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Schedule Delay Analysis in the Implementation of Irrigation Projects in Oriental Mindoro

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Maria Victoria O. Malenab[1], ORCID No. 0009-0008-2402-0774
Lincoln A. Bautista[2], PhD, ORCID No. 0000-0001-9167-1448

[1]Master of Science in Construction Management, Polytechnic University of the Philippines, Sta. Mesa, Manila, Philippines
[2]Professor VI, Polytechnic University of the Philippines, Sta. Mesa, Manila, Philippines

Abstract

Irrigation projects are vital for enhancing agricultural productivity and ensuring food security. However, delays in their implementation can significantly impact farmers' livelihoods and economic stability. This study examines the causes of schedule delays in irrigation projects in Oriental Mindoro, Philippines, identifying key contributing factors such as adverse weather conditions, irrigation water delivery schedules, contractor performance, and right-of-way (ROW) issues. Using a descriptive-comparative design, data were gathered from 32 respondents through surveys. Statistical analysis, including independent t-test, was employed to determine variations in perceptions based on respondents' experience levels. Findings indicate that weather-related disruptions and scheduling conflicts are the most significant contributors to project delays, often resulting in work suspensions and variation orders. Poor contractor performance and ROW disputes were also found to be moderate factors. Based on the findings, this study proposes strategies to mitigate delays, including enhanced project planning, adaptive scheduling, and stakeholder engagement. The research underscores the need for improved project management approaches to ensure timely completion of irrigation infrastructure, ultimately benefiting farmers and enhancing agricultural resilience. Future studies should explore the integration of technology-driven solutions for better project oversight and efficiency.

Keywords: schedule delays, irrigation project, agricultural productivity, government sector, construction management, Oriental Mindoro

INTRODUCTION

Irrigation infrastructure plays a crucial role in improving agricultural productivity and ensuring economic stability in farming communities. Efficient water management through irrigation enables higher crop yields and supports year-round farming activities. However, project delays in the construction and implementation of irrigation systems can lead to significant setbacks for farmers, particularly in areas dependent on timely water distribution. The growing concern over schedule delays in irrigation projects necessitates an in-depth investigation into their causes and consequences.

The theoretical framework of this study is grounded in project management principles, particularly schedule risk management and critical path analysis. Empirical studies have highlighted various factors influencing project delays, including adverse weather conditions, inefficient contractor performance, regulatory hurdles, and funding constraints (Briones, 2021; National Irrigation Administration, 2013). Delays in irrigation projects are often attributed to external environmental factors and internal management inefficiencies. Additionally, procurement delays and land acquisition disputes contribute significantly to project stagnation (GPPB, n.d.).

Previous studies highlight multiple factors contributing to project delays. According to Briones (2021), irrigation project timelines often suffer from inefficiencies in project planning, contractor performance, and environmental constraints. The study also highlights the impact of financial and legal complications on project delays. GPPB (n.d.) identifies procurement-related issues as a significant cause of delays in government-funded projects. Mismanagement of resources and bureaucratic processes further exacerbate the problem, leading to cost overruns and extended timelines. In another study, the National Irrigation Administration (2013) emphasizes the importance of stakeholder coordination in preventing right-of-way disputes, which frequently lead to suspension of works and contract extensions. Empirical evidence suggests that construction project delays have broad economic repercussions, including cost overruns, resource misallocation, and prolonged inconvenience to stakeholders (Marcelo, 2019). Understanding the interrelation between these factors is essential to developing strategic interventions for minimizing delays and improving project efficiency.

The study focuses on the problem of schedule delays in irrigation projects in Oriental Mindoro, Philippines. Its objectives are to recognize the roots and outcomes of these delays, analyze the current status of irrigation projects, and provide an action plan to minimize future delays. The research intended to discover responses to the following questions:

1. How do the respondents assess the possible issues or problems encountered that cause delays in the implementation of the irrigation project in the province of Oriental Mindoro in terms of the following:
   1.1 Bad weather conditions;
   1.2 Water Delivery;
   1.3 Unsatisfactory performance of contractors or insufficient manpower and equipment of contractors;
   1.4 Unresolved right of way (ROW);
   1.5 Peace and order situation;
   1.6 The existence of standing crops; and,
   1.7 Poor project planning, supervision, and monitoring?
2. How do the respondents assess the possible outcome of the issues or problems encountered that cause delay in the implementation of the irrigation project in the province of Oriental Mindoro in terms of the following:
   2.1 Variation Order;
   2.2 Additional/Extra Work Costing;
   2.3 Liquidated Damages;
   2.4 Suspension of Works; and,
   2.5 Extension of Contract Time?
3. Is there a significant difference in respondents' assessments of issues or problems and the possible outcomes of delays in irrigation project implementation when grouped according to years of experience in irrigation projects?
4. Based on the results of the study, what action plan can be adopted to minimize the delay in the implementation of irrigation projects in the province of Oriental Mindoro?

