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Analysis of Construction Delays in Public Sector Projects at Apayao State College in the Philippines

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ABSTRACT
Public sector construction projects, funded by the government, are crucial for driving economic growth and progress, particularly in the rural areas of the Philippines. These projects are essential for improving the quality of life by providing vital infrastructure to the people. However, various factors have led to significant delays in these projects, consequently postponing the delivery of services to constituents. This study investigates the major causes of delays in public sector construction projects, with a focus on Apayao State College, and their effects on project success. A systematic approach was employed, highlighting the demographic characteristics of respondents to provide context and understanding of different perceptions regarding construction delays. The study adopted a descriptive correlational design. The key findings revealed that the top causes of delays include: delays in the delivery of materials (RII=0.870); force majeure events such as natural disasters and pandemics (RII=0.850); shortage of materials (RII=0.830); shortage of equipment (RII=0.805); decision-making delays from the agency (RII=0.795); improper technical studies of the project, inaccurate bid proposals during the bidding period, and problems with subcontractors due to their lack of capacity to execute the project (RII=0.775); financial difficulties faced by the contractor (RII=0.770); equipment failures, long delays in progress payments by the agency, and ambiguities and mistakes in specifications and drawings (RII=0.755); work suspensions by the agency, insufficient coordination among the parties, and difficulties in obtaining government permits and certifications (RII=0.750); and delays in project mobilization/start (RII=0.745). The six highlighted effects of these delays include: time overruns (RII=0.845); cost overruns (RII=0.785); disputes (RII=0.715); arbitration and abandonment (RII=0.705); and litigation (RII=0.630). It was further analyzed that both the agency and contractors shared similar views on the causes and effects of delays on project success.

KEYWORDS
Causes of delays, Effects of construction delays, Public sector projects

Introduction

Public sector infrastructure projects are pivotal in driving economic growth and enhancing the quality of life, particularly in rural and underserved areas (Aiyetan & Das, 2021). These projects largely compose school buildings, healthcare facilities, transportation networks, and other public utilities. In the midst of a historic structural transformation, developing countries are becoming major drivers of global savings, investment, and urbanization. This transformation necessitates robust infrastructure development to support rapid growth and urbanization (Bisbey et al., 2020). Government around the world invest in these projects to boost development, and unfortunately, many of these initiatives suffer from significant delays and cost overruns that can have detrimental impacts (Akhund et al., 2019) (Bisbey et al., 2020) (Aiyetan & Das, 2021).

Delays in public sector construction projects are a persistent issue globally, significantly impacting the timely completion and success of infrastructure developments. Such delays can be attributed to various factors including inadequate planning, bureaucratic hurdles, and unforeseen challenges such as material shortages or adverse weather conditions (Akhund et al., 2019). In areas like the Province of Apayao in the Philippines, these issues are

particularly pronounced. Extreme weather, predominantly during the rainy season, hinders transportation and delivery of construction materials and disrupts construction work, leading to extended timelines and increased costs (Hosseini et al., 2019). These challenges are compounded by the logistical difficulties inherent in remote areas, further complicating efforts to maintain project schedules (Cabahug, 2021).

Existing solutions to address construction delays have focused on improving planning and project management practices, enhancing communication among stakeholders, and investing in advanced forecasting tools to anticipate and mitigate risks (Olatunji & Das, 2021). Despite these measures, delays remain a common challenge, highlighting the need for more comprehensive and context-specific solutions. As stipulated in the quarterly report on publicized projects, programs, and activities of Apayao State College ending June 30, 2024, the College has thirteen (13) construction projects spread across its four sites. It is noted that 38.46% of these projects are on track, while the remainder are delayed. This significant proportion of delayed projects underscores the urgent need to investigate the underlying causes of these delays. The college's location in the countryside, where the supply and delivery of construction materials are major concerns, further exacerbates the issue.

This study proposes a systematic approach to identify the significant factors contributing to delays in public sector construction projects and their corresponding effects. By examining the demographic characteristics of respondents, it seeks to provide a nuanced understanding of how different individuals perceive and interact with the problem of construction delays (Bisbey et al., 2020). The primary focus is on factors related to labor, materials, contractors, and agency processes (Akhund et al., 2019).

The significance of this research lies in its potential to enhance project efficiency, reduce costs, and improve the timely completion of public infrastructure projects. Addressing the unique challenges faced by institutions like Apayao State College will contribute to the overall improvement of the construction industry's performance, benefiting government agencies, contractors, and the public. Moreover, this research will fill gaps in existing literature by providing a comprehensive analysis of construction delays specifically within the public sector located in the countryside and offering practical recommendations for stakeholders to implement.

