IMPACT OF NATIONAL IRRIGATION ADMINISTRATION'S (NIA) IRRIGATION PROJECTS ON AGRICULTURAL PRODUCTIVITY, SOCIO-ECONOMIC BENEFITS AND MAINTENANCE CHALLENGES IN CATANDUANES

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ABSTRACT

This study assessed the impact of National Irrigation Administration (NIA) irrigation projects on agricultural productivity, socio-economic benefits, and maintenance challenges in Catanduanes. Utilizing a descriptive-correlational research design, the study involved selected stakeholders from NIA, local government units, and farming communities. It sought to determine the perceived effects of NIA's irrigation initiatives on crop yield, quality, and farming practices, as well as the socio-economic gains experienced by farmers, the maintenance challenges encountered, and the relationships among these variables. Data were collected using structured questionnaires and analyzed using weighted means and Pearson correlation coefficients. Findings revealed that NIA's irrigation projects had a strong positive impact on agricultural productivity, with an overall weighted mean of 3.53. Specifically, 115 respondents strongly agreed that crop yields increased (WM = 3.55), crop resilience improved (WM = 3.61), and crop diversity expanded (WM = 3.52). Farmers also reported adopting more sustainable practices, including fertilization (WM = 3.56), crop rotation (WM = 3.54), and drip irrigation (WM = 3.53). Socio-economic benefits were substantial, with farmers indicating higher income and profit (WM = 3.57), improved market access (WM = 3.44), enhanced food security (WM = 3.55), and community infrastructure development (WM = 3.53–3.62). Maintenance challenges were rated as highly significant (overall WM = 3.43), particularly in canal cleaning, inconsistent irrigation schedules, low participation in meetings, poor coordination, delayed reporting of issues, water-sharing conflicts, and irregular fee payments. Correlational analyses revealed a significant positive relationship between the perceived impact on agricultural productivity and socio-economic benefits ($r = 0.523 >$ critical value 0.444, $p < 0.05$). However, there was no significant relationship between agricultural productivity impact and maintenance challenges ($r = 0.456 <$ critical value 0.632, $p > 0.05$), nor between socio-economic benefits and maintenance challenges ($r = 0.333 <$ critical value 0.632, $p > 0.05$). Based on these results, the study concluded that NIA irrigation projects strongly enhance agricultural productivity and socio-economic well-being, while farmers face substantial maintenance challenges. The positive correlation between productivity impact and socio-economic benefits underscores the value of irrigation investments for rural communities. Strategic interventions are recommended to address manpower limitations, improve coordination, and strengthen community engagement in irrigation maintenance. Regular orientations and monitoring are essential to sustain both project performance and farmer participation.

Keywords: Irrigation projects, agricultural productivity, socio-economic benefits, maintenance challenges, strategic intervention

INTRODUCTION

Irrigation systems are vital for agricultural productivity, especially in regions where rainfall is unpredictable or insufficient. This study focuses on the impact, socio-economic benefits, and challenges of the National Irrigation Administration (NIA) irrigation projects in Catanduanes. Its goal is to evaluate how these projects improve crop yields, enhance food security, and support rural livelihoods, while identifying operational, environmental, and socio-economic challenges that affect their effectiveness. By examining these variables, the study aims to provide practical recommendations to improve irrigation efficiency, sustainability, and the overall welfare of local farming communities (Geda, 2023; Guno & Agaton, 2022; Ndoro & Matiwane, 2025).

The legal framework guiding irrigation development in the Philippines includes the NIA Act of 1963 (Republic Act No. 3601), which mandates the development, management, and maintenance of irrigation systems nationwide (National Irrigation Administration, 1963). The Philippine Constitution (1987), under Article XII, Section 1, emphasizes equitable access to land and resources, including water for irrigation purposes. Additionally, the Irrigation Modernization Act (RA No. 10969) and related policies focus on enhancing the efficiency and sustainability of irrigation systems (Republic of the Philippines, 2018). These laws and policies create the necessary institutional and regulatory environment for NIA projects, ensuring that irrigation infrastructure is developed and managed to promote agricultural productivity and socio-economic development.

Despite the recognized benefits of irrigation, gaps remain in understanding the localized impact of NIA projects in provinces like Catanduanes. Existing studies often focus on urban centers or large-scale irrigation projects, leaving rural and geographically isolated areas underexplored. Challenges such as limited funding, technical expertise, natural disasters, climate change, and inefficient water distribution hinder optimal irrigation system performance. This study addresses these gaps by providing a detailed analysis of the socio-economic outcomes, operational hurdles, and environmental concerns associated with irrigation projects in Catanduanes, emphasizing the need for context-specific evaluation.

