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Cultivating Prosperity: "Unraveling Farmers Sentiments On Livelihood Through Irrigation"

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Abstract: In many poor countries, small farmers face significant challenges, such as limited access to markets and resources, which hinders their contributions to global agriculture. In the Philippines, there are 3.0 million hectares of irrigable land, with about 1.9 million hectares equipped with irrigation facilities. The National Irrigation System (NIS) serves 46% of this area, covering at least 1,000 hectares per system. Another 45% is served by farmer-owned Communal Irrigation Systems (CIS), which manage smaller areas.From 1999 to 2012, the National Irrigation Administration (NIA) implemented the Balog-Balog Multipurpose Project (BBMP) Phase 1, restoring irrigation to 8,600 hectares affected by the Mt. Pinatubo eruption. NIA continued to promote Phase 2, which involved constructing the Balog-Balog Dam and new irrigation structures for an additional 21,935 hectares. The study highlighted how irrigation projects positively impacted farmers' livelihoods by providing a steady water supply and creating jobs in rural areas. However, eight key challenges affecting the sustainability and efficiency of irrigation projects were identified. The study focused on the life experiences of 30 farmers near irrigation areas in Tarlac City, revealing that most farmers are middle-aged, have limited education, and often struggle with inadequate irrigation systems, particularly during the dry season. Farmers requested urgent improvements to irrigation systems to increase agricultural productivity. One of the study's key recommendations was for the government to establish a strong subsidy program, purchasing farmers' products directly to improve their livelihoods and better control rice prices. This approach would help farmers manage production costs and enhance their overall quality of life.

Key Words: Farmers, Irrigation, Crops, Investments, Livelihood, Sustainability, Agriculture, National Irrigation Administration, Department of Agriculture.

I. INTRODUCTION

In many poor countries, small farmers face challenges like limited access to markets, water, and resources, which hinder their productivity. In Africa, small-scale farmers produce about 50% less than the global average but still manage to feed themselves and urban populations. Water scarcity remains a critical issue, as seen in Kenya, where only 3% of farmers utilize proper irrigation. To address this, SunCulture introduced the RainMaker in 2017, a solar-powered irrigation system that lifts 6,000 liters of water daily. Using a pay-as-you-go model, it reduced costs, saved farmers 17 hours weekly, and boosted incomes. Innovations like RainMaker are essential as climate change exacerbates water scarcity and increases the demand for reliable irrigation systems.

Globally, agricultural irrigation consumes over 70% of freshwater resources, covering 19% of farmland. However, the share of clean water for agriculture is declining due to growing demands for drinking water. Efficient water use in agriculture is vital, especially in developing nations with rising populations and food needs. In the Philippines, 3.0 million hectares of land are suitable for irrigation, but only 1.9 million hectares are equipped with irrigation facilities. The National Irrigation System (NIS) covers 46% of this, while Communal Irrigation Systems (CIS) and farmer-owned systems serve 45%. Despite significant government

investments, irrigation in the Philippines struggles due to poor management, underdevelopment, and environmental degradation.

Irrigation is key to food and water security, but climate change poses significant risks to infrastructure. Inconsistent rainfall, altered water cycles, and weak typhoons disrupt irrigation systems, threatening food production. The Balog-Balog Multipurpose Project (BBMP) in Tarlac exemplifies efforts to address these challenges. Phase 1 of BBMP restored irrigation to 8,600 hectares affected by the Mt. Pinatubo eruption. However, limited water supply from the Moriones River constrained its effectiveness. Phase 2 aims to construct a high dam on the Bulsa River, expanding irrigation to an additional 21,935 hectares, increasing the total service area to 34,410 hectares.

The study examines the impact of irrigation on farmers' livelihoods, focusing on crop yields, income, employment, and food security. It identifies challenges such as water management, infrastructure development, socioeconomic inequality, and environmental sustainability. The findings aim to inform policy decisions and promote sustainable agricultural practices. Understanding how irrigation affects farmers helps reduce poverty, improve food security, and support rural development.

As the Engineering Manager of BBMP Phase II, the researcher plays a critical role in planning and implementing irrigation projects. Efforts include collaborating with farmers through Institutional Development Sections to establish Irrigators Associations, ensuring effective communication, and addressing agricultural challenges. This participatory approach empowers farmers and enhances the sustainability of irrigation systems, contributing to the province's agricultural growth and resilience.

II. METHODOLOGY

The research used a qualitative case study approach to examine the impacts of irrigation projects on farmers' lives in Tarlac City. This method provided a comprehensive understanding of the challenges faced by farmers and the contextual factors influencing irrigation outcomes. By utilizing qualitative tools such as literature reviews, interviews, and observations, the researchers gained insights into the interactions between irrigation associations and farmers' livelihoods, enabling the formulation of policy recommendations based on findings.

Tarlac City, the provincial capital, served as the research setting due to its agricultural significance. Spanning 274.66 square kilometers, the city had a population of 385,398 in 2020, with a density of 1,403 inhabitants per square kilometer. Its extensive rice and vegetable farms and dynamic agricultural environment made it ideal for studying the subtleties and complexities of irrigation projects.

Participants were selected using a convenient sampling method, focusing on those affected by the development of the Balog-Balog Multipurpose Project (BBMP) since 1987. A minimum of 30 farmers shared their experiences, challenges, and benefits from irrigation facilities. This sampling approach ensured a representative group contributing meaningfully to the research objectives.

Three data collection tools were employed:

1. Documentary Analysis involved obtaining relevant documents and permissions from government agencies and the Irrigators' Association to support the study. This step provided qualitative data on participants' opinions, challenges, and experiences.
2. Interviews used a structured guide to explore participants' views and experiences with irrigation projects. Unclear responses were clarified through follow-up interviews, while a Google Form facilitated participation for those unavailable for face-to-face sessions.
3. Observation enabled the researcher to witness firsthand the conditions of farmers benefiting from TASMORIS (Tarlac San Miguel O'Donnell River Irrigation System). These observations enriched the qualitative data and offered valuable insights into the farmers' realities.