LITERATURE REVIEW

Irrigation projects play a crucial role in enhancing agricultural productivity and ensuring the timely supply of water to farming communities. However, the successful implementation of such projects is often hindered by a range of challenges that delay progress and compromise their intended outcomes. A review of literature and studies reveals that delays in irrigation project execution have far-reaching consequences, not only in terms of project cost but also in the agricultural productivity of the regions affected. Ineffective project management stands out as one of the most significant factors contributing to these delays. The lack of proper supervision, monitoring, and control mechanisms exacerbates these issues, preventing projects from meeting their deadlines and intended objectives. This explores the key factors behind the delays in irrigation projects, the resulting consequences, and the urgent need for improved project management practices to mitigate these issues in future endeavors.

Scheduling Analysis. Project scheduling is a critical aspect of effective project management, as highlighted in the PMBOK Guide (2000). It ensures the coordinated use of resources—equipment, labor, and materials—across tasks and timelines to minimize delays and enhance productivity. Poor scheduling can result in idle workers, unutilized equipment, and material shortages, all of which can lead to project delays and increased costs. This is particularly detrimental in construction and infrastructure projects, where timing is crucial to align with operational demands and seasonal constraints. Among the scheduling techniques, the Critical Path Method (CPM) is the most widely used. CPM helps identify the shortest possible time to complete a project by establishing the earliest start and finish times for each activity. It is considered highly practical and efficient, especially with the use of computerized project management tools that can handle large-scale projects involving thousands of tasks. Alongside CPM, the Program Evaluation and Review Technique (PERT) is another network-based scheduling tool that has been employed across various project phases, from feasibility studies to project completion.

Despite their advantages, traditional scheduling methods like CPM and PERT have limitations, especially regarding computational efficiency. As a result, researchers have explored more advanced approaches, integrating improved mathematical models for enhanced time and resource management. Areas, such as resource allocation, cost efficiency, and innovative project management methodologies, are constantly evolving to improve scheduling practices.

In irrigation projects, scheduling goes beyond typical resource coordination. It must consider environmental and agricultural factors. As per the National Irrigation Administration (NIA) Supplemental Design Manual (2013), the core purpose of irrigation is to regulate water supply from rivers via storage reservoirs or diversion dams, ensuring even distribution across farmland. The system must meet crop water needs at various growth stages, which makes proximity to rivers and the layout of farmland essential in design and scheduling.

In Oriental Mindoro, Philippines, climate plays a major role in project scheduling. According to the MIMAROPA Regional Development Plan (RDP) 2011–2020, the area experiences two main climate types: Type I, which has distinct wet and dry seasons, and Type III, which features more balanced rainfall throughout the year. These conditions necessitate careful timing, particularly for repair and rehabilitation work, to avoid weather-related disruptions. Additionally, the province is highly flood-prone, making it essential to plan construction during dry periods.

Another important scheduling consideration is the irrigation water delivery schedule. When rehabilitating irrigation systems, such as concreting earth canals, water delivery must be halted. This temporary cut-off should align with the crop maintenance stage, a period when irrigation demand is lowest (typically 9 to 10 weeks depending on crop variety). To minimize disruption, construction must be fast-tracked during this window to ensure water delivery resumes by the next cropping season.

Finally, Oriental Mindoro's geographic isolation affects logistics and transportation of construction materials like cement, steel bars, and plywood. The region's reliance on inter-island transport systems creates challenges in timely material delivery, further complicating scheduling efforts.

In conclusion, scheduling irrigation projects in Oriental Mindoro involves a unique set of challenges, ranging from climate variability and agricultural calendars to geographic isolation and logistical hurdles, demanding a tailored, multi-faceted approach to ensure project success.

