr. Godfrey Lambrecht Building; SMU Main Campus, Ponce Street, Don Mariano Marcos, Bayombong, 3700 Nueva Vizcaya, Philippines with an email: reb@smu.edu.ph and cell phone number: 09177053041.

Conflict of Interest

There is no conflict of interest and the research team does not intend to gain anything from the study. It is only intended for research purposes and for the benefit of the tenant farmers and other public or private agencies or institutions.

Confidentiality and Data Protection

The researchers themselves retrieved the collected data through in-depth semi-structured interviews in seven focus groups. All the data gathered were held with utmost confidentiality and privacy. Furthermore, the research team ensured that the respondents' identities are anonymized by providing

number codes instead of their names. All data gathered remained private, accessible only to the researchers.

Management of Vulnerability

To manage participants' vulnerability, they were informed that they can withdraw from the research at any time without consequence. They were further informed that their participation is voluntary and they may withdraw anytime during the duration of the study.

Informed Consent

The research team selected participants and started data gathering after getting approval from the university's Research Ethics Board. The consent form, together with the semi-structured interview guide, was given personally to the participants as face-to-face encounters are now allowed under the basic health protocol during the pandemic. The research team explained the Informed Consent form, and once the respondents agreed to participate, the respondent was asked to sign the informed consent.

Results and Discussions

This section presents the participants' sociodemographic profiles and the findings based on focus group discussions that explored the effects of mechanization on gender roles, household food security, socioeconomic status, and cultural practices.

Section 1: Sociodemographic Profile of Tenant Farmers

Table 2

Participant Profile by Sex and Age									
Barangay	Age Range	Male			Female			Total	
		f	% by sex	% by total	f	% by sex	% by total	f	%
Magapuy	40-60	4	4.9	3.10	4	8.51	3.10	8	6.20
Paitan	25-55	9	11.0	6.98	6	12.77	4.65	15	11.63
PD Galima	31-59	8	9.8	6.20	1	2.13	0.78	9	6.98
Wacal	30-64	7	8.5	5.43	2	4.26	1.55	9	6.98
Tuao North	25-55	14	17.1	10.85	7	14.89	5.43	21	16.28
Tuao South	30-55	15	18.3	11.63	9	19.15	6.98	24	18.60
Villaverde	20-60	25	30.5	19.38	18	38.30	13.95	43	33.33
Total	20-64	82	100	63.57	47	100.00	36.43	129	100

The table above indicates that most of the participants are from Villaverde (33%), Tuao South (18.6%), and Tuao North (16.28%). There is a greater number of participants who are male (63.57%) than female. According to the Philippine Statistics Authority (2020), there is a greater number of males employed in the agriculture sector than in other industries, with statistics in Cagayan Valley being the second highest in the country (512,000), thus supporting the above findings. The age range of the

participants is 20 to 64 years old, with the youngest from Brgy. Villaverde and the eldest from Brgy. Wacal. The diversity in age groups shows that farming is passed on from generation to generation, with some confirming that they took over farming tasks from their parents, a continuation of a family tradition, or were engaged in through marriage.

Several participants were single, and do not have tertiary education. They also mostly originate from the region where they currently live, and have years of experience in farming. When asked when mechanization began in their municipalities, some said as early as the 1970s. The farm holdings based on tenancy are between one to two hectares. This is lower than the average area of farms, which is 4805 hectares, based on a 2022 PSA survey. Huo et al. (2022) argued that having lower agricultural land holdings suggest less intense rice production and lower income.

Section 2: How Farm Mechanization Started in Nueva Vizcaya

Farm mechanization in Nueva Vizcaya began as early as the 1970s, with hand tractors and plow pulled by carabaos, as the popular machinery. Eventually, reaper, rotovator, grass cutters, and even planters were introduced but mostly, according to the participants, these were rented from other places. On average, the length of time that the participants had been using machinery for farming was between 23-65 years. This is an extensive amount of time since mechanization was introduced, but there remains to be a lack of sustained growth in agriculture. Various factors account for this situation. One factor is the declining performance of the country's national irrigation system (NIS), which has been a persistent problem for over 20 years (Agriculture Monthly, 2015). An assessment of Philippine irrigation by Briones (2021) highlighted that the government has addressed this concern over three administrations. A reviving irrigation development program is put in place to assess water resources and explore issues in governance and needed policy changes. Other factors include small farmlands that lead to lower productivity, and a declining number of farm laborers (Briones, 2021).