Data analysis involved organizing information into figures and tables for proper communication of results. Statistical methods, including frequency analysis, determined the prevalence of challenges encountered by farmers. Ranking techniques arranged data points to highlight key findings, while sentiment analysis using natural language processing (NLP) categorized responses as positive, neutral, or negative.

The study provided an in-depth exploration of irrigation's role in enhancing farmers' livelihoods in Tarlac City. By addressing challenges and identifying opportunities for improvement, the research contributed to a better understanding of irrigation systems' effectiveness and informed sustainable agricultural practices.

III. RESULTS AND DISCUSSIONS

This chapter presented the data gathered in the case study on the profile, experiences, and challenges faced by Farmers in Tarlac City. In addition, it included the problems encountered, prosed measures, and their implications to public administration.

3.1 Described the livelihood of farmers

The farmers in Tarlac City they valued the importance of irrigation not just only for their crops but rather for their livelihood that support the irrigation. the livelihood of the farmers depended heavily on their skills, determination, and natural resources. Generations of farming families had called matter, and their deep connection to the land shaped every facet of their lives. The story of their daily struggles and triumphs offered a vivid glimpse into the importance of irrigation for vegetable farming, the extra income rice planting provided, and the role animal husbandry played in sustaining their modest livelihoods.

3.1.1 The Irrigation in Vegetable Farming

For the farmers of their area, irrigation was the lifeblood of their livelihood. Their primary source of income came from cultivating vegetables—cabbage, eggplants, tomatoes, and other hardy crops that were sold at the bustling wet markets in nearby or at Tarlac Wet Market. Every farmer knew that without a steady water supply, their crops would wither, and their income would vanish. They had been entirely dependent on seasonal rains, which often came in unpredictable patterns. The dry fields had forced the farmers to delay planting or risk losing entire crops or they might use alternative ways to support their planting that need gas called “Paranum” that cause additional expenses for them. During the monsoon season, torrential downpours sometimes flooded their plots, destroying what little progress had been made. To the farmers, water was both a blessing and a curse, for while it could nourish their fields, it could also bring disaster.

Those canals and water pumps had been constructed, drawing water from nearby rivers and reservoirs but sometimes it wasn’t clean enough. This development revolutionized farming practices in the village, allowing farmers to grow vegetables year-round. It provided a reliable water source that could be directed to individual plots, giving them control over their planting schedules. Every barangay in Tarlac City hoping maintain the irrigation system, ensuring it remained functional and accessible to all.

With irrigation in place, the farmers were able to expand their fields and experiment with different crops. They no longer had to rely solely on the unpredictable rains to grow their vegetables. If they have the consistent water supply meant that crops could be rotated throughout the year, maximizing production and increasing their incomes. Each farmer tended their plot with the knowledge that irrigation had transformed their prospects. Families who had once struggled to meet their basic needs now had a continued produce to sell at the wet markets.

It was very heartfelt to saw every morning that farmers waking before the sunrise, heading out to their fields to check the irrigation, adjust the flow of water, and prepare the soil for planting. Their hands that full of soil symbolize their hearts filled with hope to harvest good numbers of vegetable. The sight of thriving crops growing in rows, vibrant and healthy, was their reward. After months of taking care and labor, the farmers would harvest their vegetables, they wash it to make it clean, and ready pack them to sell in wet markets, where they fetched competitive prices. The markets became a lifeline for them, offering not just a place to sell but a connection to the larger community.

As the seasons passed, irrigation allowed the barangay farmers to plan ahead and invest for their daily needs or expenses. They began saving money, purchasing better tools and seeds, and even sending their children to school until they graduate college.

3.1.2 Rice Planting as an Extra Source of Income

While vegetable farming remained the primary source of income for most barangay farmers, rice planting provided a vital supplement during the planting season. Every year, when the monsoon rains arrived, farmers shifted their focus to planting rice. For many, it was not merely a way to feed their families but also a way to generate extra money that could tide them over during lean times; they can crop 2 to 3 times a year depends to the water supply.

Rice was a staple crop for their location, and the planting season was met with anticipation and hard work. The fields were prepared, the paddies flooded, and seedlings are well prepared. Although rice farming required less hands-on labor than vegetable farming, it was just as crucial to the barangays survival. After all, rice was their main food source, and any surplus could be sold at the market to generate money.

During planting season, the entire barangay worked together to plant rice. Families helped one another in the fields, sharing tools and labor to ensure that all the paddies were sown on time with the help of their

associated president. There was a sense of camaraderie as they stood knee-deep in muddy water, carefully planting each seedling by hand as what traditions they do.

As the rice grew tall in the flooded fields, farmers checked on their crops regularly, keeping an eye out for pests or diseases that could damage the harvest. The months between planting and harvesting were a time of waiting, where the farmers' hopes were pinned on the health of their rice fields. They knew that a successful harvest could provide a cushion for their families to generate extra money, and allowing them to make necessary repairs to their homes, pay off debts, and send their children to school especially when they are in college or invest in other areas of their farms.

When harvest time arrived, the fields were a sea of golden grains swaying. The entire barangay mobilized once again, this time to cut and thresh the rice. Farmers worked from dawn to dusk, bundling the stalks and drying them in the sun. The harvested rice was stored in granaries or sold to local buyers, providing much-needed income before the next cycle of vegetable farming resumed. Though it was seasonal work, rice planting added a vital layer of security to the livelihood, allowing them to weather difficult times and plan for the future.

3.1.3 Animal and Agriculture

In addition to their crops, the farmers raised animals as part of their livelihood. Ducks, chickens, goats, and the occasional pig were common sights around their area, wandering freely in the yards and fields. Animal husbandry provided a significant source of food and income, as well as helping with various agricultural tasks. For many families, raising animals was a tradition passed down from their ancestors. Most of the time, Ducks and chickens provided eggs and meat, which were either consumed by the family or sold in the market. The ducks were particularly important to rice farmers, as they helped control pests in the rice paddies by eating insects and weeds. The sight of a flock of ducks waddling through the fields was a familiar one, and the farmers relied on their natural pest control abilities to keep their rice crops healthy.