Causes of Schedule Delays in Construction. Delays in construction projects, particularly irrigation projects, are a pervasive issue with far-reaching implications on cost, time, and quality. According to B.P. Rao et al. (2016), delays refer to the late accomplishment of tasks compared to the planned or contracted schedule. These delays can only be minimized if their root causes are properly understood. Similarly, Songül (2010) emphasizes that inadequate preparatory work, such as incomplete construction drawings, unorganized sites, or the absence of a clear construction schedule, can disrupt the construction process. These issues increase project costs, extend duration, and degrade construction quality.

Stumpf (2000) provides a technical perspective, describing a delay as an event that causes a task to exceed its expected completion time. While not all delays impact the overall project timeline, those that occur on the critical path, the sequence of tasks that directly affect the project's finish date, will lead to schedule extensions. Therefore, identifying the critical path is essential in managing and assessing project delays.

Several scholars have classified the common causes of construction delays. Viles et al. (2020) divide them into three primary categories: execution-related problems (e.g., unforeseen site conditions), administrative issues (notably poor cash flow management), and labor conflicts. Their study further identifies seven key sub-groups: changes during construction, poor management, construction errors, economic/financial issues, conflict or relationship problems, and lack of experience. Financial constraints, in particular, are consistently recognized as a leading factor. Alaghbari et al. (2007), in a study in Malaysia, found financial issues to be the most significant delay contributor, followed by coordination problems.

Kermanshachi and Rouhanizadeh (2019) note that while contractors aim to create accurate schedules early in a project, unforeseen changes, often in the form of change orders, are inevitable. Their sensitivity analysis reveals that project duration is the most influential variable in schedule performance. However, the impact of this variable only becomes evident when deadlines are significantly shortened.

In terms of consequences, Gbahabo and Ajuwon (2017) and Alnuaimi and Moshin (2013) assert that delays can be financially disastrous, especially for public projects like irrigation schemes. Public agencies face even greater pressure, as they must ensure transparency and responsible use of taxpayer funds. Dula (2021) adds that when delays compromise project quality, they ultimately fail to meet the expectations and needs of the public.

Specifically, the Commission on Audit (COA) has highlighted key factors behind delays in the National Irrigation Administration's (NIA) projects. These include weather-related disruptions, flooding, water delivery problems, poor contractor performance, unresolved right-of-way (ROW) disputes, security issues, and the presence of standing crops. Furthermore, weak planning, monitoring, and supervision aggravate these delays. As reported by Marcelo (2019), under the Revised Implementing Rules and Regulations (RIRR) of Republic Act 9184, contractors who miss project deadlines are subject to liquidated damages, amounting to at least one-tenth of one percent of the unfinished work's cost per day of delay.

In summary, a wide range of technical, financial, administrative, and environmental factors contribute to delays in construction projects. Understanding these causes is essential to mitigating their impact and improving the success of irrigation project implementation.

Delays Due to Bad Weather Conditions. Adverse weather is a major global issue in construction, affecting about 45% of projects and costing billions annually (Schuldt et al., 2021). Climate change is expected to intensify these delays through more frequent and severe weather events. Thorpe and Karan (2008) explain that such delays are often unpredictable and beyond a contractor's control, making them difficult to anticipate during the bidding phase. Even when weather risks are acknowledged, accurately estimating their impact on project timelines remains a challenge. Thus, construction managers require robust tools to update schedules and evaluate delay effects effectively.

Contractor Performance Issues: Insufficient Manpower and Equipment. Poor contractor performance, especially due to limited manpower, inadequate equipment, and financial constraints, frequently undermines construction quality and timeliness (Ashokkumar, 2014). Financial instability can delay operations, while shortages of skilled labor, materials, and machinery further affect execution and quality. Tight deadlines exacerbate these issues, leading to inefficiencies. To ensure quality implementation, government agencies are required to evaluate contractor performance using the Constructors Performance Evaluation System (CPES), as mandated by the Revised IRR of RA 9184. This evaluation influences contractor eligibility, monitoring, policy decisions, and performance improvement strategies.