Section 3: Effects of Farm Mechanization on Gender Roles, Household Food Security, Socioeconomic Status, and Cultural Practices

This section explores the changes that occurred among tenant farmers as a result of farm mechanization. It compares practices before and after mechanization and provides insight into how mechanization affected gender roles, household food security, socioeconomic status, and cultural practices.

Mechanization, Household Food Security, and Socioeconomic Status

Tenant farmers in this study were one to say that farming is tiring. With the many processes involved in rice production, the International Labour Organization (2023) stated that farming, or any agricultural work, for that matter, is, by nature, physically demanding. With the introduction of mechanized farming, farmers felt relieved of heavy and exhausting labor. More tasks were completed in less time and with fewer physical exertions. Finances were also reduced because they had to pay and feed fewer laborers. Several farmers explained that they were deep in debt before, but now, they can feel some

financial relief with mechanized farming. However, a major drawback to mechanized farming, according to the participants, is that food crops were no longer given for free. Apart from rice, many farmers also grow fruits and vegetables for household consumption, oftentimes sharing their yield with neighbors or community members. Nowadays, farmers are less generous; some even report those who get their crops without permission to the local government units.

Many farmers also complained that farm inputs have become expensive, such that their net profit remains low even when their yield is what they expected. This is due to tenant farmers giving their landowners a share as part of the lease agreement and paying rental fees for machinery and other expenses. Also, mechanization entails capital investments that most tenant farmers of small landholdings cannot afford. Galang (as cited in Briones, 2021) stated that about 62% of small farmers incur debt from formal sources to purchase capital investments for farming; the rest decide not to borrow money because of the voluminous requirements in securing a bank loan. Eventually, some resort to self-financing their mechanization process. Because crop yield depends on the weather, there was still no assurance of high profit per harvest. These factors led the participants to feel and say that they preferred the previous form of farming. According to the participants, before the government introduced mechanization to their communities, they had several side jobs related to farming (pa-extra-extra), allowing them to send their children to school and put food on the table. Nowadays, many agree that they can barely feel the increase in profit because with mechanization and increased productivity came increased expenses, prices of basic commodities, and wages for laborers. This can be partly explained by the observation that rice is more expensive in the Philippines than in most developing countries of Asia (Balisacan et al., 2003). This leads to lowered purchasing power among the poor, including landless farmers whose spending on rice reaches about 22% of their total household expenditure.

Since most of the farmers were engaged in small-scale farming, there was barely a change in their socioeconomic status even when they shifted to mechanized farming. This can be explained by the fact that most of the participants were holding one to two hectares only, considered as small-scale farming. Another explanation is possibly the middleman's presence in rice wholesale. Tenant farmers sometimes cannot be as profitable as they want because there are layers of marketing agents in the Philippines who buy their rice cheaply and then sell it at a higher price (Philippine Rice Research Institute, 2016). It appears that farm mechanization led to increased productivity and crop yields, but it cannot be concluded that it led to an increase in net profit and socioeconomic status among tenant farmers. Tacio (2022) confirmed this in an article for the Philippine Center for Postharvest Development and Mechanization, stating that the Philippines remains to be at a low-mechanization level. This was due to farmers' low buying power, small landholdings, high costs of machinery, and government policies that did not support the mechanization of agriculture. These suggest that farmers are not getting the most profit from mechanization.

A common sentiment among the participants is the changing norm in lease agreements that puts the tenant at a disadvantage. Previously, *tertihan* was practiced, enabling the tenant to receive proportionate profits and consider extraordinary circumstances, such as crop damage by natural disasters. Nowadays, the agricultural land lease is typically more advantageous to the landlord, such as having a fixed number of rice cavan for the landlord regardless of the amount of harvest.

