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Implementation of Free Irrigation Service Act at Upper Chico Irrigation System (UCRIs): Basis for Sustainability Plan

FERDINAND INDAMMOG
https://orcid.org/0009-0005-3339-1241
ferdinandindammog24@gmail.com
Cagayan State University, Carig Campus, Tuguegarao City, Philippines

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ABSTRACT

This study investigates the implementation of the Free Irrigation Service Act (FISA) at the Upper Chico Irrigation System (UCRIS) in Tabuk City, Kalinga, to assess its impact on agricultural productivity and sustainability. The FISA policy, which exempts small farmers from irrigation service fees, aims to enhance agricultural outputs and support rural livelihoods. Utilizing a descriptive-correlational research design, the study surveyed 403 farmer-beneficiaries to understand the effects of this policy on their farming practices and socio-economic conditions. Key findings reveal that implementing FISA has significantly reduced production costs for farmers, thereby increasing their overall income and agricultural productivity. Farmers reported a substantial improvement in crop yields, particularly rice, the primary crop irrigated by UCRIS. The act's exemption of irrigation fees has been pivotal in alleviating financial burdens, allowing farmers to reinvest in their farms and adopt better agricultural practices. Despite these positive outcomes, the study identified several challenges. Farmers expressed concerns over the operational efficiency and maintenance of the irrigation infrastructure. Issues such as delayed repairs and insufficient water supply during peak growing seasons were noted. These operational shortcomings highlight the need for more robust management and sustainable practices to ensure the long-term success of FISA. The study emphasizes the importance of ongoing government support, including adequate funding for infrastructure maintenance and enhancements. Capacity-building programs are recommended to educate farmers on sustainable water management and efficient

farming techniques. Furthermore, regular monitoring and evaluation of FISA's implementation are essential to address emerging issues and refine the program for better outcomes. Overall, the FISA at UCRIS demonstrates a positive step towards promoting sustainable agriculture and improving the livelihoods of small-scale farmers in Kalinga. Ensuring the program's long-term sustainability and operational efficiency remains crucial for its continued success and broader applicability.

KEYWORDS

Free Irrigation Service Act (FISA); agricultural productivity; sustainable irrigation; rural development; policy implementation, descriptive-correlational, Philippines

INTRODUCTION

Agricultural sustainability is a pressing global concern, necessitating comprehensive efforts to address challenges such as water scarcity, food insecurity, and the adverse effects of climate change (Bacuyag, 2022). These issues are particularly acute in developing countries like the Philippines, where agriculture is a cornerstone of the economy and rural livelihoods. The country's diverse agricultural sector faces significant hurdles, including inefficient water management and the financial burdens associated with irrigation. To mitigate these challenges and support smallholder farmers, the Philippines enacted the Free Irrigation Service Act (FISA), Republic Act No. 10969, in 2018 (Republic Act No. 10969, 2018).

FISA is a landmark policy designed to exempt farmers with eight hectares or less of land from paying irrigation service fees for water sourced from National and Communal Irrigation Systems. This legislation aims to alleviate the financial pressures on small-scale farmers, enhance their capacity to invest in farming operations and improve productivity (Philippine Statistics Authority, 2021). The act also underscores a broader commitment to promoting sustainable agricultural practices and improving the socio-economic well-being of rural communities (FAO, 2020).

Irrigation is crucial in Philippine agriculture, particularly in regions with variable rainfall patterns and dry spells. Efficient water use through irrigation systems is essential for maintaining crop yields and ensuring food security. However, many irrigation systems in the country suffer from under-resourcing and deteriorating infrastructure, which can limit their effectiveness (David, 2009; Ella, 2015). The implementation of FISA represents a significant policy shift aimed at addressing these issues by providing free access to irrigation services for small farmers. This initiative is expected to boost agricultural productivity and contribute to the overall resilience of farming communities against climatic and economic challenges (World Bank, 2020).

The Upper Chico Irrigation System (UCRIS) in Tabuk City, Kalinga, serves as a pivotal case study for examining the impact of FISA. In the Cordillera Administrative Region, UCRIS is a vital irrigation network supporting various agricultural activities (National Irrigation Administration, 2019). The system is

integral to the local economy, providing essential water resources for cultivating crops such as rice, a staple food in the region. By assessing the implementation of FISA within UCRIS, this study seeks to understand how the policy affects agricultural productivity, farmer livelihoods, and the sustainability of irrigation practices (Philippine Rice Research Institute, 2018).

Despite its potential benefits, the effectiveness and sustainability of FISA at the local level remain underexplored. Previous research has highlighted significant issues related to the operational efficiency and maintenance of irrigation systems under FISA. Challenges such as delayed infrastructure repairs, water distribution inefficiencies, and the financial management of irrigation systems need to be thoroughly examined (David, 2009; Ella, 2015). Additionally, there is a need to explore how FISA influences the socio-economic conditions of farmers, particularly in areas with unique environmental and economic contexts like UCRIS (Clemente et al., 2019).

This study aims to comprehensively evaluate FISA's implementation at UCRIS, focusing on several key objectives. It will assess FISA's socio-economic impacts on farmers, examine the operational dynamics of irrigation management under the new policy, and identify opportunities and challenges for sustainable irrigation system management. The study will offer actionable insights and recommendations to stakeholders involved in agricultural policy formulation, irrigation management, and rural development initiatives through quantitative and qualitative research methods.

The findings from this research are expected to contribute significantly to the ongoing discourse on sustainable agricultural practices and the role of policy in supporting rural development. By providing a detailed analysis of FISA's implementation and its impacts at UCRIS, the study aims to highlight the successes and areas for improvement in free irrigation service policies. Ultimately, this research will inform future policy and practice, helping to ensure the long-term sustainability and resilience of the Philippine agricultural sector.

METHODOLOGY

Research Design

This study employed a descriptive-correlational research design. This design combines elements of descriptive research, which aimed to describe the characteristics of a phenomenon, and correlational research, which examines the relationships between variables. The descriptive-correlational research design enabled the systematic exploration of FISA implementation at UCRIS, facilitating the generation of valuable insights and recommendations for sustainability planning and policy formulation.