Unresolved Right of Way (ROW). ROW acquisition is essential for constructing irrigation infrastructure and involves securing land through donation, compensation, or permits (NIA & PRIMEX, 2006). It affects a wide area—including canals, embankments, and access roads—and can lead to loss of agricultural or residential land, structures, crops, and income. This often results in the displacement of households and significant resistance from landowners. A particularly sensitive issue arises when indigenous peoples are affected, as they may lose both property and cultural ties to the land (NIA, 2013). During implementation, unresolved right of way issues frequently lead to strong opposition from affected parties, which in turn would cause project delays.

Poor Project Planning, Supervision, and Monitoring. Effective project planning and scheduling are critical for construction success, yet inconsistent approaches and lack of resources often compromise performance (Majumder et al., 2021). According to the Revised IRR of RA 9184, detailed engineering should follow a thorough feasibility study to ensure technical and regulatory viability. Components such as field surveys, contract plans, quantity estimates, and value engineering are essential for accurate planning. When these elements are neglected or poorly executed, delays, cost overruns, and implementation inefficiencies become inevitable.

The Revised Implementing Rules and Regulations (IRR) of RA 9184 allow procuring entities to issue Variation Orders (VO) to modify contracts in response to changes in project scope, costs, or unforeseen conditions encountered during construction. These changes may involve adding new work or adjusting the project to better align with actual field conditions. Contractors are required to submit claims for VO within 7 days of work commencement or 28 days from the occurrence of the changes. The process for approving a VO must be completed within 30 days (Government of the Philippines, 2016). Additionally, the Government Procurement Policy Board (GPPB) Generic Procurement Manual permits contractors to be compensated for additional work through an Extra Work Order (EWO), which is issued for work not originally included in the contract (GPPB, n.d.).

The head of the procuring entity may suspend work due to reasons like force majeure, safety issues, or changes in conditions that require adjustments to the project. Contractors can also suspend work if delays occur in material delivery, payments, or if right-of-way issues prevent progress (Government of the Philippines, 2016). Furthermore, contractors may request an extension of the contract time when additional work or exceptional circumstances arise. These requests must be made within 30 days of the event causing the delay. Circumstances such as natural calamities or delays by the procuring entity in providing necessary resources can justify an extension (GPPB, n.d.; Government of the Philippines, 2016).

In cases of project delays, liquidated damages are applied, which are predetermined compensations agreed upon in the contract. These damages are automatically imposed if the contractor fails to meet the contract deadlines, including any approved extensions. If liquidated damages reach 10% of the total contract cost, the procuring entity may rescind the contract (GPPB, n.d.). The implementation of government contracts, including those managed by the National Irrigation Administration (NIA), is governed by the provisions of RA 9184 and its IRR, ensuring that procurement and project management follow legal guidelines and that variations, payments, and contract timelines are handled properly (Government of the Philippines, 2016).

NIA projects, like other government infrastructure projects, are often subject to delays due to external factors such as weather conditions, peace and order concerns, and water-related issues at construction sites. These factors may necessitate the issuance of suspension orders and contract time extensions. Changes in project designs or work programs may also require variation orders, and any resulting adjustments to project timelines and costs undergo strict validation. NIA ensures that these changes are thoroughly reviewed and that all adjustments are well-documented to maintain accountability and transparency (NIA, 2021).

Given the recurring nature of these challenges, the need for a more systematic approach to analyzing delays in irrigation projects is clear. A comprehensive schedule delay analysis can uncover the root causes of delays, their impact on timelines, and potential mitigation strategies. Proactive planning, improved monitoring, and better coordination among stakeholders are essential to addressing these issues. By enhancing project management practices, irrigation projects can be completed on schedule, within budget, and with a more positive impact on agricultural productivity, ensuring that farmers receive the water supply needed to thrive.

METHODS

Research Design. This study employed a descriptive-comparative design to analyze schedule delays in irrigation projects in Oriental Mindoro. The design was appropriate because the research sought to determine whether there were significant differences in respondents' assessments of issues or problems and the possible outcomes of project delays when grouped according to years of experience in irrigation project implementation. To test these differences, the independent t-test was applied, which is suitable for comparing the means of two independent groups.

To gather relevant data, a structured questionnaire was developed and distributed to respondents involved in different irrigation projects across Oriental Mindoro. The respondents included project engineers, contractors, and site supervisors who play key roles in the preparation, implementation, and monitoring of irrigation projects. The questionnaire was designed to collect quantitative data ensuring a complete evaluation of the aspects influencing delays.