1. Objectives

This study aimed to analyze the main factors in the delay of construction projects in the public sector and to develop effective strategies for mitigating these delays. Specifically, the study sought to answer the following questions:

1. What are the main factors in the delay of construction project in the public sector?
2. What are the potential effects of construction delays in the implementation of construction projects?
3. Is there a significant difference on the perception of contractors and Agency on the delays of construction project?
4. Is there a significant difference on the perception of contractors and Agency on the effects of delays of construction project?
5. Is there a significant relationship of the delays and its effects to construction project?
6. What suggestions and recommendations elicited from the findings can be institutionalized to reinforce the provision of RA 9184?

2. Scope and Methodology

Research Design

The study utilized a descriptive correlational design, which is an essential approach that allows for an in-depth exploration of relationships between variables in real-world settings without intervention (Polit and Beck, 2017). In the context of analyzing construction delays in public sector projects, this design enables the researcher to systematically investigate the various factors that may influence delays, such as factors related to labor, materials, contractors, and agency.

By employing this design, the study aims to identify and quantify the relationships between these independent variables and the dependent variable of construction delays. Additionally, the descriptive correlational design

facilitates the collection of both quantitative data and qualitative data providing a comprehensive view of the interplay between factors affecting project timelines.

Moreover, this approach allows for the examination of real-world scenarios across various public sector construction projects. By not imposing any experimental controls or interventions, the study remains realistic and applicable, offering insights that can directly inform policymakers, project managers, and other stakeholders in improving future project planning and execution.

Finally, the descriptive correlational design provides a robust framework for uncovering patterns within the data, helping to highlight critical areas for attention and improvement that can mitigate delays in public sector projects.

Locale of the Study

The study was conducted at Apayao State College (ASC), the sole higher learning institution in the province of Apayao and a Levell II state college in the Philippines. ASC's main campus is situated in Centro Malama (Malama Site), with an extension located in Sitio Cubet (Cubet Site), both in the Municipality of Conner, Apayao. Additionally, the college has a satellite campus in San Isidro (Luna Site) and a satellite extension campus in Payanan (Payanan Site), both located in the Municipality of Luna, Apayao. Geographically, Conner and Luna are approximately 103 kilometers apart. The distances from Tuguegarao City are approximately 77 kilometers to Conner and 174 kilometers to Luna, respectively.

Informants of the Study

The informants of the study were the professionals directly involved in the implementation of construction projects of Apayao State College from FY 2022 – FY 2024. There were nineteen (19) informants from the agency, and twenty-one (21) informants from the contractors. Table 1 below presents the number of informants and the distribution of informants per sector.

Table 1. Distribution of Informants

Sector	Unit/Company	Number of Informants, n	Percentage, %
Agency (Apayao State College)	Infrastructure and Development Unit	9	22.50
	Inspection Committee	6	15.00
	BAC Members	4	10
Contractors	JLL 22 Construction	3	52.5
	ECV Construction	3	
	GKA Engineering and Construction	3	
	Four M Builders	3	
	Isnag Builders and Development Corporation	3	
	Prime Master Construction and Development Corporation	1	
	Adeb's Construction	3	
	Double-D Construction	2	
Total		**40**	**100**

Data Gathering Instrument

In order to determine the construction delays and its effects to public sector projects, a questionnaire was adopted from the study of Sambasivan et al. (2006). The questionnaire was divided into three (3) parts. The first part aims to gather personal information of the respondents based on the selected variables such as age, highest educational attainment, name of organization/company, type of company, position/designation in the organization/company, and number of years in terms of work experience.

The second part of the questionnaire focused on the causes of construction delays and its effect to construction projects. The respondents were asked to answer four (4) categories namely: labor related, materials related, contractor side, and the agency side. The respondents were asked further to provide recommendations to improve the implementation of public sector projects particularly in Apayao Sate College.

The third part of the questionnaire dwelled on the effects of construction delays in the public sector particularly

in Apayao State College. The respondents were also asked on their recommendation in minimizing the effects of construction delays in public sector projects.
The questionnaire used a five-point Likert scale to capture the importance of causes of delays and its effects to public sector projects. To facilitate the analysis of responses, the following numerical values were assigned to the respondents' rating: 'strongly agree' – 5, 'agree' 4, 'neutral' – 3, 'disagree' – 2, 'strongly disagree' – 1.

Data Gathering Procedure

The researcher sought permission from the Director of Infrastructure and Development at Apayao State College to conduct the study. Upon receiving approval, the researcher communicated with targeted informants from the agency and contractors involved in public sector construction projects. The informants were selected based on their involvement and experience in managing and executing such projects.
Questionnaires were distributed through email and in-person visits to ensure a high response rate. Completed questionnaires were collected and reviewed for completeness and accuracy. Follow-up communications were made to informants who had not submitted their responses within the given timeframe to ensure adequate data collection. The validated data was then analyzed using statistical software to identify the major factors contributing to construction delays and their effects.