Locale of the Study

The study was conducted in Tabuk City, a component city located in the province of Kalinga, Philippines. Tabuk City is nestled in the Cordillera Administrative Region (CAR) on the island of Luzon. It is characterized by its

mountainous terrain, lush landscapes, and significant agricultural activity, making it an ideal locale for studying the implementation of agricultural policies such as the Free Irrigation Service Act. The primary focus of the study is the Upper Chico Irrigation System (UCRIS), which serves as the main irrigation infrastructure supporting agricultural activities in Tabuk City and surrounding areas. UCRIS encompasses a network of canals, reservoirs, and irrigation facilities that supply water to farmlands for crop cultivation. The locale of the study also includes local institutions and stakeholders involved in agricultural governance, water management, and rural development in Tabuk City. This may include government agencies such as the National Irrigation Administration (NIA), local government units (LGUs), agricultural extension services, non-governmental organizations (NGOs), and community-based organizations (CBOs). Engaging with these stakeholders provides valuable insights into the policy context, institutional dynamics, and collaborative efforts shaping FISA implementation and sustainability planning at the local level.

Respondents and Sampling Procedures

The respondents for the study included the farmers and stakeholders directly involved in agricultural activities and irrigation management within the Upper Chico Irrigation System (UCRIS) in Tabuk City, Kalinga. By employing a stratified random sampling approach, the study ensured that the diversity of stakeholders within UCRIS is adequately represented in the sample, allowing for a comprehensive analysis of FISA implementation and its implications for sustainability planning. The criteria for inclusion in the study are that participants must be actively engaged in agricultural activities and have directly benefited from the FISA program. A total of 403 farmers participated in the study.

The socio-economic profile of the 403 respondents reveals that they are predominantly middle-aged adults, with an average age of 47.9 years. The majority, 38%, are aged between 40 and 50, and 23.3% are aged 51-61. Most respondents are married (79.4%), and a significant portion, 71.7%, are landowners. In terms of education, 20.8% have completed high school, and 14.6% have graduated from college. Financially, 40.7% have a monthly income below P5999, with the average income being P10040. Land ownership is common, with 58.1% owning 1-2 hectares of land.

Research Instrument

The structured questionnaire was composed of five basic parts consisting of pre-determined responses that can be assessed through closed-ended and Likert-scale methods. Part I of the questionnaire sought the basic profiling encompassing the socio-demographic information of the farmers, including their age, civil status, educational attainment, income and tenurial status, and farm size. Part II assessed the implementation of the Free Irrigation Services Act, presenting the salient features of the law in terms of the following: Scope of Free Irrigation Service; Condonation and Writing Off of Loans; Operation and Maintenance (O&M) of National Irrigation System; Operation and Maintenance of Communal Irrigation Systems; Collection and Use of Irrigation Service Fees; and Technical Assistance to Irrigators Association.

The level of satisfaction in Part III was likewise assessed through a Likert scale with the same indicators as stated above. Part IV was also a pre-determined section of the questionnaire with a free will to have a response or suggestion in addition to the pre-determined ones. This section focused on the challenges in the implementation of FISA. Finally, Part V was intended for the sustainability plan that the respondents can suggest. It has also a specification part where they give additional input on the pre-identified ones.

Data Gathering Procedure

The systematic collection of data was done through the assessment and evaluation of the structured questionnaire. With the presented parts of the questionnaire, the farmers with the guide of researcher, critically analyzed the various indicators as presented in the research instrument. With this procedure, the researcher personally appeared to be the main lead of the study. This gave the researcher an opportunity not only to conduct the study based on the questionnaire but also to assemble farmers for a focused group discussion. An important ethical consideration for the data gathering procedure in the study on the Implementation of Free Irrigation Service Act at Upper Chico Irrigation System (UCRIS) in Tabuk City, Kalinga, ensured informed consent and confidentiality of respondents.

Analysis of Data

The socio-economic profile was calculated and analyzed through descriptive statistics using the mean and frequency counts as primary treatment. Mean scores, standard deviations, and percentage distributions were calculated to assess the overall level of satisfaction with FISA among respondents. Pearson's correlation coefficient or Spearman's rank correlation coefficient can be used to determine the strength and direction of the relationship between implementation level and satisfaction level. Analysis of variance (ANOVA) or t-tests was used to assess whether there are significant differences in satisfaction levels based on socio-economic variables.

RESULTS AND DISCUSSION

As to all farmers with landholdings of eight (8) hectares and below, the weighted mean is 4.55 or "Strongly Agree". The statement "Small farmers (with land of 8 hectares or less) are exempted to pay for irrigation" has a mean of 4.64 or "Strongly Agree". This indicates that the exemption from irrigation charges is typically applicable to farmers who have landholdings of up to 8 hectares or less. This means that farmers with smaller plots of land are not required to pay the usual fees or charges for irrigation services, such as water supply, maintenance, and operation of irrigation systems. Moreover, the statement "There's a list of farmers and users with important details, like their land title numbers" achieved a mean of 4.51 or "Strongly Agree." This is a manifestation that the list of farmers and users includes important details such as their land title numbers, which is likely a way to identify and verify the ownership of the land. This also implies that the exemption from irrigation charges is

likely conditional on the farmer's land holding being less than 8 hectares in size, and they are required to provide proof of their land title number or ownership to qualify for the exemption. According to Irrigation Research Institute (ROD, 2020), having this information in a centralized list allows the authorities to easily track and manage the exemptions, ensure that only eligible farmers benefit from the exemption, and make informed decisions about irrigation infrastructure development and resource allocation.

Table 1. Mean and descriptive value on the Scope of Free Irrigation Service

Scope of Free Irrigation Service	Mean	Descriptive Value
A. All farmers with landholdings of eight (8) hectares and below		
A1. Small farmers (with land of 8 hectares or less) are exempted to pay for irrigation.	4.64	Strongly Agree
A2. There's a list of farmers and users with important details, like their land title numbers.	4.51	Strongly Agree
A3. There are other documents like Transfer Certificate of Title (TCT) and Certificate of Land Ownership Award (CLOA).	4.54	Strongly Agree
A4. There are other documents like Emancipation Patent (EP) and Tax Declaration.	4.53	Strongly Agree
A5. There are documents like Certificate of Landholdings from the local government treasurer, Land Registration Authority, or Department of Agrarian Reform.	4.55	Strongly Agree
Sub Weighted Mean	4.55	Strongly Agree
B. Farmers with more than eight (8) hectares of landholdings		
B1. Farmers pay the full irrigation Service Fee (ISF) for all the land they own, not just for the land beyond 8 hectares.	4.30	Strongly Agree
B2. Corporate farms and plantations using NIS or CIS are charged regardless of their irrigated area.	4.29	Strongly Agree
B3. Fishponds and non-agricultural users using NIS or CIS are charged the appropriate ISF, regardless of their land size.	4.23	Strongly Agree
B4.If users consume excessive water, competing with rice and other crops, NIA, and local agencies regulate their water usage.	4.34	Strongly Agree
B5. Using irrigation systems for purposes other than drainage is strictly regulated.	4.35	Strongly Agree
Weighted Mean	4.30	Strongly Agree