Chickens, too, played important aspects in the farmers. Every household had a small flock of hens that provided fresh eggs. The farmers would collect the eggs in the morning and either uses them for their meals or sells them to neighbors and market vendors. For families with limited land, raising chickens was a practical way to supplement their income without requiring as important resources. Moreover, Goats were another valuable asset to the farmers, especially for those with larger plots of land or area. The goats grazed on the grass and weeds around the fields, helping to keep the land clear for planting. Their milk was used to sold at the markets for a profit. Some farmers even kept a few pigs, which were raised for meat and often sold for special occasions like weddings, birthday, or they can sell per kilo in their neighbour. Taking care of the animals was also a responsibility that required patience and dedication. The farmers fed them, and ensured they were healthy. As a result, the animals provided a reliable source of food and additional income.

Animal husbandry also played an essential role in preparing the fields for planting. Farmers used buffaloes, locally known as "carabaos," to plow their fields, especially for rice planting. The slow, steady animals were a vital part of traditional farming methods, and their strength made it possible for farmers to cultivate larger plots of land. Despite the advancements in irrigation, rice planting, and animal husbandry, the farmers faced numerous challenges that threatened their livelihoods. Climate change had made weather patterns increasingly unpredictable, with droughts and floods occurring more frequently. The farmers had to adapt to these changes, sometimes planting different crops or altering their schedules to accommodate the shifting seasons. Pests and diseases also posed a constant threat to their crops and animals. Despite their best efforts, the farmers sometimes lost entire harvests to blight or infestations. In such times, they relied on their community, sharing resources and supporting one another to make it through the hardships.

The cost of agricultural, such as seeds, fertilizers, and tools, had risen steadily over the years. Many farmers struggled to keep up with these costs, and some fell into debt trying to maintain their farms. Government subsidies and assistance programs provided some relief, but they were often insufficient to meet the growing needs of the farmers. Yet, through all these challenges, the farmers remained resilient. Their deep connection to the land and their commitment to their families drove them to keep working, no matter the obstacles they faced. For them, farming was not just a job—it was a way of life, one that defined their identity and sustained their community. the livelihood of the farmers was a testament to the power of perseverance, innovation, and community. Through the careful management of water for their crops, the seasonal planting of rice, and the nurturing of their animals, they found a way to thrive more.

Table 1
Livelihood of farmers in Tarlac City

Aspect	Livelihood	Importance	Significance of Irrigation	Output
Vegetable Farming	The farmers' primary livelihood came from vegetable farming, cultivating cabbage, eggplants, tomatoes, and other hardy crops.	Irrigation was crucial for sustaining their crops, as they were no longer dependent solely on unpredictable rains.	The irrigation system revolutionized farming by providing a reliable water source, allowing farmers to cultivate vegetables yearly and maximize production.	Farmers expanded their fields, grew vegetables in rotation, and increased their incomes by selling consistently at wet markets, ultimately improving their living standards.
Rice Planting	Rice planting provided an additional income during the monsoon season, supplementing the farmers' livelihood.	Rice was both a staple food and a source of income, as surplus rice could be sold at markets.	Irrigation allowed for better control of planting schedules, and the consistent water supply enabled farmers to plant rice multiple times a year, increasing yield and revenue.	Farmers sold surplus rice and used the income for essential needs, such as home repairs, paying off debts, and sending their children to school.
Animal Husbandry	Many farmers raised ducks, chickens, goats, and pigs, providing food and supplementary income.	Ducks helped control pests in rice paddies, and chickens provided eggs, while goats and pigs contributed meat, milk, and profit, especially during special occasions.	The natural pest control by ducks reduced the need for chemical interventions, while carabaos helped plow fields for rice planting, reinforcing the interconnectedness of livestock and crop production.	The farmers sold eggs, milk, and meat at markets, while animal husbandry supported agricultural activities such as field plowing, further enhancing crop production and household sustenance.
Community Support	The livelihood of the farmers depended heavily on communal efforts and cooperation, especially during planting and harvesting seasons.	The community came together to support each other in difficult times, sharing tools, labor, and resources.	The communal approach to irrigation maintenance and rice planting fostered collaboration, strengthening the irrigation system and ensuring all farmers benefited from its advantages.	Through shared efforts, the farmers were able to maintain their livelihood despite challenges, using irrigation to improve production and profitability across all aspects of farming.
Adapting to Challenges	Farmers constantly faced challenges, such as unpredictable weather, rising costs, and crop diseases, but their resilience and adaptability allowed them to persevere.	Adapting to changes in weather patterns, planting new crops, or using alternative irrigation methods helped farmers maintain their livelihoods.	Irrigation allowed farmers to plant crops out of season and adapt to changing environmental conditions, offering flexibility to respond to external pressures such as climate change and natural disasters.	Despite difficulties, farmers found ways to innovate and sustain their livelihood through the combined efforts of vegetable farming, rice planting, and animal husbandry, securing food and income for their families and communities.

3.2 The Sentiments on the Irrigation that affects the livelihood

The lived experiences of the farmers regarding their sentiments on irrigation were based on their situation during the interviews and while answering the questionnaires. This section provided insights into the life of farmers and the importance of irrigation. Their stories included their income, sentiments about being farmers, how their families influenced their lives in farming, and the problems they encountered.

To assess all the cases that have been discussed above, the stories of different life. Experiences have been shared and narrated on how the life they have been as farmer highlighted their resilience and dedication to agriculture presented on the table 2. They relied on seasonal income that varied based on crop yields and market prices, with many reporting stable earnings during good seasons, particularly when additional irrigation was available. This irrigation enabled them to harvest two or three times per year, typically earning between P10,000 and P20,000 per crop. With years of experience, some farmers dedicated 20 to 25 years to their craft, demonstrating commitment despite the challenges they faced. Their decision-making processes were influenced by available resources, weather patterns, and government support, which included free seeds and fertilizers. These programs were crucial in managing their financial constraints and improving crop production, predominantly rice, corn, and vegetables. Ultimately, irrigation played a significant role in enhancing their livelihoods, providing hope for a sustainable future for their families.