As noted by Best and Kahn (2006), a survey represents a systematic effort to analyze, interpret, and report the existing status of a specific institution, group, or area. Referencing above, the main goal of this research was to classify, generalize, and interpret the collected data to derive insights that could inform policy formulation, project planning, and decision-making in infrastructure project management. Thus, by identifying key delay factors and their effect on project duration, this research aims to support government agencies, policymakers, and construction stakeholders in ensuring the timely and efficient finalization of irrigation projects.

Ultimately, the findings of this research contributed to the development of improved project management strategies, facilitating the effective delivery of irrigation infrastructure. This, in turn, is expected to enhance agricultural productivity and support the economic growth of Oriental Mindoro by ensuring a reliable supply of irrigation water for farmers.

Population. The participants for this research were the project engineers from the National

Irrigation Administration (NIA) involved in 22 irrigation projects within Oriental Mindoro during the calendar year 2021. To ensure the collection of accurate data, a total of 30 respondents were employed.

Research Instrument. The research instrument used in this study was a structured questionnaire designed to capture respondents' assessments of issues causing delays and the possible outcomes of irrigation project implementation in Oriental Mindoro. The questionnaire consisted of three parts: (1) respondent profile, including age, gender, office/company, and years of experience in irrigation projects; (2) assessment of issues or problems encountered that cause delays; and (3) assessment of possible outcomes resulting from such delays. To measure responses, a 5-point Likert scale was employed. For issues and problems, the scale ranged from "Very likely" to "Very unlikely." For possible outcomes, the scale ranged from "Always" to "Never." The questionnaire was developed based on initial consultations with project engineers and aligned with the study objectives to ensure validity and reliability of the data collected.

Data Gathering. Data collection was conducted with permission from the National Irrigation Administration (NIA) Regional Manager and the Division Manager of the Mindoro Oriental-Marinduque-Romblon Irrigation Management Office. After approval, a briefing was held to explain the purpose of the study and secure informed consent from participants. The questionnaires were then distributed to project engineers, contractors, and site supervisors involved in irrigation projects. Completed questionnaires were retrieved, recorded, and encoded into a Microsoft Excel spreadsheet for statistical analysis. The process ensured systematic collection of data while maintaining ethical standards of research.

Statistical Treatment. Data collected in this study underwent appropriate statistical analysis. Data were coded, tallied, and tabulated to ensure a clear and comprehensive presentation and interpretation of the results. Statistical tools utilized in this research included the following:

1. ***Percentage.*** This was used to describe profile of the participants in relations of age, gender, name of office/company, and years of experience in the implementation of irrigation projects.

2. ***Weighted Mean.*** This was utilized to assess respondents' knowledge on issues or problems encountered, as well as the possible outcomes that cause delays in the implementation of irrigation projects in the province of Oriental Mindoro.

3. ***Independent t-test.*** To test this comparative problem, the independent t-test was applied. This statistical tool is appropriate for determining whether there are significant differences between the means of two independent groups, thereby aligning the inferential problem with the chosen method of analysis.

RESULTS

Issues or problems encountered that cause delays in the implementation of the irrigation project. Respondents rated various factors contributing to delays in irrigation projects using a 5-point Likert scale. The results are summarized in Table 1, showing the weighted mean for each factor.

Table 1
Respondents Rate on Factors Contributing to Delay in Irrigation Projects

Factor	Weighted Mean	Description
Bad weather condition	4.28	Likely
Irrigation water delivery schedule	4.00	Likely
Unsatisfactory performance of contractors	3.78	Neutral
Unresolved right of way (ROW)	3.72	Neutral
Peace and order situation	2.91	Unlikely
The existence of standing crops	3.66	Neutral
Poor project planning, supervision, monitoring, control	2.91	Unlikely

The survey results show that bad weather (4.28) and irrigation water delivery schedules (4.00) are the most significant causes of delays in irrigation projects, highlighting the impact of environmental factors and water management on project timelines. Contractor performance (3.78), unresolved right-of-way issues (3.72), and standing crops (3.66) were rated as moderate contributors, occasionally affecting schedules. Meanwhile, peace and order situations (2.91) and poor project planning (2.91) were seen as having minimal impact. With an overall mean of 3.61, delays are generally perceived as moderate, emphasizing the need for improved weather preparedness and resource scheduling to mitigate disruptions.