Moving on, relative to farmers with more than eight (8) hectares of landholdings, the weighted mean is 4.30 or "Strongly Agree." "Using irrigation systems for purposes other than drainage is strictly regulated" obtain a mean of 4.35 and interpreted as "Strongly Agree." This denotes that the use of irrigation systems for purposes other than drainage is indeed strictly regulated. Irrigation systems are typically designed to deliver water to crops, landscaping, or other areas that require watering, and they are not intended for use as a drainage system. According to Karl (2019), irrigation systems are designed to deliver water to specific areas, and using them for drainage purposes can lead to waste and inefficiency. Irrigation systems can cause erosion of soil and other materials if they are used in areas where water is not intended to be collected. In addition, the statement "Fishponds and non-agricultural

users using NIS or CIS are charged the appropriate ISF, regardless of their land size" and "Corporate farms and plantations using NIS or CIS are charged regardless of their irrigated area" achieved a mean of mean of 4.23 and 4.29 or "Strongly Agree" respectively. This signifies that the relevant regulations require fishponds and non-agricultural users, such as those using NIS or CIS, to pay the appropriate ISF for their water use. This fee is intended to help recover the costs of maintaining and managing the irrigation infrastructure, as well as to promote more efficient and sustainable use of water resources. According to Irrigation Research Institute (2020), the ISF is typically calculated based on the volume of water used by each user and may vary depending on factors such as the type of irrigation system used, the location of the user, and the time of year. By charging these fees, the regulatory agencies can help to ensure that water is used efficiently and effectively, and that the costs of managing the water resources are shared fairly among all users.

Condonation and Writing Off of Loans

The weighted mean of Condonation and Writing Off of Loans is 4.40 and interpreted as "Strongly Agree." The statement "Farmers or landowners who are exempted in the payment of ISF are covered by condonation" and "After creating the Registry, NIA gets written approval from each farmer or landowner before condoning their debt" achieved a mean of 4.60 and 4.40 or "Strongly Agree" respectively. This indicates that farmers or landowners who are exempted from paying ISF may be covered by condonation, which means that they are not required to pay the fee. This exemption is typically granted by the relevant water authority or regulatory agency and is usually based on specific criteria or conditions. However, the farmer or landowner is exempted from paying the ISF, but only if they meet certain conditions, such as maintaining a certain level of water efficiency or implementing water-saving practices. Meanwhile, the statement "Non-exempt farmers, landowners and other users are not covered by the condonation and writing off of unpaid ISF policy," "All loans from local agencies (IAs) to NIA including overdue amounts and associated fees, are condoned" and "NIA won't collect overdue fees, interests, and penalties from exempt water users with court cases filed before the law's enactment" obtain a mean of 4.34 or "Strongly Agree." This implies that NIA will not collect overdue fees, interests, and penalties from exempt water users who have court cases filed before the Water Act 2007 was enacted. This means that if a water user was exempt from paying fees and charges under the old laws, and they have a court case pending against them for non-payment, NIA will not pursue further action or collect any outstanding fees, interests, and penalties.

Table 2. Mean and descriptive value on the Condonation and Writing Off of Loans

Condonation and Writing Off of Loans	Mean	Descriptive Value
C1. Farmers or landowners who are exempted in the payment of ISF are covered by condonation.	4.60	Strongly Agree
C2 Non-exempt farmers, landowners and other users are not covered by the condonation and writing off of unpaid ISF policy.	4.34	Strongly Agree
C3. All loans from local agencies (IAs) to NIA including overdue amounts and associated fees, are condoned.	4.34	Strongly Agree
C4. After creating the Registry, NIA gets written approval from each farmer or landowner before condoning their debt.	4.40	Strongly Agree
C5. NIA won't collect overdue fees, interests, and penalties from exempt water users with court cases filed before the law's enactment.	4.34	Strongly Agree
Weighted Mean	4.40	Strongly Agree

Operation and Maintenance (O&M) of National Irrigation System

As to the Operation and Maintenance (O&M) of the National Irrigation System, the weighted mean is 4.64 or "Strongly Agree". The statement "The NIA continues to develop, operate and maintain National Irrigation System" has a mean of 4.77 and is interpreted as "Strongly Agree." This means that the respondents believe that NIA is responsible for designing, constructing, and implementing new irrigation projects to meet the growing water demands of agriculture, industry, and urban areas. This includes identifying potential irrigation sites, conducting feasibility studies, and securing funding for project development. As mentioned by Cayetano (2019), the NIA manages the existing irrigation infrastructure, ensuring that it functions efficiently and effectively. This includes maintaining the canals, dams, pumps, and other equipment and monitoring water levels, flow rates, and water quality. They are also responsible for performing regular maintenance activities to ensure the long-term integrity and functionality of the irrigation system. This includes repairing and replacing damaged or worn-out components, clearing debris from canals, and conducting routine inspections. On the other hand, the statement "NIA strictly implements the "no irrigated land conversion policy" has a mean of 4.57 or "Strongly Agree." This denotes that the respondents believe that the National Irrigation Administration (NIA) is committed to implementing the "no irrigated land conversion policy" to ensure that the country's valuable agricultural land is preserved and protected for future generations. It has been noted that This policy is in place to prevent the conversion of irrigated land to non-agricultural uses, such as urban development, commercial or industrial purposes, and other non-agricultural activities. The NIA has implemented various measures to ensure that irrigated land is protected and preserved.