Mechanization and its Effect on Cultural Practices

In Nueva Vizcaya, the practice that is slowly fading due to farm mechanization is *ammuyo*. In this practice, non-family members unite to help each other during harvest season. Typically they are not paid, but when they are, it is in a meager amount or in kind. According to the participants, *ammuyo* is slowly disappearing due to mechanization. For instance, one participant said that in the past, when they were still using traditional farming, neighbors who discovered that they will be planting or harvesting rice would immediately say that they would come and help. The job would be completed faster since several people were helping. Nowadays, with farm mechanization, farmers do not help each other; rather, they conduct their farming activities independently of each other.

Also, previously, harvesting was done in succession, in which one would harvest this week, and the farmers would help out. Then next week, another farmer harvests, and the previous one who harvested would also help. This unique Filipino practice is rooted in *utang na loob* and *pakikisama*. *Utang na loob*, translated as a debt of goodwill, is a sense of obligation to repay a favor. It involves a deeply personal and internal element of shared self (Gundran et al., 2022). The other possible Filipino values lost as a result of mechanized farming are *malasakit* (solicitude), *pagdadamayan* (systematic support), *pakikipagkapwa-tao* (authentic interpersonal relationship). It would appear, therefore, that while mechanization led to more productivity, it gave fewer opportunities for the tenants to be more communal and practice *bayanihan* (helping others without expecting rewards).

Mechanization and Gender Roles

Adopting mechanized farming definitely lowered labor costs for farmers since workers are replaced by machines. But this was disadvantageous to tenant farmers who work part-time as laborers. According to the participants, losing jobs due to farm mechanization led female farmers to become vendors, laundry women, and household helpers. Among women farmers, mechanization forced them to diversify their workforce participation – that is, to discover jobs that are non-rice farm-related and are less labor-intensive to help provide food for the family. Several also began subsistence farming for household consumption. According to the Food and Agriculture Organization of the United Nations (2023), women play a critical role in many farming communities, and in some countries, the total farm labor is done by women. However, women experience significant discrimination regarding land ownership, equal pay, access to credit and financial services, and participation in decision-making (Food & Agriculture Organization/FAO in the United Nations, 2023). Given women's critical role in farming, it is important to address this discrimination and enable women to participate more capably now that farming has become mechanized. The FAO (2023) recommends providing women with entrepreneurial and business planning skills to promote their independence and earning capabilities.

Conversely, men who lost their side jobs due to mechanization turned to construction, gardening, and left the province for farming job opportunities. Some found jobs that were still farm-related (e.g. fishpond) and labor-intensive jobs (i.e. construction). It must be noted that for both genders, most jobs they find are manual, below minimum wage, and paid on a work-for-pay basis. Alternative jobs found by landless farmers due to farm mechanization do not substantially contribute to household food security.

Section 4: Reactions to Farm Mechanization

Tenant farmers' reactions to farm mechanization were generally positive, highlighting how it led to ease in farming and faster operations. They are aware of the benefits that mechanization can provide but are limited in resources (financial and technical) to mechanize their farm holdings fully to maximize returns. Some farmers said they had to borrow money to sustain their activities and were left with little net profit after harvesting. Farmers with young children explained that profit was good enough to provide food for the family, but not enough to support children's educational needs. The participants who are members of farmers' associations felt that the government can contribute more to improving the current farming mechanization efforts. Several suggested providing more free fertilizer for farmers and medium-to large-scale machinery for cooperatives/associations. There appears to be a general sentiment that openness to long-term mechanized farming is dependent on how well they will be supported by the government to sustain this form of farming. Sustainable mechanization is indeed critical since it can reduce poverty, lead to food security, and improve farmers' livelihoods (Food and Agriculture Organization of the United Nations, 2023).