Assessments of Possible Outcomes of Delay Factors in Irrigation Project Implementation. Participants assessed the possible outcomes of delays. The outcomes are showed in Table 2.

Table 2
Respondent Rate on Possible Outcomes of Delays in Irrigation Projects

Outcome	Weighted Mean	Description
1. Variation Order		
Due to Poor Project Planning	3.19	Sometimes
Due to Unresolved ROW	3.40	Sometimes
Due to the actual site condition	3.69	Sometimes
2. Additional/Extra Work Costing		
Due to poor project planning	2.88	Rarely
Due to the unresolved Right of Way	3.06	Sometimes
Due to the actual site condition	3.28	Sometimes
3. Liquidated Damages		
Due to the unsatisfactory performance of contractors thus resulting in to delay	3.00	Sometimes
Due to insufficient manpower and equipment of contractors thus resulting in to delay	3.00	Sometimes
4. Suspension of Works		
Due to bad weather conditions	4.00	Often
Due to irrigation water delivery schedule	3.59	Sometimes
Due to the unresolved Right of Way	3.22	Sometimes
Due to Peace and order situation	2.25	Rarely
Due to the existence of standing crops	3.31	Sometimes
5. Extension of Contract Time		
Due to a change order	3.31	Sometimes
Due to additional/extra work order	3.34	Sometimes
Due to bad weather conditions	3.91	Sometimes
Due to irrigation water delivery schedule	3.56	Sometimes
Due to the unresolved Right of Way	3.19	Sometimes
Due to Peace and order situation	2.53	Rarely
Due to the existence of standing crops	3.25	Sometimes

The survey results indicate that bad weather is the leading cause of delays in irrigation projects, with work suspensions (4.00) and contract extensions (3.91) being frequent issues. Variation orders due to actual site conditions (3.69) and unresolved right-of-way disputes (3.40) also contribute to delays, requiring project adjustments. Other moderate factors include work suspensions and contract extensions due to irrigation water delivery schedules (3.59, 3.56) and additional costs from unforeseen site conditions (3.28). Less significant issues, such as peace and order situations (2.25) and poor project planning (2.88), rarely impact delays. With an overall mean of 3.25, these delays occur occasionally, emphasizing the need for proactive planning and mitigation strategies to address weather-related disruptions and site-specific challenges effectively.

Differences in Assessments of Delay Issues and Outcomes in Irrigation Project Implementation by Experience Level. The independent t-test analysis highlights significant differences in respondents' assessments of delay factors in irrigation projects when grouped according to years of experience. The results show that perceptions of certain issues vary depending on professional exposure, while others remain consistent across groups.

Table 3
Comparative Analysis of Respondents' Perceptions on Delay Factors in Irrigation Projects Using Independent t-Test

Factor	t-value (df = 28)	p-value	Significance	Interpretation
1. Bad Weather Condition	2.35	$p < 0.05$	Significant	Experience affects perception; experienced respondents anticipate/mitigate better.
2. Irrigation Water Delivery Schedule	1.72	$p > 0.05$	Not Significant	Perceptions consistent regardless of experience level.
3. Unsatisfactory Performance of Contractors	2.10	$p < 0.05$	Significant	Experience influences perception; experienced individuals may have higher standards.
4. Unresolved Right of Way (ROW) Issues	1.50	$p > 0.05$	Not Significant	Similar perception across experience levels.
5. Peace and Order Situation	0.75	$p > 0.05$	Not Significant	No variation in perception based on experience.
6. The Existence of Standing Crops	1.90	$p < 0.05$	Significant	Experience shapes views; seasoned individuals see it as a recurring constraint.
7. Poor Project Planning, Supervision, Monitoring, Control	3.00	$p < 0.01$	Highly Significant	Strong variation in perception; experienced respondents better recognize management shortcomings.

Key factors such as poor project planning and bad weather conditions were rated significantly differently by respondents. Experienced professionals tended to be more critical of poor project planning, recognizing its cascading effects on timelines, costs, and resource management. In contrast, less experienced respondents were less sensitive to these systemic shortcomings. Similarly, seasoned respondents viewed bad weather as a recurring and disruptive constraint, emphasizing the need for contingency measures, while less experienced individuals tended to perceive it as an unavoidable external challenge.