The study is significant as it contributes to a deeper understanding of how irrigation systems influence agricultural productivity, food security, and rural livelihoods in resource-constrained areas. Its findings can guide policymakers, NIA officials, and local stakeholders in improving project design, maintenance, and sustainability. By identifying key challenges and benefits, the research provides actionable recommendations to enhance irrigation efficiency, adapt infrastructure to local conditions, and maximize the socio-economic impact for rural farming communities. Ultimately, this study supports informed decision-making to strengthen agricultural development and rural resilience in Catanduanes.

LITERATURE REVIEW

Irrigation plays a critical role in enhancing agricultural productivity and ensuring food security, particularly in regions where rainfall is unpredictable or insufficient. Studies have consistently highlighted that well-managed irrigation systems increase crop yields, stabilize production, and provide socio-economic benefits to farming communities (Separa & Salapa, 2025; Delos Reyes, 2025). In the Philippines, the National Irrigation Administration (NIA) has been instrumental in implementing irrigation projects aimed at supporting smallholder farmers, particularly in lowland areas where water access is limited (Pastolero & Besa, 2025).

These systems allow farmers to cultivate multiple cropping cycles and improve their livelihoods through increased agricultural output. The empowerment and active participation of farmer beneficiaries are crucial components in the success of NIA-assisted irrigation projects. Separa and Salapa (2025) emphasize that engaging farmers in decision-making, maintenance, and management of irrigation systems strengthens their sense of ownership, encourages proper water use, and improves overall system efficiency. Participatory approaches also foster knowledge sharing among community members, which enhances technical skills and resource management, thereby promoting sustainable agricultural practices.

Technological integration in irrigation management has become a growing focus to ensure efficiency and sustainability. Delos Reyes (2025) highlights that modernizing irrigation systems through automation, remote sensing, and mobile-based monitoring platforms improves water allocation, reduces wastage, and enables timely interventions in case of system failures. Similarly, Perin, Feliscuzo, Aliac, and Catayas (2025) developed a mobile and web-based platform for farm water monitoring, demonstrating that technology can enhance transparency and data-driven decision-making in irrigation management.

Globally, trends in irrigation show both challenges and innovations that can inform local practices. In India, Narayanamoorthy (2022) and Kiran, Punia, Mondal, and Pramanik (2025) observed that spatio-temporal analyses of irrigation systems reveal regional disparities in water availability and infrastructure effectiveness. Their studies suggest that continuous monitoring, maintenance, and adoption of water-saving technologies are necessary to optimize irrigation outcomes. Comparable observations are reported in Ethiopia, where Dejene, Samago, and Dejene (2022) noted that smallholder farmers benefit significantly from targeted irrigation interventions that align with sustainable development goals.

The relationship between irrigation management and productivity has also been explored in the Philippine context. Pastolero and Besa (2025) found that NIA-managed water systems in Lambayong, Sultan Kudarat, improved rice yield and farming efficiency by ensuring reliable water supply during critical growing periods. Likewise, Mukundi and Mwangi (2025) emphasized that remote sensing tools for crop water productivity assessment can guide optimal irrigation scheduling, reducing both water and input losses while maximizing yields. These findings underline the importance of combining proper infrastructure management with scientific tools to enhance agricultural productivity.

Finally, the evolution of irrigation systems worldwide highlights the necessity of adapting policies and practices to local conditions. Shevchenko, Isaeva, and Dedova (2023) observed that modern land reclamation and water management initiatives in Russia benefit from institutional frameworks and technological integration, a lesson applicable to Philippine NIA projects. Collectively, these studies reinforce that successful irrigation projects require a combination of participatory governance, technological adoption, continuous monitoring, and context-specific policy frameworks to ensure long-term socio-economic benefits for farming communities in regions like Catanduanes.

METHODOLOGY

This study used a descriptive-correlational research design to assess the impact, socio-economic benefits, and maintenance challenges of NIA irrigation projects in Catanduanes. Surveys and interviews were conducted with NIA personnel, local government units, and

farmer beneficiaries to gather data on crop yields, quality, diversity, farming practices, income, market access, and community development. The descriptive component captured the perceived effects of irrigation projects, while the correlational aspect examined relationships between productivity, socio-economic benefits, and maintenance challenges using statistical analyses. This design provided a clear understanding of how NIA irrigation projects influence agricultural productivity, rural livelihoods, and operational challenges, guiding recommendations for sustainable irrigation management.