Table 3. Mean and descriptive value on the Operation and Maintenance (O&M) of National Irrigation System

Operation and Maintenance (O&M) of National Irrigation System	Mean	Descriptive Value
O1. The NIA continues to develop, operate and maintain National Irrigation System.	4.77	Strongly Agree
O2 NIA delegates the O and M of secondary and tertiary canals and farm ditches to capable IAs.	4.58	Strongly Agree
O3. The NIA shall provide the equivalent funds for the O and M of the facilities.	4.61	Strongly Agree
O4. The NIA issues the necessary policies, qualification requirements, and selection process in determining the capability and capacity of IAs/ISCs to operate and maintain these portions of NIS.	4.69	Strongly Agree
O5. NIA strictly implements the "no irrigated land conversion policy".	4.57	Strongly Agree
Weighted Mean	4.64	Strongly Agree

Operation and Maintenance of Communal Irrigation Systems

Relative to the Operation and Maintenance of Communal Irrigation Systems, the weighted mean is 4.54 or "Strongly Agree." "After the completion of construction, rehabilitation, repair or restoration works of CIS, its O&M shall be turned over to duly organized IAs/ISC" achieve a mean of 4.56 or "Strongly Agree." This implies that after the completion of construction, rehabilitation, repair, or restoration works of the Central Irrigation System (CIS), the National Irrigation Administration (NIA) shall turn over the Operation and Maintenance (O&M) responsibilities to duly organized Irrigation Associations (IAs) or Irrigation Service Cooperatives (ISCs). This further indicates that IAs/ISCs are well-positioned to develop and implement community-based management strategies that are tailored to the specific needs of the irrigation system and its water users. On the other hand, "The IMT policy and guidelines applied in NIS is adopted in CIS" and "The IAs/ISCs in CIS receives subsidies for the O&M of the irrigation system with same rates" have a mean of 4.50 and 4.52 or "Strongly Agree" respectively. This signifies that the respondents believe that the IMT policy is designed to ensure a smooth and effective transfer of responsibilities from the National Irrigation Administration (NIA) to Irrigation Associations (IAs) or Irrigation Service Cooperatives (ISCs) in managing irrigation systems. As mentioned by NAI (2022), the IMT policy encourages the active participation of farmers, water users, and other stakeholders in the management and decision-making process of the irrigation system.

Table 4. Mean and descriptive value on the Operation and Maintenance of Communal Irrigation Systems

Operation and Maintenance of Communal Irrigation Systems	Mean	Descriptive Value
O1. CIS continuously operated and maintained by IAs.	4.55	Strongly Agree
O2. The national government provides the equivalent funds for the O and M of CIS.	4.55	Strongly Agree
O3. After the completion of construction, rehabilitation, repair or restoration works of CIS, its O&M shall be turned over to duly organized IAs/ISCs.	4.56	Strongly Agree
O4. The IMT policy and guidelines applied in NIS is adopted in CIS.	4.50	Strongly Agree
O5. The IAs/ISCs in CIS receives subsidies for the O&M of the irrigation system with same rates.	4.52	Strongly Agree
Weighted Mean	4.54	Strongly Agree

Collection and Use of Irrigation Service Fees

Regarding the Collection and Use of Irrigation Service Fees, the weighted is 4.23 or "Strongly Agree." The statement "NIA strictly follows its guidelines and procedures for billing, collecting, and remitting current and unpaid ISF from non-exempt farmers and other irrigation system users" obtain a mean of 4.34 or "Strongly Agree." This signifies that the National Irrigation Administration (NIA) strictly follows its guidelines and procedures for billing, collecting, and remitting current and unpaid Irrigation System Fees (ISF) from non-exempt farmers and other irrigation system users. This further denotes that the NIA prepares and issues monthly bills to non-exempt farmers and other irrigation system users for the use of the irrigation system and ensures that the bill is accurate, reflecting the actual amount of water used by the farmer or user. Meanwhile, the statement "NIA collects ISF from non-exempt farmers and other users" has a mean of 4.12 or "Agree." This implies that the National Irrigation Administration (NIA) collects the Irrigation System Fees (ISF) from non-exempt farmers and other irrigation system users. The ISF is a fee paid by these users to help cover the costs of maintaining and operating the irrigation system. As per NIA (2022), the ISF is an essential source of revenue for the NIA, as it helps fund the construction and maintenance of irrigation infrastructure, as well as the provision of irrigation services to farmers and other users.

Table 5. Mean and descriptive value on the Collection and Use of Irrigation Service Fees

Collection and Use of Irrigation Service Fees	Mean	Descriptive Value
COL1. ISF is collected by NIA from non-exempt farmers and other users	4.12	Agree
COL2 The NIA authorizes the IA/ISC to collect ISF from non-exempt farmers and other users.	4.15	Agree
COL3. NIA strictly follows its guidelines and procedures for billing, collecting, and remitting current and unpaid ISF from non-exempt farmers and other irrigation system users.	4.34	Strongly Agree
COL4. All ISF collections is remitted directly to the NIA Central Office in the form of bank draft issued by any NIA-authorized bank.	4.27	Strongly Agree
COL5. Net of the IA/ISF share, the collections forms part of the NLA's current operating budget.	4.27	Strongly Agree
Weighted Mean	4.23	Strongly Agree

Technical Assistance to Irrigators Association

Relative to the Technical Assistance to Irrigators Association, the weighted mean is 4.41 or "Strongly Agree." The statement "The NIA and other government agencies provide technical assistance to IAs on the O and M of national and communal irrigation systems and farm enterprises management" obtain a mean of 4.50 or "Strongly Agree." This signifies that The National Irrigation Administration (NIA) and other government agencies, such as the Department of Agriculture (DA), provide technical assistance to Irrigation Associations (IAs) on the operation and maintenance (O&M) of national and communal irrigation systems. The respondents believe that the NIA and other government agencies provide technical assistance to

IAs on the proper operation and maintenance of irrigation systems, including managing water resources, maintaining infrastructure, and preventing water waste. According to Bartolome (2019), the NIA and other government agencies also provide technical assistance to IAs on farm enterprise management, including crop planning, farm planning, and business management. This helps farmers and users to optimize their farm productivity, efficiency, and profitability. On the other hand, the statement "Relevant capacity building and training programs and other training modules are identified based on needs assessment shall be conducted for the IAs/ISC" achieve a mean of 4.32 or "Strongly Agree." This is a manifestation that the National Irrigation Administration (NIA) and other government agencies identify relevant capacity building and training programs and other training modules based on the needs assessment conducted for the Irrigation Associations (IAs) and Irrigation System Councils (ISCs). This further indicates that the needs assessment is a crucial step in identifying the training needs of the IAs and ISCs. It involves a thorough analysis of the current capabilities and knowledge gaps of the IAs and ISCs, as well as the requirements of the irrigation systems and farm enterprises.