Other factors, such as contractor performance and the existence of standing crops, also showed significant differences in perception. Experienced respondents often held higher standards for contractor performance and recognized standing crops as a recurring logistical constraint, while less experienced respondents viewed these issues with less severity. On the other hand, factors like irrigation water delivery schedules, right-of-way disputes, and peace and order situations did not show significant differences, indicating that perceptions of these issues are relatively consistent regardless of experience level.

The comparative findings underscore the importance of incorporating diverse perspectives into project management. Experienced professionals contribute strategic foresight and recognition of systemic risks, while less experienced individuals highlight immediate, observable challenges. This divergence suggests that project strategies should balance both long-term planning and short-term responsiveness.

To mitigate delays, irrigation project management should prioritize robust planning and supervision, supported by adaptive scheduling to counter external factors like weather. Enhanced training for contractors and project managers can reduce deficiencies that lead to variation orders and liquidated damages. Moreover, fostering collaboration among team members with varying levels of experience can bridge perception gaps, ensuring that solutions are comprehensive and inclusive. Ultimately, addressing these comparative insights can strengthen project delivery, reduce costs, and build resilience against disruptions.

Table 4

Action Plan for Mitigating Schedule Delays in Irrigation Projects

Recommendation	Action Steps	Timeline	Responsible Parties
Enhanced Project Planning and Supervision			
Develop a detailed project timeline	Include key milestones, dependencies, critical paths, weather forecasts, and resource availability.	Within the first month of initiation	Project managers
Conduct a risk assessment workshop	Engage experts to identify risks (e.g., weather, ROW issues, standing crops) and prepare a risk registry.	Within the first month of initiation	Risk management team
Create contingency strategies	Develop backup plans, allocate resources, and revise timelines for identified risks.	Within the first month of initiation	Project planners, risk management team
Assign supervision roles	Designate experienced supervisors and form a risk management team for risk assessment and monitoring.	Within the first month of initiation	Project managers
Adaptive Scheduling			
Build flexibility into the timeline	Add buffer periods for unpredictable factors like weather and water supply delays. Use the historical data of rainfall in the province to compute the average rainy days and coordinate with the farmer's for their cropping calendar of farming activities	At the start of the project	Project planners
Use dynamic scheduling tools	Implement software for schedule modifications and delay alerts. For unexpected Weather Delays, use Dynamic Scheduling like Primavera P6 to update timelines when weather forecasts predict heavy rain. Reallocate resources to tasks not affected by weather (e.g., design reviews, or equipment maintenance).	At the start of the project	Scheduling team
Conduct monthly reviews	Assess project status and adjust schedules to accommodate emerging challenges.	Ongoing	Scheduling team
Capacity Building			
Develop training modules	Training Modules in Project Planning: Mastering Project Planning for Effective Project Management Module 1: Fundamentals of Project Planning Module 2: Developing Project Schedules and Timelines Module 3: Risk Assessment and Management in Project Planning Module 4: Resource Allocation and Optimization Module 5: Dynamic Scheduling and Adaptive Planning Module 6: Stakeholder Engagement in Project Planning Module 7: Monitoring, Reporting, and Continuous Improvement Final Module: Capstone Workshop	Before project kickoff	HR department, training coordinators
Regular Monitoring and Evaluation			
Implement project status updates	Set up daily/weekly reporting systems to monitor progress.	Within the first month	Monitoring and evaluation department
Use performance-tracking tools	Purchase monitoring software: **Microsoft Project:** A project management software for planning, tracking, and analyzing project progress. **Primavera P6:** A high-performance project management tool suitable for complex projects.	Within the first month	Project management team
Conduct monthly review meetings	Evaluate progress and implement corrective actions based on findings.	Monthly	Monitoring and evaluation department
Stakeholder Engagement			
Establish a communication plan	Identify key stakeholders and determine communication strategies and frequency.	Before project initiation	Community relations team, legal team
Hold regular stakeholder meetings	Organize quarterly/monthly updates and feedback sessions.	Quarterly or monthly	Project managers
Address ROW issues proactively	Coordinate with local authorities and landowners to resolve ROW challenges.	Ongoing	Legal team
Conduct community outreach	Engage local communities to mitigate disruptions from standing crops or other local factors.	Ongoing	Community relations team

- Performance Metrics:
  - Timely achievement milestone
  - Percentage of completed tasks versus planned tasks
  - Stakeholder satisfaction
  - Resource utilization efficiency
  - Number of issues addressed promptly
- Review Frequency:
  - Two-week interval progress reports
  - Monthly performance assessments
  - Quarterly stakeholder satisfaction surveys

By following this action plan, irrigation projects in Oriental Mindoro can enhance their planning and management processes, reduce delays, and ensure the efficient delivery of project while maintaining positive relationships with stakeholders.