Respondents of the Study

The study population consisted of 437 active NIA members involved in irrigation projects across the 11 municipalities of Catanduanes. Using Slovin's formula at a 5% margin of error, a sample of 209 respondents was selected. Stratified random sampling ensured representation from different municipalities and farmer profiles, capturing diverse perspectives on the implementation and effectiveness of NIA irrigation systems.

Instrumentation

A self-made questionnaire was used to collect data on the impact of NIA's irrigation projects on agricultural productivity, socio-economic benefits, and maintenance challenges. It was divided into three sections: agricultural productivity, socio-economic benefits, and challenges in implementation and maintenance.

The instrument was validated by a panel of four experts in agriculture, irrigation, and socio-economic development for clarity, relevance, and alignment with the study objectives. A pre-test with a small group of farmers and NIA personnel ensured clarity and consistency, and the final questionnaire demonstrated high reliability with a Pearson r coefficient of 0.890.

RESULTS

Table 1
Composite Table on Impact of NIA's Irrigation Projects on Agricultural Productivity

Variable	Weighted mean	Verbal Interpretation	Rank
Increase In Crop Yield	3.53	Strongly Positive Impact	3
Improvement In Crop Quality And Diversity	3.53	Strongly Positive Impact	3
Reduction In Crop Failures	3.53	Strongly Positive Impact	3
Changes In Farming Practices	3.54	Strongly Positive Impact	1
Overall weighted mean	3.53	Strongly Positive Impact	

The composite table shows that NIA's irrigation projects have a strongly positive impact on agricultural productivity. Among the specific variables, Changes in Farming Practices received the highest rating (WM = 3.54), followed closely by Increase in Crop Yield, Improvement in Crop Quality and Diversity, and Reduction in Crop Failures, all with a weighted mean of 3.53. The overall weighted mean of 3.53 indicates that the irrigation projects consistently contribute to enhancing agricultural productivity in the surveyed areas.

These findings align with studies highlighting that irrigation increases crop yields, stabilizes production, and benefits farming communities (Separa & Salapa, 2025; Delos Reyes, 2025). In the Philippines, NIA supports smallholder farmers by improving water access, enabling multiple cropping cycles, and enhancing livelihoods (Pastolero & Besa, 2025).

Table 2
Composite Table on Socio-Economic Benefits of Local Communities Gained from NIA's Irrigation Systems

Variable	Weighted mean	Verbal Interpretation	Rank
Increase In Income And Profit	3.57	Highly Beneficial	1
Improvement In Food Security	3.55	Highly Beneficial	2
Enhanced Market Access	3.44	Highly Beneficial	4
Development Of Community	3.53	Highly Beneficial	3
Overall weighted mean	3.52	Highly Beneficial	

The composite table shows that NIA's irrigation systems provide highly beneficial socio-economic outcomes for local communities. Increase in Income and Profit received the highest rating (WM = 3.57), followed by Improvement in Food Security (WM = 3.55), Development of Community (WM = 3.53), and Enhanced Market Access (WM = 3.44). The overall weighted mean of 3.52 indicates that the irrigation projects consistently deliver positive socio-economic impacts.

These results support studies emphasizing the importance of farmer participation in irrigation projects. Engaging beneficiaries in decision-making, maintenance, and management fosters ownership, improves system efficiency, and enhances technical skills and resource management, promoting sustainable agricultural practices (Separa & Salapa, 2025).

Table 3
Challenges Farmers encounter in the maintenance of NIA's Irrigation projects in Catanduanes in terms of Challenges Farmers Encounter

Indicators	Frequency (n=209)				Weighted Mean	Verbal Interpretation	Rank
	4	3	2	1			
. Difficulty in joining canal cleaning activities due to lack of time or manpower.	114	90	4	0	3.51	Highly Challenging	1
. Low attendance in irrigation meetings.	110	90	9	0	3.48	Highly Challenging	3
. Inconsistent following of irrigation schedules.	110	91	8	0	3.50	Highly Challenging	2
. Conflicts in sharing water with other farmers.	100	98	11	0	3.43	Highly Challenging	6
. Delay or failure in reporting irrigation problems.	109	88	12	0	3.46	Highly Challenging	4

. Irregular or non-payment of irrigation fees.	96	95	18	0	3.37	Highly Challenging	9
. Improper use or wastage of irrigation water.	96	99	13	1	3.39	Highly Challenging	8
. Lack of participation in scheduled maintenance work.	104	92	13	0	3.44	Highly Challenging	5
. Poor cooperation among farmers.	100	96	13	0	3.42	Highly Challenging	7
. Neglect in taking care of tools and irrigation facilities.	95	91	18	5	3.32	Highly Challenging	10
Average weighted mean					3.43	Highly Challenging	

The composite table shows that farmers encounter highly challenging issues in maintaining NIA's irrigation projects, with Difficulty in Joining Canal Cleaning Activities receiving the highest rating (WM = 3.51), followed closely by Inconsistent Following of Irrigation Schedules (WM = 3.50) and Low Attendance in Irrigation Meetings (WM = 3.48). Other notable challenges include Delay in Reporting Irrigation Problems, Lack of Participation in Maintenance Work, and Conflicts in Sharing Water, with an overall weighted mean of 3.43 indicating that these challenges are significant and widespread.