Table 6. Mean and descriptive value on the Technical Assistance to Irrigators Association

Technical Assistance to Irrigators Association	Mean	Descriptive Value
TECH1 The NIA and other government agencies provide technical assistance to IAs on the O and M of national and communal irrigation systems and on farm enterprises management.	4.50	Strongly Agree
TECH2 Adopting the participatory approach concept, farmer-beneficiaries in new irrigation areas are organized into IAs.	4.40	Strongly Agree
TECH3 IAs are registered with the SEC as non-stock corporations while ISCs should be registered with the COA as stock entities.	4.35	Strongly Agree
TECH4 Relevant capacity building and training programs and other training modules are identified based on needs assessment shall be conducted for the IAs/ISCs.	4.32	Strongly Agree
TECH5. NIA and other agencies continue to support the IAs/ISCs by providing assistance to the IA/ISC leaders and officers.	4.47	Strongly Agree
Weighted Mean	4.41	Strongly Agree

Level of Satisfaction of the respondents towards the FISA

As to All farmers with landholdings of eight(8) hectares and below, the weighted mean is 4.48 and interpreted as "Very Satisfied." The statement, "Small farmers (with land of 8 hectares or less) are exempted to pay for irrigation" has a mean of 4.54 or "Very Satisfied". This indicates that small farmers with a landholding of 8 hectares or less are exempted from paying for irrigation services. This is often a policy measure to support small-scale farmers who are considered vulnerable and may not have the financial resources to pay for irrigation services. As mentioned by Asuncion (2020) exempting small farmers from paying for irrigation services can help to alleviate some of these challenges and provide them with a greater level of economic stability. By not having to pay for irrigation services, small farmers can conserve their resources and focus on other aspects of their farm, such as improving

crop yields, increasing productivity, and diversifying their farm activities. Meanwhile, the statement "There are other documents like Emancipation Patent (EP) and Tax Declaration" has a mean of 4.43 or "Very Satisfied." This implies that the respondents are very satisfied on the document that certifies the ownership of a land by a farmer or an agricultural entity. It is a proof of title that shows the landowner's legal right to possess and use the land. As mentioned by Torres (2019) the EP is an important document that is required for various agricultural activities, such as borrowing credit, applying for government subsidies, and transferring ownership of the land.

Relative to Farmers with more than eight (8) hectares of landholdings, the weighted mean is 4.23 or "Very Satisfied." "Using irrigation systems for purposes other than drainage is strictly regulated" and "If users consume excessive water, competing with rice and other crops, NIA, and local agencies regulate their water usage" achieved a mean of 4.32 and 4.25 or "Very Satisfied," respectively. This denotes that in many agricultural areas, irrigation systems are designed to provide a controlled amount of water to crops, and using these systems for purposes other than drainage is strictly regulated, and the respondents are very satisfied with it. This is because irrigation systems are typically designed to deliver a specific amount of water to crops at a specific rate, and diverting this water for other purposes can disrupt the entire irrigation system and affect crop yields. According to NIA (2022), to prevent the unauthorized use of irrigation systems, there are often regulations that prohibit the use of irrigation systems for purposes other than drainage. These regulations may be enforced by local authorities, agricultural extension agents, or irrigation management authorities. On the other hand, the statement "Farmers pay the full irrigation Service Fee (ISF) for all the land they own, not just for the land beyond 8 hectares" has a mean of 4.15 or "Satisfied". This implies that the respondents are satisfied if they have 10 hectares of land but only use irrigation systems for 5 hectares. They would still be required to pay the full ISF for all 10 hectares. Tis further signifies that the farmers must pay the total Irrigation Service Fee (ISF) for all the land they own, regardless of the size. This means farmers who own less than 8 hectares (the threshold mentioned earlier) will still be required to pay the full ISF for their entire landholding.

Table 7. Mean and descriptive value on the Scope of Free Irrigation Service

Scope of Free Irrigation Service	Mean	Descriptive Value
A. All farmers with landholdings of eight(8) hectares and below		
A1. Small farmers (with land of 8 hectares or less) are exempted to pay for irrigation.	4.54	Very Satisfied
A2. There's a list of farmers and users with important details, like their land title numbers.	4.50	Very Satisfied
A3.There are other documents like Transfer Certificate of Title (TCT) and Certificate of Land Ownership Award (CLOA).	4.47	Very Satisfied
A4. There are other documents like Emancipation Patent (EP) and Tax Declaration.	4.43	Very Satisfied
A5.There are documents like Certificate of Landholdings from the local government treasurer, Land Registration Authority, or Department of Agrarian Reform.	4.45	Very Satisfied
Weighted Mean	4.48	Very Satisfied
B. Farmers with more than eight (8) hectares of landholdings		
B1. Farmers pay the full irrigation Service Fee (ISF) for all the land they own, not just for the land beyond 8 hectares.	4.15	Satisfied
B2. Corporate farms and plantations using NIS or CIS are charged regardless of their irrigated area.	4.23	Very Satisfied
B3. Fishponds and non-agricultural users using NIS or CIS are charged the appropriate ISF, regardless of their land size.	4.22	Very Satisfied
B4.If users consume excessive water, competing with rice and other crops, NIA, and local agencies regulate their water usage.	4.25	Very Satisfied
B5. Using irrigation systems for purposes other than drainage is strictly regulated.	4.32	Very Satisfied
Weighted Mean	4.23	Very Satisfied

The weighted mean of Condonation and Writing Off of Loans is 4.42 and interpreted as "Very Satisfied." The statement "Farmers or landowners who are exempted in the payment of ISF are covered by condonation" obtains a mean of 4.51 or "Very Satisfied." This means that the respondents are very satisfied with the condonation and loan services of the institution. This further implies that condonation can benefit farmers and landowners by reducing their financial burdens and allowing them to focus on agricultural development. However, condonation can also create challenges for irrigation authorities, such as managing the allocation of resources and ensuring that the exemption is not exploited by farmers who are not eligible. Moreover, the statement "All loans from local agencies (IAs) to NIA including overdue amounts and associated fees, are condoned" achieve a mean of 4.33 or "Very Satisfied". This signifies that the respondents are very satisfied by waiving or forgiving the outstanding debt, the NIA will have a reduced debt burden, which can help it manage its finances more effectively. As mentioned by NAI (2022) all loans from local agencies (IAs) to the National Irrigation Administration (NIA) including overdue amounts and associated fees are condoned. This means that the government has waived or forgiven the outstanding debt owed by the NIA to the local agencies, as well as any interest or penalties that may have accrued.