DISCUSSION

The study's findings align with the principles of schedule delay analysis, which involves identifying and addressing delay factors to minimize disruptions and improve efficiency. Bad weather and irrigation water delivery schedules require strategies like contingency planning and adaptive scheduling. Contractor performance and unresolved Right of Way (ROW) issues, peace and order issues, and poor project planning, still underscore the importance of localized risk assessments.

The study also emphasizes the cascading effects of delays, such as suspension of works and variation orders needs for accurate schedules, comprehensive risk assessments, and flexible resource allocation. Variation orders indicate deficiencies in planning, which delay analysis seeks to prevent.

Additionally, perceptions of delays varied with experience, indicating the importance of expertise in addressing challenges through tools like critical path method adjustments. Less experienced respondents focused on immediate issues, suggesting a need for capacity-building. By integrating these insights, project teams can better anticipate challenges, implement adaptive strategies, and improve overall project delivery.

The recommendations for addressing schedule delays in irrigation projects provide a well-organized and thorough framework for enhancing project management. Below is an overview of how these strategies align with schedule delay analysis:

1. ***Enhanced Project Planning and Supervision***. This approach emphasizes thorough planning and risk assessments, key aspects of schedule delay analysis. Identifying potential risks in advance allows for proactive management of delays and the development of mitigation strategies, ensuring that resources and time are allocated effectively.
2. ***Adaptive Scheduling.*** Flexible scheduling is a critical component in addressing the uncontrollable factors that can lead to delays. By incorporating buffer periods or alternate pathways, the schedule can adapt to unexpected challenges, such as weather changes or supply chain issues, which are often highlighted during schedule delay analysis.
3. ***Capacity Building.*** Training programs strengthen the ability to handle unforeseen challenges, a core element of effective delay analysis. Well-trained teams can quickly recognize the root causes of delays and device corrective actions, ensuring project timelines are not unduly impacted.
4. ***Collaboration Across Experience Levels.*** Bringing together experienced and less experienced professionals can enhance decision-making in delay analysis. Experienced individuals can provide insights on past delays, while newcomers can offer innovative solutions. This collaborative environment can lead to more effective identification of delay risks and timely interventions.
5. ***Regular Monitoring and Evaluation.*** This measure supports continuous delay analysis by enabling the tracking of project progress in real-time. Monitoring can reveal emerging issues that may not have been anticipated, and timely evaluations can help make adjustments before small issues evolve into major delays.
6. ***Stakeholder Engagement.*** Strong coordination with stakeholders helps to address external causes of delays specially government regulations, and community concerns that are frequently highlighted in delay analyses. By aligning the project timeline with stakeholder expectations, potential roadblocks related to ROW issues and crop management can be mitigated.
7. ***Risk Assessment.*** Regular risk reviews, tracking of mitigation strategies, and post-

delay evaluations are crucial for refining risk management practices and improving project delivery. By implementing these strategies, irrigation projects can improve and address delays, leading to more efficient and timely completion.

By incorporating these recommendations into the management strategy for irrigation projects, delays can be minimized, ensuring smoother project execution and timely completion.

The researcher strongly recommends conducting similar studies in other National Irrigation Administration (NIA) offices. Future researchers should aim to enhance the methodology for conducting such studies, ensuring the inclusion of perspectives from various stakeholders. They should also carefully identify the specific delay factors relevant to their respective provinces when designing their research instruments. Additionally, future studies could expand to explore other types of irrigation projects, such as multi-purpose high dams and automated irrigation systems, among others.

DISCLOSURES

Author contributions. The author independently carried out every stage of the research and publication process, encompassing the formulation of the study concept, development of the framework, execution of data collection, application of statistical analyses, interpretation of results, and the writing and finalization of the manuscript.

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