These findings are consistent with studies emphasizing the role of technology in improving irrigation efficiency and sustainability. Modernizing systems with automation, remote sensing, and mobile-based monitoring improves water allocation, reduces wastage, and supports timely interventions (Delos Reyes, 2025). Similarly, digital platforms for farm water monitoring enhance transparency and enable data-driven decision-making, helping farmers address common management challenges (Perin, Feliscuzo, Aliac, & Catayas, 2025).

Table 4
Relationship between the Perceived Impact of NIA's Irrigation Projects on Agricultural Productivity and Socio-Economic Benefits Experienced by Farmers

Variables	Statistical Test	Computed Value	Critical-Value @ .05	Decision	Interpretation
Impact of NIA's Irrigation Projects on Agricultural Productivity VS Socio-Economic Benefits of Local Communities Gained from NIA's Irrigation Systems.	Person r	.523	.444	**Reject Ho**	**Significant Relationship**

The result shows a significant positive relationship between the perceived impact of NIA's irrigation projects on agricultural productivity and the socio-economic benefits experienced by local communities, with a computed r-value of 0.523, exceeding the critical value of 0.444 at the 0.05 significance level. This indicates that improvements in crop yield, quality, and farming practices are strongly associated with higher income, better food security, and overall community development. These findings are supported by global studies highlighting the importance of effective irrigation management. Research in India and Ethiopia demonstrates

that continuous monitoring, maintenance, and adoption of water-saving technologies enhance agricultural productivity and socio-economic outcomes for smallholder farmers (Narayanamoorthy, 2022; Kiran, Punia, Mondal, & Pramanik, 2025; Dejene, Samago, & Dejene, 2022). This underscores the role of well-managed irrigation systems in promoting both agricultural efficiency and community well-being.

Table 5
Relationship between the Impact of NIA's Irrigation Projects on Agricultural Productivity and Challenges Farmers Encountered in the Maintenance of NIA's Irrigation Projects

Variables	Statistical Test	Computed Value	Critical-Value @ .05	Decision	Interpretation
Impact of NIA's Irrigation Projects on Agricultural Productivity VSChallenges do Farmers Encounter in the Maintenance of NIA's Irrigation Projects.	Person r	.456	.632	**Accept Ho**	**No Significant Relationship**

The result shows no significant relationship between the impact of NIA's irrigation projects on agricultural productivity and the challenges farmers encounter in maintenance, as the computed r-value of 0.456 is below the critical value of 0.632 at the 0.05 significance level. This suggests that despite maintenance challenges, farmers still experience improvements in crop yield, quality, and farming practices.

These findings align with studies in the Philippine context, where NIA-managed irrigation systems improved rice yields and farming efficiency through reliable water supply (Pastolero & Besa, 2025). Similarly, the use of remote sensing tools for crop water productivity can optimize irrigation scheduling, minimizing losses and maximizing outputs (Mukundi & Mwangi, 2025). This highlights that effective agricultural productivity can be maintained even when farmers face operational challenges.

Table 6
Relationship between the Socio-Economic Benefits Experienced by Farmers and Challenges do Farmers Encounter in the Maintenance of NIA's Irrigation Projects on Agricultural Productivity

Variables	Statistical Test	Computed Value	Critical-Value @ .05	Decision	Interpretation
Socio-Economic Benefits of Local Communities Gained from NIA's Irrigation Systems VS Challenges do Farmers encounter in the maintenance of NIA's Irrigation Projects.	Person r	.333	.632	**Accept Ho**	**No Significant Relationship**

The result shows no significant relationship between the socio-economic benefits experienced by farmers and the challenges they encounter in maintaining NIA's irrigation projects, as the computed r-value of 0.333 is below the critical value of 0.632 at the 0.05 significance level. This indicates that even when farmers face maintenance challenges, they still gain notable

socio-economic benefits such as increased income, improved food security, and community development.These findings are consistent with global observations highlighting that successful irrigation projects depend on participatory governance, technological adoption, continuous monitoring, and context-specific policy frameworks (Shevchenko, Isaeva, & Dedova, 2023). Such approaches help ensure that irrigation systems provide sustainable socio-economic benefits despite operational challenges.