Section 5: Recommended Interventions

While participants have accepting views towards mechanization, they are aware that there remains to be a low implementation of mechanized farming in their communities. When asked how the government can help improve this situation, they quickly shared the following interventions:

Improve the irrigation system

Infrastructure is vital for the efficient implementation of farm mechanization. Several farmers mentioned the difficulty in mechanized farming since some farmlands are not yet fully irrigated or stable in water supply, leading to dry soil. Those with irrigation complain of water leaks from the rice field, or the absence and lack of levees to contain, control, or divert the water flow. This signifies that the farmers' lands in this study currently have a poor irrigation system.

This observation of poor irrigation systems is not new. An article in Development Research News (2015) indicated that these problems are persistent, occurring as early as the 1980s, and continuing 20 years later. Clemente et al. (2019) found that the Philippine national irrigation systems (NIS) are inefficient and cited issues like siltation, flooding, deterioration of canals, and salinity problems that threaten crop production and yield. Irrigation is critical to any agricultural system since it raises land productivity and stability despite severe weather conditions. For farmers to maximize the economic benefits of farm mechanization, it is therefore important that NIS facilities be created or rehabilitated.

Increase agricultural subsidies

Several participants felt financially constrained by the cost of farm inputs for mechanization. Some wished for more free fertilizer (abono) to augment their net profits. Through the Department of Agriculture (DA), the Philippine government provided free seeds and fertilizer starting the 2020 wet cropping season

to boost rice production. However, participants of this study who availed of these free farm products felt that these were not enough.

Apart from free farm inputs, farmers also wanted subsidized machinery to be given to their cooperatives/associations. Some municipalities were provided with subsidies, but some farmers had to travel far to avail of this cooperative-based machinery. As of March 2022, the Philippine Center for Postharvest Development and Mechanization (PHilMech) has acquired 19,542 machinery and distributed 16,167 as part of the government's intensified mechanization program. Gomez (2022) reported that the PhilMech urges farmers to join farmer cooperatives and associations (FCAs) since these are the program's primary beneficiaries. By joining FCAs, farmers can utilize machinery with lower rental fees. However, many farmers complain that the fees are the same as those of privately owned ones, possibly explaining why some farmers are not urgently joining FCAs.

The above recommendations culled directly from the participants are critical inputs on how the government can improve the farming culture in the Philippines. Huo et al. (2022) support these when they said that the government should make policies that encourage or provide targeted subsidies for agricultural machinery, among others.

6. Conclusions

Tenant farmers of agricultural towns in Nueva Vizcaya engage in small-scale farming that does not ensure increased rice productivity, agricultural profit, or a change in socioeconomic status. While mechanization remained low, it affected gender differently, with women's participation leaning toward less labor-intensive tasks, while men continued to engage in farm-related and labor-intensive activities. A major effect of mechanization was the decreased and slowly disappearing tradition of mutual cooperation (bayanihan and ammuyo) during planting and harvest times. Mechanization has been practiced for more than five decades. Still, existing farming conditions, such as poor irrigation, inadequate government subsidies, and small farm landholdings, hinder the positive impacts on farming culture, productivity, and profit. Tenant farmers clamor for greater government support to improve mechanized farming and allow farmers to earn more money on what they produce.

7. Recommendations

Mechanization remains to be low in the agricultural towns of Nueva Vizcaya. With this, it is recommended that a needs assessment be conducted to explore farmers' urgent needs given their current farming conditions. Part of this exploration might be related to understanding why farmers are hesitant to join farmers' associations and what conditions or benefits they would like to be given to increase their intent to join. Furthermore, since some lost their part-time farming jobs, it is useful to introduce them to other sources of livelihood. Participants may be referred to government and non-government organizations offering livelihood training to promote food security. There is much more to be done to improve the lives of tenant farmers. Schools can organize livelihood training for farmers and provide them linkage or networking opportunities. The government is urged to increase and provide financial subsidies for

machine purchase, operations, and training. Further research is encouraged to explore how to make small-scale farming more sustainable amidst the current challenges of the tenant farmers.

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