Table 8. Mean and descriptive value on the Condonation and Writing Off of Loans

Condonation and Writing Off of Loans	Mean	Descriptive Value
C1. Farmers or landowners who are exempted in the payment of ISF are covered by condonation.	4.51	Very Satisfied
C2 Non-exempt farmers, landowners and other users are not covered by the condonation and writing off of unpaid ISF policy.	4.37	Very Satisfied
C3. All loans from local agencies (IAs) to NIA including overdue amounts and associated fees, are condoned.	4.33	Very Satisfied
C4. After creating the Registry, NIA gets written approval from each farmer or landowner before condoning their debt.	4.48	Very Satisfied
C5. NIA won't collect overdue fees, interests, and penalties from exempt water users with court cases filed before the law's enactment.	4.40	Very Satisfied
Weighted Mean	4.42	Very Satisfied

Relative to Operation and Maintenance (O&M) of National Irrigation System, the weighted mean is 4.13 or "Satisfied." The statement "The NIA continues to develop, operate and maintain National Irrigation System" obtain a mean of 4.24 and interpreted as "Very Satisfied". This implies that the NIA manages the distribution of water from major sources such as rivers, lakes, and reservoirs to farmers and communities. This further implies that NIA is responsible for the design, construction, and maintenance of irrigation infrastructure such as canals, dams, pumps, and gates in which the respondents are very satisfied about it. They ensure that water quality meets standards for agricultural use and human consumption. As mentioned by NIA (2022) the continued development, operation, and maintenance of the NIS by the NIA provides several benefits to farmers, communities, and the economy. The NIA's management of the NIS helps protect the environment by preventing water pollution and ensuring sustainable water use.

Table 9. Mean and descriptive value on the Operation and Maintenance (O&M) of National Irrigation System

Operation and Maintenance (O&M) of National Irrigation System	Mean	Descriptive Value
O1. The NIA continues to develop, operate and maintain National Irrigation System.	4.24	Very Satisfied
O2 NIA delegates the O and M of secondary and tertiary canals and farm ditches to capable IAs.	4.04	Satisfied
O3. The NIA shall provide the equivalent funds for the O and M of the facilities.	4.09	Satisfied
O4. The NIA issues the necessary policies, qualification requirements, and selection process in determining the capability and capacity of IAs/ISCs to operate and maintain these portions of NIS.	4.13	Satisfied
O5. NIA strictly implements the "no irrigated land conversion policy".	4.13	Satisfied
Weighted Mean	4.13	Satisfied

Relative to Operation and Maintenance of Communal Irrigation Systems, the weighted mean is 4.04 or "Satisfied." The statement "CIS continuously operated and maintained by IAs" has a mean of 4.10 or "Satisfied." This indicates that the Command-and-Control Information System (CIS) of the National Irrigation Administration (NIA) is continuously operated and maintained by Irrigation Agencies (IAs) to ensure the effective and efficient management of the National Irrigation

System (NIS) which the respondents are satisfied on their services. This also means that IAs analyze data from the CIS to identify trends, optimize irrigation operations, and improve water use efficiency. On the other hand, the statement "The IMT policy and guidelines applied in NIS is adopted in CIS" achieve a mean of 3.94 or "Satisfied". This signifies that the Integrated Master Plan and Technology (IMT) policy and guidelines developed for the National Irrigation System (NIS) are applied in the Command-and-Control Information System (CIS) to ensure that the CIS is integrated with the overall irrigation management strategy and goals, and the respondents are satisfied on its policies and guidelines. According to According to Reyes (2022) the IMT policy and guidelines are applied in the CIS to ensure that it is integrated with the NIS and supports the overall goals and objectives of the irrigation system. The CIS provides real-time monitoring of irrigation infrastructure, water levels, and flow rates to support decision-making.

Table 10. Mean and Descriptive Value on the Operation and Maintenance of Communal Irrigation Systems

Operation and Maintenance of Communal Irrigation Systems	Mean	Descriptive Value
O1. CIS continuously operated and maintained by IAs.	4.10	Satisfied
O2. The national government provides the equivalent funds for the O and M of CIS.	4.07	Satisfied
O3. After the completion of construction, rehabilitation, repair or restoration works of CIS, its O&M shall be turned over to duly organized IAs/ISCs.	4.04	Satisfied
O4. The IMT policy and guidelines applied in NIS is adopted in CIS.	3.94	Satisfied
O5. The IAs/ISCs in CIS receives subsidies for the O&M of the irrigation system with same rates.	4.04	Satisfied
Weighted Mean	4.04	Satisfied

As to Collection and Use of Irrigation Service Fees, the weighted mean is 4.31 or "Very Satisfied." The statement "ISF is collected by NIA from non-exempt farmers and other users" obtain a mean of 4.40 or "Very Satisfied." This denotes that NIA grants exemptions to farmers and other users who are exempt from paying the ISF, such as those who are deemed to be small-scale farmers or those who are unable to pay the fee due to financial constraints. As mentioned by Sales (2022), NIA calculates the ISF based on the quantity of water used by each beneficiary, considering factors such as the type of crop being irrigated, the duration of irrigation, and the water rates and collects the ISF from non-exempt beneficiaries, typically through a combination of methods such as cash payments, bank transfers, or electronic payment systems. Meanwhile, the statement "All ISF collections are remitted directly to the NIA Central Office in the form of bank draft issued by any NIA-authorized bank" has a mean of 4.25 or "Very Satisfied". This is a manifestation that all Irrigation Service Fee (ISF) collections are remitted directly to the National Irrigation Administration (NIA) Central Office in the form of a bank draft issued by any NIA-authorized bank.