STRATEGIC INTERVENTION PLAN

Challenge	**Strategic Objectives**	**Interventions / Activities**	**Respon-sible Units**	**Time-frame**	**Resources Needed**	**Expected Outcomes**
Difficulty in joining canal cleaning due to lack of time/manpo wer (Rank 1)	Increase farmer participation in cleaning activities	- Community scheduling - Mobilize youth or LGU support - Incentive/recognit ion programs	NIA, IA, LGU	Quarterly	Manpower, cleaning tools, incentive funds, communicat ion tools	Higher participation rate in communal cleaning; better canal maintenance
Inconsistent following of irrigation schedules (Rank 2)	Ensure efficient and equitable water distribution	- Farmer reorientation - Cluster water managers - Install schedule signage	NIA, IA	Monthly	Training materials, signage, coordinator allowance	Improved water access, reduced schedule conflicts
Challenge	**Strategic Objectives**	**Interventions / Activities**	**Respon-sible Units**	**Time-frame**	**Resources Needed**	**Expected Outcomes**
Low attendance in irrigation meetings (Rank 3)	Improve attendance and information access	- Schedule during non-peak hours - Provide summaries - Use SMS/online updates	NIA, IA	Bi-monthly	Meeting space, print materials, mobile load/credits	Increased farmer awareness and participation
Delay/failure in reporting irrigation problems (Rank 4)	Strengthen reporting and feedback mechanisms	- Reporting hotline or SMS system - Barangay liaison assignment - Feedback drop boxes	NIA, Barangay	Continuo us	Phones, hotline system, feedback boxes	Faster reporting and response to irrigation issues
Lack of participation in scheduled maintenance work Rank 5)	Promote shared responsibility in system upkeep	- Community orientation - "Work-for-Water" days - Record system for maintenance	NIA, IA, LGU	Quarterly	Orientation kits, record books, cleaning tools	More consistent maintenance work
Conflicts in sharing water (Rank 6)	Promote equitable use through conflict resolution	- Water-sharing agreements - Water rotation enforcement - Conflict resolution training	NIA, IA, Barangay Council	Semi-annually	Facilitator fees, agreement templates	Reduced disputes over water usage
Poor cooperation	Strengthen unity and	- Team-building activities	NIA, IA, NGOs	Semi-annually	Venue, facilitator,	Stronger community

among farmers (Rank 7)	shared ownership	- Cooperative-based incentives - Peer monitoring			incentives	collaboration
Improper use/wastage of irrigation water (Rank 8)	Promote responsible water management	- Efficient water use training - Visual water-saving reminders - Water audits	NIA, DA, IA	Bi-monthly	Posters, water usage tools, training facilitators	Reduced water wastage, improved efficiency
Irregular/non-payment of irrigation fees (Rank 9)	Improve fee collection and compliance	- Flexible payment options - Service-linked incentives - Full-payer recognition	NIA, IA	Quarterly	Finance tracking sheets, receipts, discount incentives	Higher collection rates; better system funding
Neglect in taking care of tools and facilities (Rank 10)	Encourage accountability in equipment care	- Assign tool custodians - Train on use/maintenance - Implement tool-sharing policies	IA, Barangay Council	Monthly	Tool logbooks, storage boxes, training materials	Extended tool lifespan; better shared-use discipline

The strategic intervention plan addresses the key challenges encountered by farmers in maintaining NIA's irrigation projects in Catanduanes. Each challenge is paired with specific objectives, interventions, responsible units, timeframes, and expected outcomes. For instance, to address difficulty in joining canal cleaning activities, the plan proposes community scheduling, mobilization of youth or LGU support, and incentive programs, aiming to increase participation and improve canal maintenance. Similarly, interventions for challenges such as inconsistent following of irrigation schedules, low attendance in meetings, and delays in reporting irrigation problems focus on reorientation, enhanced communication, and structured reporting mechanisms to ensure efficient water distribution and timely responses.

Other interventions target community cohesion and accountability, including conflict resolution for water sharing, team-building activities to improve cooperation, training on responsible water use, and measures to improve fee collection and equipment care. Collectively, these strategies are designed to foster shared responsibility, strengthen farmer engagement, and promote sustainable maintenance practices. By aligning strategic objectives with concrete activities and resources, the plan is expected to enhance the efficiency, reliability, and long-term sustainability of NIA-assisted irrigation systems in Catanduanes.

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