Table 2
The Common Life Experiences of Farmers

Similarities	Experience and programs of the Farmers in Tarlacv City
In terms of Income	Farmers typically rely on seasonal income that fluctuates based on crop yields and market prices. In Tarlac City, farmers reported stable income during good seasons, especially when additional irrigation was installed, allowing them to harvest two or three times per year. Most of them earned an average of P10,000 to P20,000 per crop, but income decreased significantly without reliable irrigation.
In terms of Crop production	Consistent access to irrigation allowed farmers to increase crop cycles (up to two or three per year) most of their crop production are rice, corn and vegetable production, ensuring higher yields compared to areas with insufficient water supply.
Years of being Farmer	Many farmers in Tarlac City have worked in agriculture for many years, with some starting in their teenage years and continuing for 20 to 25 years. Their long experience shows their strength and dedication despite the challenges they face.
Decision Making	Farmers often made decisions based on available resources and weather patterns. Most of the farmers in Tarlac City decided to plant according to the season, especially when it came to rice and corn, so that their crop selection would not be affected. Their decisions were heavily influenced by water availability and government support programs.
Budget	Farmers frequently face financial constraints, allocating limited funds for fertilizers, labor, and equipment. However, with the helped of the government, they received free seeds and fertilizer programs that reduce their expenses.
Family Status	Farming supported their families, providing for their children's education and household needs. Farmers in Tarlac City took pride in how farming contributed to their family's stability and development.
Personal Development	Farming taught discipline, resource management, and adaptability. Many farmers highlighted personal growth through overcoming challenges, developing skills, and staying optimistic despite setbacks.
Received Criticism	Farmers often faced criticism for out-dated practices or low production during bad seasons. Some also experienced doubts from others about their reliance on farming as a livelihood.
Challenges as farmers	Droughts, unpredictable weather, and financial limitations were common struggles. Those farmers in Tarlac City, has poor irrigation maintenance and the rising cost of diesel for pumps were significant barriers.

Government Support they received	Farmers received free seeds, fertilizers, and some irrigation assistance from programs led by the Department of Agriculture (DA), National Irrigation Administration (NIA), Local Government of Tarlac, and local barangay officials. These supports helped reduce costs but were often inconsistent or inadequate for all needs.
Positive Outcome helps by the irrigation as farmers	The Irrigation provided a reliable water supply, improving crop yields and income. Those farmers noted that irrigation not only enhanced their productivity but also reduced operational costs and gave them hope for a sustainable future in agriculture and for their family as well.

3.3 The Government Support programs given to Farmers

As of 2024, the Philippine government and local authorities have significantly intensified their efforts to support farmers through a variety of comprehensive programs aimed at enhancing agricultural productivity, reducing production costs, and promoting sustainability. These initiatives are critical in addressing the numerous challenges faced by farmers, particularly in light of rising production expenses, fluctuating market prices, and the increasing threats posed by climate change.

Table 3
Government Support Program to Farmers

Program	Objectives	Budget	Agency
IRR of R.A. 10969 "Irrigation Service Act"	To increase in the rate of operations subsidy is to augment the high rate including the high cost of materials and labor.	Php 500/ha/cropping	NIA
Rice Farmers Financial Assistance (RFFA).	aimed to stabilizing the rice supply and prices in the country	Php 5,000 each eligible	Department of Agriculture (DA)
National Rice Program	To modernize rice farming practices. By encouraging the adoption of hybrid seeds.	Php 30.87 Billion	Department of Agriculture (DA)
Fertilizer Assistance Program	to help farmers afford fertilizers, which are essential for maintaining soil fertility and increasing crop yields	Php 9.55 Billion	Department of Agriculture (DA)
National High-Value Crops Development Program	to help farmers afford fertilizers	Php 1.94 Billion	Department of Agriculture (DA)
Quick Response Fund (QRF)	to transition from traditional staple crops to more lucrative alternatives	Php 1 billion	Department of Agriculture (DA)
National Urban and Peri-Urban Agriculture Program	To promote food security and self-sufficiency	Php 436 Million	National Urban and Peri-Urban Agriculture Program
Kadiwa Program	To eliminate intermediaries in the food supply chain,	Php 495.7 Million	
Agricultural Credit Programs	To invest in essential inputs such as seeds, fertilizers, and equipment.	Php 2.7 Billion	Department of Agriculture (DA)

The government's proactive approach seeks to empower the agricultural sector, ensuring farmers can adapt to changing conditions while improving their livelihoods. Key initiatives include financial assistance programs, which provide low-interest loans and grants to help farmers invest in modern technologies and

sustainable practices. Additionally, training and capacity-building programs are being implemented to educate farmers on efficient farming techniques, resource management, and crop diversification.

The program under the IRR of R.A. 10969, also known as the "Irrigation Service Act," aimed to increase the rate of operations subsidy. This was intended to address the rising costs associated with materials and labor, which had significantly impacted the efficiency of irrigation services. The budget allocated for this initiative was set at Php 500 per hectare per cropping season. The National Irrigation Administration (NIA) was the responsible agency tasked with the implementation of the subsidy program. This increase in subsidy rates helped NIA mitigate the financial burden on irrigation services and supported farmers in maintaining productivity amidst rising costs.

The Rice Farmers Financial Assistance (RFFA) provided direct cash assistance to small-scale rice farmers, specifically those managing two hectares or less. The program was funded through excess tariffs collected from rice imports under the Rice Tariffication Law, which was aimed at stabilizing the rice supply and prices in the country. Each eligible farmer received a one-time cash grant of PHP 5,000. This financial aid was vital in helping rice farmers mitigate the adverse effects of rising production costs and decreasing income due to market volatility. This initiative ensured that smallholder farmers had enough resources to continue cultivating rice and improving food security across the country.

The National Rice Program supported by The Department of Agriculture allocated PHP 30.87 billion for the National Rice Program in 2024, which sought to address core issues in rice production, including high production costs and the need for increased efficiency. A significant portion, PHP 9.8 billion, was earmarked for hybrid rice seed assistance, reflecting the government's intent to modernize rice farming practices. By encouraging the adoption of hybrid seeds, the government hoped to boost crop yields and reduce farmers' reliance on costly inputs. This initiative supported long-term sustainability in rice farming, enabling the Philippines to reduce its dependence on rice imports.