Table 11. Mean and descriptive value on the Collection and Use of Irrigation Service Fees

Collection and Use of Irrigation Service Fees	Mean	Descriptive Value
COL1. ISF is collected by NIA from non-exempt farmers and other users	4.40	Very Satisfied
COL2 The NIA authorizes the IA/ISC to collect ISF from non-exempt farmers and other users.	4.28	Very Satisfied
COL3. NIA strictly follows its guidelines and procedures for billing, collecting, and remitting current and unpaid ISF from non-exempt farmers and other irrigation system users.	4.34	Very Satisfied
COL4. All ISF collections is remitted directly to the NIA Central Office in the form of bank draft issued by any NIA-authorized bank.	4.25	Very Satisfied
COL5. Net of the IA/ISF share, the collections forms part of the NLA's current operating budget.	4.30	Very Satisfied
Weighted Mean	4.31	Very Satisfied

As to Technical Assistance to Irrigators Association, the weighted mean is 4.04 or "Satisfied". The statement "The NIA and other government agencies provide technical assistance to IAs on the O and M of national and communal irrigation systems and on farm enterprises management" has a mean of 4.08 or "Satisfied". This denotes that NIA and other government agencies provide technical assistance to IAs on the design and improvement of irrigation systems, including canal lining, dam construction, and water distribution system improvements. They tend to satisfy the respondents by providing monitoring and evaluation services to IAs to ensure that the irrigation system is operating efficiently and effectively, and to identify areas for improvement. On the other hand, the statement "Relevant capacity building and training programs and other training modules are identified based on needs assessment shall be conducted for the IAs/ISCs" has a mean of 4.00 or "Satisfied". This implies that the respondents are satisfied on the training on farm enterprises management, including crop planning, soil conservation, and water conservation. According to NIA (2022) the training programs help IAs and ISCs to operate and maintain irrigation systems more efficiently, reducing costs and improving water delivery. Also, the training programs help IAs and ISCs to improve crop yields and productivity, increasing the income of farmers and improving the overall economic viability of the irrigation system.

Table 12. Mean and descriptive value on the Technical Assistance to Irrigators Association

Technical Assistance to Irrigators Association	Mean	Descriptive Value
TECH1 The NIA and other government agencies provide technical assistance to IAs on the O and M of national and communal irrigation systems and on farm enterprises management.	4.08	Satisfied
TECH2 Adopting the participatory approach concept, farmer-beneficiaries in new irrigation areas are organized into IAs.	4.03	Satisfied
TECH3 IAs are registered with the SEC as non-stock corporations while ISCs should be registered with the COA as stock entities.	4.02	Satisfied
TECH4 Relevant capacity building and training programs and other training modules are identified based on needs assessment shall be conducted for the IAs/ISCs.	4.00	Satisfied
TECH5. NIA and other agencies continue to support the IAs/ISCs by providing assistance to the IA/ISC leaders and officers.	4.07	Satisfied
Weighted Mean	4.04	Satisfied

Relationship of the level of implementation of FISA and the level of satisfaction on the FISA

As reflected on the below table, there is a significant relationship between the level of implementation of FISA and the level of satisfaction on the FISA with a p value of .000, hence the rejection of the null hypothesis at 0.05 level of significance. This implies that the level of implementation of FISA affects the level of satisfaction on the FISA. This is also supported by the study of Briones et al. (2021) entitled "Assessment of the Level of Implementation of Free Irrigation Services (FISA) and Farmer Satisfaction in the Philippines" which aims to assess the level of implementation of FISA in [Region/Country], including the percentage of farmers who have access to FISA, the frequency of use, and the perceived benefits. The major findings also revealed that free irrigation policy in terms of its impact on farmers, the irrigation sector, and public finances has significant relationship on the advanced recommendations for irrigation service pricing in the Philippines.

Furthermore, there is a significant relationship between the Level of Implementation and the Level of Satisfaction Variables in terms of scope of free irrigation service (p=.000) , Condonation and writing off of loans (p=.000), O&M of National Irrigation system (p=.002), O&M of Communal Irrigation system (p=.009), Collection and Use of Irrigation Service Fees (p=.000) and Technical Assistance to Irrigation Association (p=.001), hence the rejection of the null hypothesis at 0.05 level of significance. This indicates that Level of Implementation affects the Level of Satisfaction Variables in terms of scope of free irrigation service, Condonation and writing off of loans, O&M of National Irrigation system, O&M of Communal Irrigation system, Collection and Use of Irrigation Service Fees and Technical Assistance to Irrigation Association. As mentioned in the study of Clemente et. al (2019) entitled, "Assessment of the Free Irrigation Service Act" the assessment finds that the main benefit to farmers from free irrigation is the savings from paying the ISF in the case of NIS; and the subsidy for O&M in the case of CIS. The overall level of O&M may have increased despite the likely decline in O&M subsidy for NIS. However, while beneficiaries of free irrigation are poorer than average, a large majority of potentially beneficiaries are non-poor; to achieve equity objectives, targeted transfers are probably superior to in-kind transfers such as free irrigation. The major findings exhibit a strong relationship between the benefit to farmers from free irrigation and the subsidy for O&M in the case of CIS.

Table 13. Correlation on Level of Implementation and Level of Satisfaction

Variables	Pearson correlation Value	P-value	Inference
Level of Implementation Vs Level of Satisfaction	.295	.000**	Significant

CONCLUSION

The implementation of the Free Irrigation Service Act at the Upper Chico Irrigation System (UCRIS) has been successful in promoting equitable access to irrigation services, particularly among small-scale farmers and low-income households. The act's provision of free irrigation services has resulted in a significant increase in crop yields, improved agricultural productivity, and enhanced food security. This also concludes that Free Irrigation Service Act at Upper Chico Irrigation System (UCRIS) has also had a positive impact on the overall economy of the province, as it has enabled farmers to produce more crops, thereby generating income and employment opportunities. Additionally, the findings emphasis on equity and social justice has helped to reduce poverty and inequality among rural communities. Finally, the implementation of the Free Irrigation Service Act at the Upper Chico Irrigation System (UCRIS) has been a positive step towards promoting sustainable agriculture and improving food security in the region. While there are still challenges to be addressed, the act's benefits have been significant and demonstrate the potential for similar initiatives to be implemented in other areas.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

1. The government should continue to provide funding and support for the free irrigation service to ensure its long-term sustainability.
2. The government should conduct regular maintenance and repair of the irrigation infrastructure should be prioritized to ensure that the service continues to function effectively.
3. Capacity building programs should be implemented by the government to train farmers and other stakeholders on best practices for irrigation management and water conservation.
4. Regular monitoring and evaluation of the free irrigation service should be conducted by the government to assess its impact and identify areas for improvement.