The Fertilizer Assistance Program was recognizing the critical need for accessible fertilizers; the government allocated PHP 9.55 billion to help farmers afford fertilizers, which are essential for maintaining soil fertility and increasing crop yields. Fertilizer costs have been rising globally, and this subsidy was designed to shield farmers from bearing the brunt of these costs. By providing financial relief, the program aimed to ensure that farmers could sustain optimal crop growth, particularly in rice and corn production. This was especially relevant during periods of heightened inflation, where input costs could otherwise render farming operations unsustainable.

The National High-Value Crops Development Program were diversify farmers' income sources and ensure long-term agricultural viability, the government allocated PHP 1.94 billion for the cultivation of high-value crops such as fruits and vegetables. This program encouraged farmers to transition from traditional staple crops to more lucrative alternatives. High-value crops not only offered better market prices but also helped farmers manage risks associated with monocropping and climate-induced disasters. By focusing on market-oriented crop production, the government supported farmers in increasing their incomes and enhancing their resilience to market fluctuations.

The Quick Response Fund was a crucial safety net for farmers affected by natural calamities such as typhoons, droughts, or floods, which have become more frequent due to climate change. With a budget of PHP 1 billion, the QRF enabled the Department of Agriculture to provide immediate assistance to farmers whose crops and livelihoods were destroyed by extreme weather events. This fund helped minimize disruptions in food production by allowing for quick recovery efforts, including replanting and rebuilding irrigation systems.

The National Urban and Peri-Urban Agriculture Program, In response to the growing demand for fresh produce in urban areas, the government launched the National Urban and Peri-Urban Agriculture Program with a PHP 436 million budget. This initiative encouraged the development of small-scale, community-based agricultural projects in urban settings, promoting food security and self-sufficiency. By turning vacant lots, rooftops, and other unused spaces into productive agricultural areas, this program supported urban food systems while reducing the logistical challenges of transporting food from rural to urban areas.

The last programs were Kadiwa Program aimed to improve market access for farmers by creating direct links between producers and consumers. With an allocation of PHP 492.7 million, this initiative sought to eliminate intermediaries in the food supply chain, allowing farmers to receive better prices for their produce. The Kadiwa stores and mobile markets also offered consumers affordable agricultural products, ensuring food availability at fair prices. This initiative was particularly important in stabilizing food prices amid inflationary pressures while supporting local farmers.

The Agricultural Credit Programs support farmers' financial needs, the DA allocated PHP 2.75 billion for agricultural credit programs. These low-interest loans enabled farmers to invest in essential inputs such as

seeds, fertilizers, and equipment. Access to affordable credit was crucial for enabling farmers to upgrade their operations, adopt modern technologies, and cope with unpredictable market and environmental conditions.

3.4 The problems encountered of the Farmers in Tarlac City that affects their livelihood

The Farmers in Tarlac City face numerous challenges that directly affect their livelihood, with irrigation being a central concern. the problems encountered by farmers in relation to water management and irrigation, drawing connections between these challenges and their broader implications for farming sustainability and resilience.

Table 4
Problems Encountered

Problems Encountered	*f*	R
Limited availability of water resources hinders their ability to effectively irrigate and grow crops.	28	1
Unpredictable weather patterns, such as droughts or floods, affect my water availability and irrigation schedules.	26	2
The installation, maintenance, and operation of irrigation systems are expensive for me.	24	3
Lack of access to training and technical support of the government that need to implement and maintain efficient irrigation systems.	21	4
My poor irrigation practices can lead to water wastage and inefficient use of available resources.	20	5.50
Facing difficulties in understanding and operating advanced irrigation technologies	20	5.50
Over-irrigation or improper irrigation practices lead to soil erosion, salinization, and nutrient depletion on my farm	18	7
Inadequate or outdated infrastructure causes disruptions in my water supply and distribution	15	8
Inconsistent or unfavorable government policies and regulations limit my access to necessary resources and support for irrigation	13	9
Excessive water extraction for irrigation negatively impacts local ecosystems and biodiversity around my farm	8	10

Based on the Table 4 presented, the Limited availability of water resources hinders their ability to effectively irrigate and grow crops got the most problems with 28 farmers, the limited availability of water, which directly affects their ability to irrigate crops efficiently. Water scarcity forces farmers to ration water, reducing crop yields and increasing vulnerability to droughts. This directly impacts their income and long-term agricultural viability. They rely heavily on seasonal rainfall, such scarcity can exacerbate poverty among farming communities, further entrenching their economic challenges.

Next, the Unpredictable weather patterns, such as droughts or floods, affect my water availability and irrigation schedules Unpredictable weather patterns, identified by 26 farmers and second most problems encountered, they have disrupted traditional farming cycles. Climate change has caused erratic rainfall, leading to water shortages or, conversely, excessive flooding. Farmers find it difficult to plan irrigation schedules, increasing crop loss risk. The changing climate has altered growing seasons, further complicating resource management. This unpredictability requires adaptive measures, including improved forecasting and risk management, which many farmers have yet to adopt.

Third, the installation, maintenance, and operation of irrigation systems are expensive for me with 24 farmers responded the high costs of irrigation systems as a significant burden. The initial investment, coupled with on-going maintenance expenses, creates a barrier for small-scale farmers. Without affordable options or subsidies, many farmers struggle to adopt modern irrigation technologies that could enhance their productivity. This financial burden exacerbates the existing resource scarcity and leads to inefficiencies in water use, which further undermines farming success.

Moreover, the Lack of access to training and technical support of the government that needs to implement and maintain efficient irrigation systems. The lack of access to government training and technical support, responded by the 21 farmers, hinders the adoption of efficient irrigation practices. Without proper guidance, farmers may rely on out dated or inefficient methods, which can lead to water wastage. Government programs aimed at capacity building are essential for enabling farmers to adopt sustainable practices, but many farmers in the City reported limited outreach or poorly implemented initiatives, reducing their ability to improve irrigation efficiency.

The Poor irrigation practices can lead to water wastage and inefficient use of available resources with 20 respondents, which acknowledged that poor irrigation practices contribute to water wastage. These inefficient practices not only deplete valuable water resources but also reduce crop yields. Many farmers rely on traditional methods that may not optimize water usage, leading to losses. Proper training in modern irrigation techniques is crucial for addressing this problem. Sustainable water management practices, if adopted widely, could mitigate this issue and contribute to better resource allocation for farming.

On the other hand, the Facing difficulties in understanding and operating advanced irrigation technologies got the same number of respondents of 20 also reported challenges in understanding and operating advanced irrigation technologies. The gap in technical knowledge limits the adoption of new irrigation systems, which could improve water efficiency and crop productivity. This knowledge barrier reflects a broader need for agricultural education and support to facilitate the integration of new technologies that can help farmers manage their resources more effectively.

The Over-irrigation or improper irrigation practices lead to soil erosion, salinization, and nutrient depletion on my farm Over-irrigation, as respondent by 18 farmers, is a critical problem that leads to environmental degradation, including soil erosion and nutrient loss. Improper irrigation practices can damage soil health, reducing long-term productivity. For farmers, this translates into declining yields and increased vulnerability to environmental changes. Addressing over-irrigation requires a shift toward precision agriculture, where water use is carefully calibrated to prevent these adverse effects.

Next, the inadequate or out dated infrastructure causes disruptions in my water supply and distribution Inadequate infrastructure, with 15 respondent, contributes to disruptions in water distribution. Out-dated irrigation systems fail to deliver water efficiently, further exacerbating the challenges farmers face. Investments in infrastructure are critical to ensuring a reliable water supply, but many farmers lack access to funding or government initiatives that could help upgrade their systems. This inadequacy forces farmers to rely on inefficient methods, increasing their vulnerability to water shortages.

Moreover, the Inconsistent or unfavourable government policies and regulations limit my access to necessary resources and support for irrigation the 13 farmers mentioned that inconsistent or unfavorable government policies limit their access to necessary irrigation resources. Regulatory barriers or unclear policies often prevent farmers from receiving adequate support. In some cases, farmers may be excluded from government programs or find it difficult to comply with stringent regulations, further exacerbating their challenges in managing water resources. More transparent and farmer-friendly policies could help address this issue (Philippine Statistics Authority, 2022).

The Excessive water extraction for irrigation negatively impacts local ecosystems and biodiversity around the farm with 8 farmers noted that excessive water extraction for irrigation negatively affects local ecosystems and this considered as the least among the problems encountered. Overuse of water depletes natural resources, affecting biodiversity and the ecological balance. In the long term, this over-extraction can lead to desertification and further degrade farmland. Sustainable water management practices are essential to prevent this environmental degradation, ensuring that irrigation practices do not compromise the ecological health of surrounding areas.

3.5 Proposed Measures to address the problems encountered of the farmers in Tarlac City

The table 4 presents the interventions measured were formulated and proposed by the respondents and the based on the problems of irrigation faced by farmers in Tarlac City. The researcher was compromised to formulate the essence of the intervention in collaboration with the respondents to address the prevailing problems. It includes the strategies, objectives, expected outcomes, and identifies the responsible government agencies.

The Develop and expand water catchment systems and rainwater harvesting facilities Water catchment systems and rainwater harvesting facilities were proposed to increase the water supply for irrigation. This approach aimed to mitigate the impact of water shortages during dry seasons by storing rainwater for agricultural use. The development of small dams, reservoirs, and rainwater collection systems provided

farmers with a more reliable water source, reducing their dependence on natural rainfall. By implementing these facilities, farmers were expected to enhance crop production and resilience to droughts. This measure also helped to promote sustainable water use in regions prone to water scarcity.

Table 5
Proposed Measures

Problems Encountered	Proposed Measures	Objectives	Strategies	Expected Output	Responsible Government
Limited availability of water resources hinders my ability to effectively irrigate and grow crops	Develop and expand water catchment systems and rainwater harvesting facilities	To Increase water availability for irrigation	Construction of small dams, reservoirs, and rainwater harvesting systems	Improved water storage and access for irrigation	National Irrigation Administration (NIA), Department of Public Works and Highways (DPWH)
Problems Encountered	Proposed Measures	Objectives	Strategies	Expected Output	Responsible Government
Unpredictable weather patterns, such as droughts or floods, affect water availability and irrigation schedules	Promote climate-resilient agriculture and adaptive water management practices	To Minimize the impacts of climate change on irrigation and crop production	Provide weather forecasting tools and early warning systems for farmers; promote climate-smart farming practices	Enhanced ability to adapt to weather variability	Department of Agriculture (DA), Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)
The installation, maintenance, and operation of irrigation systems are expensive	Provide subsidies or financial assistance for irrigation infrastructure	To Reduce the financial burden on farmers for irrigation system installation and maintenance	Government subsidies, low-interest loans for irrigation system installations	Reduced costs for farmers and increased adoption of modern irrigation systems	NIA, DA, Land Bank of the Philippines
Lack of access to training and technical support from the government to implement and maintain efficient irrigation systems	Implement regular training programs for farmers on efficient irrigation and water management	To Enhance farmers' knowledge of modern and sustainable irrigation practices	Conduct workshops, seminars, and hands-on training on irrigation system maintenance and water efficiency	Farmers equipped with knowledge on efficient irrigation practices	DA, Agricultural Training Institute (ATI), Technical Education and Skills Development Authority (TESDA)
Poor irrigation practices can lead to water wastage and inefficient use of available	Promote efficient irrigation techniques such as drip irrigation and water-saving technologies	To Maximize water use efficiency and reduce wastage	Introduce drip and sprinkler irrigation systems, encourage water-saving	Improved water efficiency, reduced wastage, and increased crop	DA, NIA