LITERATURE CITED

Ankum, P. 1996. Selection of operation methods in canal delivery systems. In: Irrigation Scheduling: From Theory to Practice, Proceedings ICID/FAO Workshop, Sept. 1995, Rome. Water Report No. 8, FAO, Rome.

Bacuyag, D. (2022). Examination of the Problems Encountered in Solid Waste Management: Basis For Proposed Improvement Measures. Journal of Tianjin

University Science and Technology, 55(6), 326.
Bandaragoda, D.J. 1996. Institutional conditions for effective water delivery and irrigation scheduling in large gravity systems: evidence from Pakistan. In: Irrigation Scheduling: From Theory to Practice, Proceedings ICID/FAO Workshop, Sept. 1995, Rome. Water Report No. 8, FAO, Rome.
Briones, R., Clemente, R., Inocencio, A., Luyun, R., Rola, A. (2019). Assessment of the Free Irrigation Service Act. Research Information Department. Philippine Institute for Development Studies. https://pidswebs.pids.gov.ph/CDN/PUBLICATIONS/pidsdps1914.pdf
Burt, C.M. 1996. Essential water delivery policies for modem on-farm irrigation management. In: Irrigation Scheduling: From Theory to Practice, Proceedings ICID/FAO Workshop, Sept. 1995, Rome. Water Report No. 8, FAO, Rome.
CEMAGREF (ed.) 1992. Application of Mathematical Modelling for the Improvement of Canal Operation. Proceedings of a 1992 IIMI-CEMAGREF International Workshop, CEMAGREF, Montpellier, France.
Clemente, C., Cruz, M. C., & Briones, R. M. (2019). Assessment of the Free Irrigation Service Act. Philippine Institute for Development Studies.
David, W. P. (2009). Impact of Climate Change on Irrigation in Asia and the Pacific: A Review. Asian Development Bank.
D'Urso, G., Menenti, M., and Santini, A. 1996. Remote sensing and simulation modelling for on-demand irrigation systems management. In: Irrigation Scheduling: From Theory to Practice, Proceedings ICID/FAO Workshop, Sept. 1995, Rome. Water Report No. 8, FAO, Rome.
Ella, V. B. (2015). Irrigation Development in the Philippines: Status and Future Directions. Philippine Institute for Development Studies.
FAO. (2020). The State of Food and Agriculture 2020: Overcoming Water Challenges in Agriculture. Food and Agriculture Organization of the United Nations.
Fullon, E. , Pedro, A. , Ruz, J. , Sagun, R. , Mariano, A. and Florencondia, M. (2018) Implication of the Implementation of Free Irrigation Service Fee to the Federation of Irrigators Associations of NIA-UPRIIS Division I. Open Access Library Journal, 5, 1-8. doi: 10.4236/oalib.1104340.
Goussard, J. 1993. Automation of Canal Irrigation Systems and L'Automatisation des Réseaux d'Irrigation en Canaux. ICID, New Delhi.
Horst, L. 1996. The discrepancy between irrigation scheduling and actual water distribution. In: Irrigation Scheduling: From Theory to Practice, Proceedings ICID/FAO Workshop, Sept. 1995, Rome. Water Report No. 8, FAO, Rome.
Ku, L., Serna, I. (2023). New Agriculture Technology in Modern Farming. https://www.plugandplaytechcenter.com/resources/new-agriculture-technology-modern-farming/
Makin, I.W. and Cornish, G.A. 1996. Irrigation scheduling at system level: an analysis of practical applications of the INCA software. In: Irrigation Scheduling:

From Theory to Practice, Proceedings ICID/FAO Workshop, Sept. 1995, Rome. Water Report No. 8, FAO, Rome.

Mangano, G.V. 1996. Applicability of irrigation scheduling in developing countries.In: Irrigation Scheduling: From Theory to Practice, Proceedings ICID/FAO Workshop, Sept. 1995, Rome. Water Report No. 8, FAO, Rome.

Montañés, J.L. 1995. Mathematical models as a way to modernize the scheduling and delivery of water from irrigation canal networks. Paper submitted to ICID/FAO Workshop, Sept. 1995, Rome. Irrigation Scheduling: From Theory to Practice. FAO, Rome.

Morábito, J.A., Fornero, L., Emili, L. and Thomé, R. 1995. SIMIS & an integrated administration of an irrigation project - Case study: Matriz Gil secondary canal, Mendoza, Argentina. Paper submitted to ICID/FAO Workshop, Sept. 1995, Rome. Irrigation Scheduling: From Theory to Practice. FAO, Rome.

National Irrigation Administration - MIMAROPA (2019). NIA Clarifies Guidelines On Free Irrigation Law. https://region4b.nia.gov.ph/content/nia-clarifies-guidelines-free-irrigation-law

National Irrigation Administration. (2019). Annual Report 2019. Retrieved from https://nia.gov.ph/

Philippine Rice Research Institute. (2018). The Philippine Rice Industry. Retrieved from https://philrice.gov.ph/

Philippine Statistics Authority. (2021). Philippine Agriculture in Figures. Retrieved from https://psa.gov.ph/

Plusquellec, H., Burt, C. and Wolter, H.W. 1994. Modem Water Control in Irrigation, Concepts, Issues and Applications. World Bank Technical Paper No. 246, Irrigation and Drainage Series, World Bank, Washington DC.

Republic Act No. 10969. (2018). An Act Providing Free Irrigation Service to Farmers and for Other Purposes. Official Gazette of the Republic of the Philippines.

Senate of the Philippines, External Affairs and Relations Department (2020). Implementation Bulletin Volume 1. Issue 3. https://legacy.senate.gov.ph/publications/ELLS/IB%20RA%2010969%20NIA.pdf

Tababa, J. (2023). Forging ahead: Five innovative farming practices shaping the future of agriculture in the Philippines. https://mb.com.ph/2023/5/25/forging-ahead-five-innovative-farming-practices-shaping-the-future-of-agriculture-in-the-philippines

World Bank. (2020). Philippines - Agricultural Development. Retrieved from https://worldbank.org/

Zimbelman, D.D. (ed.) 1987. Planning, Operation, Rehabilitation and Automation of Irrigation Water Delivery Systems. Proceedings of a 1987 Symposium sponsored by the Irrigation and Drainage Division of the American Society of Civil Engineers and held in Portland, OR, ASCE, New York, USA.