resources			devices and strategies	yields	
Facing difficulties in understanding and operating advanced irrigation technologies	Provide technical support and advisory services on advanced irrigation technologies	To Improve farmers' capacity to operate advanced irrigation systems	Establish technical assistance centers, create user-friendly guides, and offer troubleshooting services	Increased adoption of advanced irrigation systems by farmers	DA, ATI, TESDA
Over-irrigation or improper irrigation practices lead to soil erosion, salinization, and nutrient depletion on my farm	Implement sustainable irrigation practices to prevent over-irrigation	To Protect soil quality and prevent degradation	Promote soil moisture monitoring, introduce precision irrigation techniques	Reduced soil degradation and improved long-term farm productivity	DA, Bureau of Soils and Water Management (BSWM)
Inadequate or outdated infrastructure causes disruptions in my water supply and distribution	Upgrade and rehabilitate existing irrigation infrastructure	To Ensure consistent water supply and distribution	Invest in upgrading outdated irrigation systems, provide regular maintenance and repairs	Improved irrigation infrastructure leading to reliable water supply for farming	DPWH, NIA
Inconsistent or unfavorable government policies and regulations limit my access to necessary resources and support for irrigation	Review and update irrigation policies to make them more inclusive and accessible for farmers	To Align government policies with farmers' needs for sustainable irrigation practices	Engage stakeholders in policy-making, establish farmer consultation and feedback mechanisms	More responsive and inclusive policies supporting irrigation and water resource management	DA, NIA, Department of Environment and Natural Resources (DENR)
Excessive water extraction for irrigation negatively impacts local ecosystems and biodiversity around my farm	Enforce sustainable water extraction limits and promote eco-friendly irrigation practices	To Protect local ecosystems and biodiversity from the adverse effects of over-extraction	Establish water use monitoring systems, promote practices like rainwater harvesting and water recycling	Reduced ecological damage and preservation of biodiversity	DA, DENR, NIA

The Develop and expand water catchment systems and rainwater harvesting facilities Water catchment systems and rainwater harvesting facilities were proposed to increase the water supply for irrigation. This approach aimed to mitigate the impact of water shortages during dry seasons by storing rainwater for agricultural use. The development of small dams, reservoirs, and rainwater collection systems provided farmers with a more reliable water source, reducing their dependence on natural rainfall. By implementing

these facilities, farmers were expected to enhance crop production and resilience to droughts. This measure also helped to promote sustainable water use in regions prone to water scarcity.

Promote climate-resilient agriculture and adaptive water management practices the promotion of climate-resilient agriculture focused on helping farmers adapt to unpredictable weather patterns, such as droughts or floods. Adaptive water management practices, including the use of early warning systems and weather forecasting tools, enabled farmers to adjust irrigation schedules more effectively. These practices minimized crop loss due to extreme weather events and optimized water use. By adopting climate-smart techniques, farmers increased their resilience to changing environmental conditions. This measure was particularly important in areas where traditional farming methods were no longer reliable due to climate variability.

Provide subsidies or financial assistance for irrigation infrastructure Subsidies and financial assistance for irrigation systems were introduced to reduce the high costs faced by farmers. This measure included government programs offering low-interest loans or grants to support the installation and maintenance of modern irrigation technologies. By alleviating the financial burden, farmers were able to adopt more efficient systems that optimized water usage, leading to higher crop yields and improved farm productivity. The increased access to affordable irrigation systems also encouraged sustainable farming practices, as farmers no longer relied on out dated or inefficient methods.

Implement regular training programs for farmers on efficient irrigation and water management Regular training programs were proposed to enhance farmers' knowledge of efficient irrigation techniques and sustainable water management. These programs included workshops, seminars, and hands-on demonstrations on topics such as irrigation system maintenance, water-saving technologies, and modern agricultural practices. By providing farmers with technical skills, the programs helped to reduce water wastage and improve crop yields. The training also empowered farmers to adopt new technologies, ensuring they could manage their irrigation systems effectively and sustainably.

Promote efficient irrigation techniques such as drip irrigation and water-saving technologies efficient irrigation techniques, such as drip irrigation, were promoted to address water wastage. Drip irrigation allowed for precise water delivery directly to the roots of plants, minimizing water loss through evaporation and runoff. Water-saving technologies, like moisture sensors, were also introduced to help farmers monitor soil water levels and irrigate accordingly. By adopting these methods, farmers optimized water usage, reduced waste, and improved crop yields. This measure aimed to make water use more sustainable, particularly in regions with limited water resources.

Provide technical support and advisory services on advanced irrigation technologies Technical support and advisory services were made available to help farmers understand and operate advanced irrigation systems. Many farmers struggled with the complexity of modern technologies; therefore, government agencies offered user-friendly guides, troubleshooting assistance, and training to address this issue. By ensuring farmers had the necessary knowledge and resources, this measure facilitated the adoption of more efficient irrigation systems. As a result, farmers improved water management, leading to better resource conservation and enhanced productivity on their farms.

Implement sustainable irrigation practices to prevent over-irrigation Sustainable irrigation practices were encouraged to prevent over-irrigation, which often caused soil erosion, salinization, and nutrient depletion. Precision irrigation methods, which deliver the right amount of water to crops based on their needs, were introduced to address this issue. Monitoring tools, such as soil moisture sensors, helped farmers avoid excessive watering. By implementing these practices, farmers were able to protect soil health and maintain long-term farm productivity. This measure also contributed to environmental sustainability by preventing the degradation of agricultural land.

Upgrade and rehabilitate existing irrigation infrastructure the rehabilitation and upgrading of outdated irrigation infrastructure were proposed to ensure a consistent water supply for farming. Many farmers experienced disruptions in water distribution due to aging systems. Investments in infrastructure repairs and upgrades aimed to improve the reliability of water delivery, making irrigation more efficient. By modernizing irrigation networks, this measure sought to prevent water losses and ensure that farmers could access the water they needed for crop cultivation, even during dry seasons.

Review and update irrigation policies to make them more inclusive and accessible for farmers Inconsistent or unfavorable government policies were reviewed and updated to ensure they were more inclusive and accessible to farmers. This measure involved engaging stakeholders, such as farmer organizations and local governments, in policy-making processes to ensure regulations aligned with the needs of agricultural communities. By simplifying regulations and improving access to government support,

farmers were able to better manage their water resources. This measure also promoted a more supportive policy environment, enabling farmers to participate in irrigation programs more effectively.

Enforce sustainable water extraction limits and promote eco-friendly irrigation practices Sustainable water extraction limits were enforced to prevent the depletion of local ecosystems and biodiversity. Regulations were introduced to monitor and control water usage, ensuring that farmers extracted water at sustainable rates. Eco-friendly irrigation practices, such as rainwater harvesting and recycling water, were also promoted to reduce the environmental impact of irrigation. These measures aimed to balance the needs of agriculture with the preservation of natural ecosystems, preventing long-term damage to local biodiversity.

IV. Summary of Findings, Conclusions, Recommendations

This chapter summarized the results of the study. Based on these results, conclusions were made, and recommendations were given. The findings presented in the same order as the research questions.

4.1 Summary of Findings

1. Most farmers are men, with a total of 23, which suggests they possess better physical abilities for farming. There are also 7 female farmers, contributing to the agricultural efforts in the community.
2. Many farmers have only completed elementary and high school education, which has limited their opportunities for advancement and improved living conditions. This lack of education affects their farming practices and economic potential.
3. A significant number of farmers primarily grow rice, which serves as their main crop. Additionally, they cultivate various vegetables, corn, and fruits, diversifying their agricultural production and income sources.
4. The farmers in Tarlac City are predominantly married couples who collaborate closely. They work together to ensure their family has a decent life, focusing on providing education and necessities for their children.
5. Many farmers are middle-aged, typically ranging from 50 to 60 years old, yet they persist in farming activities. Their experience plays a crucial role in maintaining agricultural productivity despite physical challenges.
6. Their earnings generally range from approximately 21,000 pesos and above per harvest. Some farmers earn based on the number of sacks produced, reflecting variations in productivity and market demand.
7. Most farmers have successfully managed to send their children to college, which has resulted in positive outcomes for their families. This accomplishment highlights their commitment to education and improving future prospects.
8. All farmers receive free fertilizer and seeds from the government, yet they express feelings of inadequacy regarding support. They believe assistance is insufficient due to the lack of effective irrigation systems.
9. Many farmers struggle with irrigation due to inadequate systems, particularly during the dry season. This challenge significantly impacts their crop yields and overall productivity, causing frustration and economic hardship.
10. Most farmers are actively requesting urgent assistance for irrigation improvements. They believe that better irrigation systems will enhance their agricultural productivity and help them manage their crops more effectively.

4.2 Conclusions

1. The predominance of male farmers, complemented by female participation, highlights a strong community effort in agriculture, leveraging physical capabilities to ensure sustainable farming practices and improved productivity.
2. Limited educational attainment among farmers indicates a need for better access to educational resources, which could empower them with knowledge and skills to enhance their farming techniques and economic status.
3. The focus on diverse crops, particularly rice, reflects the farmers' adaptability and resilience, ensuring food security for their families while contributing to local markets with a variety of agricultural products.

4. The collaboration between married couples emphasizes the importance of teamwork in farming. Their joint efforts are crucial for providing a stable home environment and fostering a supportive atmosphere for their children.
5. The persistence of middle-aged farmers showcases their dedication to agriculture despite physical challenges. Their experience is invaluable, serving as a foundation for knowledge transfer to younger generations entering farming.
6. The income variability among farmers highlights the impact of market conditions and productivity on their livelihoods. Strategies to stabilize earnings could significantly improve their overall financial security and quality of life.
7. Successful college graduations among farmers' children demonstrate the long-term benefits of hard work and investment in education. This achievement serves as a source of pride and hope for future generations.
8. The feelings of inadequacy regarding government support reflect the need for more effective assistance programs. Addressing irrigation challenges could significantly enhance farmers' productivity and overall agricultural sustainability.
9. The struggle with irrigation during dry seasons illustrates a critical gap in farming infrastructure. Improving irrigation systems is essential for maximizing crop yields and ensuring food security within the community.
10. The farmers' call for urgent irrigation assistance emphasizes the critical need for improvements in agricultural infrastructure. By addressing these concerns, stakeholders can enhance farming productivity and support sustainable development.

4.3 Recommendations

1. The Government may provide funds to improve waterways or creeks served to store rainwater during the rainy season. They will serve as small reservoirs that can be used during the dry season when irrigation water is low. These areas will also need to be cleaned to prevent flooding during the rainy season, which can damage irrigation structures and crops.
2. The City Government of Tarlac may install solar pumps, and their panels can be placed directly above the irrigation canals. If the water supply for irrigation is low, these pumps can provide extra water.
3. Farmers and NIA staff may conduct walkthroughs to create a good plan to add more structures to the irrigation system, such as Turn-Outs and Check Structures, allowing for more areas to be irrigated.
4. Through Ordinance of the City Government of Tarlac they may support Trash racks and be placed in each barangay to help maintain irrigation systems. This will make it easier to clean or remove trash. There will also be a memorandum of agreement (MOA) between NIA, farmers, and each barangay to involve local government in keeping irrigation areas clean and organized.
5. Post-harvest facilities will be built since they are currently lacking, especially drying facilities needed during the first crop season.
6. The government may establish a strong program to subsidize farmers' expenses. In return, the government will buy farmers' products, improving farmers' lives and allowing the government to control rice prices better since they will be purchasing the products directly.
7. The Local Government of Tarlac may create seminars for all farmers about modern technologies and farming methods to effectively use irrigation and fertilizers. This will help every member of the irrigators' association be more active.
8. Operation and maintenance of irrigation canals may be increased, and the Balog-Balog Dam will be completed because this is the only solution to the water shortage in our irrigation areas.
9. The association may grant them a developing comprehensive water management training programs that can significantly improve irrigation efficiency. These programs should cover modern irrigation techniques, such as drip and sprinkler systems, which use water more effectively than traditional methods.
10. Investing in solar-powered irrigation systems can provide a sustainable and cost-effective solution for farmers. These systems can harness solar energy to pump water efficiently, reducing reliance on traditional power sources and minimizing operational costs. By installing solar panels at irrigation sites, farmers can access a consistent water supply, especially during dry seasons, leading to improved crop yields and reduced water scarcity.

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