Data Analysis

Firstly, the study used the Relative Importance Index Method (RII), a statistical measure used to prioritize factors based on their perceived importance (Aibinu and Jagboro, 2002). It is commonly applied in construction management, project management, and other fields where understanding the significance of variables is crucial. The five-point likert scale was transformed to relative importance indices for each of the construction delay factors and effects in construction project. The indices were then used to compute the rank of each item. The RII was computed using the formula:

$$RII = \frac{\sum W}{A * N}$$

where W is the weight given to each factor by the respondents, A is the highest possible weigth, and N is the total number of respondents. The RII value ranges between 0 and 1, RII≈1 indicates that a factor is highly important, while RII≈ 0 indicates that a factor is of low importance.
Secondly, the Mann-Whitney U-test was also used as a statical comparison of the mean of responses of the agency and contractors on the causes of delays and its effects to public sector projects. also known as the Wilcoxon rank-sum test, is a non-parametric statistical test used to determine whether there is a significant difference between the distributions of two independent groups. It is particularly useful when the data does not follow a normal distribution or when the sample sizes are small.
Thirdly, Spearman's Rank Correlation Coefficient (often denoted as Spearman's rho, ρ) was also utilized to determine then non-parametric measure of the strength and direction of association between the responses of the agency and contractors. It assesses how well the relationship between two variables can be described by a monotonic function, meaning that as one variable increases, the other either consistently increases or decreases, though not necessarily at a constant rate.

3. Literature Review

Construction projects in the public sector is pivotal in driving economic growth and improving the quality of life by providing essential infrastructure such as roads, bridges, schools, and hospitals. Governments around the world are increasingly investing in sustainable and resilient infrastructure to address challenges coming from urbanization, climate change, and economic inequality. Amidst these developmental initiatives worldwide, there are pressing issues which affect the implementation of construction projects. In the US, construction delays are often attributed to factors such as labor shortages, supply chain disruption, and regulatory hurdles. The COVID-19 pandemic significantly exacerbated existing issues, leading to widespread project delays and increased costs in the construction sector. Additionally, weather-related disruptions, particularly in regions prone to hurricanes and severe storms, have further contributed to these delays (Akhund et al., 2019). In the UAE and Saudi Arabia, construction delays are frequently caused by political instability, economic fluctuations, and logistical challenges (Hosseini et al., 2019). Large-scale construction projects often face delays due to the complexity of the project and the need for specialized labor and materials (Aiyetan & Das, 2021). In Singapore, one of the primary causes of delays is the high cost of land. The acquisition of project sites is prohibitively expensive, and the stringent regulatory requirements further extend the timeline for mobilizing projects (Bisbey et al., 2020).

Factors in the Delay of Construction Projects

Aside from the aforementioned, many studies pointed out varied reasons of project delays which vary from one country to another. In the study of Samarah et al. (2016), they pointed out factors causing delays for public sector projects in Jordan. Top three of these include inadequate management and supervision by the contractor, client's change of the design, and inadequate planning and control by the contractor. In Saudi Arabia, the reason of delay is attributed on the procurement process particularly on financial capability of contractors. Alsuliman (2019) recommended that a mechanism for contractor selection should consider factors like financial and technical analysis, project history, and other criteria, each assigned a relative weight. The total score will determine the winning bidder.

Regulatory challenges in construction projects often stem from stringent compliance requirements and frequent changes in regulations. According to Egbebi (2024), the construction industry faces significant challenges from environmental impacts and regulatory requirements, necessitating strategic planning and compliance measure Building codes and standards are essential for ensuring the safety and integrity of construction projects. However, these codes can vary significantly between regions and are frequently updated. Navigating these changes requires continuous monitoring and adaptation, which can delay project timelines. According to a study by LetsBuild (2023), understanding and adhering to these regulations is crucial for avoiding legal pitfalls and ensuring project success.

Furthermore, the process of obtaining necessary permits and approvals from government agencies can lead to significant delays, as these processes often involve multiple steps and can be subject to bureaucratic inefficiencies (Haseeb et al., 2011). Delays can arise from the need to secure services or approvals from statutory bodies (e.g., water, gas), which can be time-consuming and affect project schedules. Bureaucratic challenges, including delays in decision-making and approval processes, are also critical factors. Khahro et al. (2023) identified that delays in decision-making by key stakeholders negatively impact construction projects. The study suggests that a lack of technical competence, incomplete paperwork, and poor leadership contribute to these delays.

The construction industry faces multiple bureaucratic challenges that affect project efficiency and success. A common issue is the administrative burden that project managers increasingly face, which shifts their focus away from innovation and problem-solving toward bureaucratic responsibilities. This is especially evident in the construction industry, where the bureaucratization of management roles often leads to inefficiencies in project execution (Styhre, 2006).

Delays in regulatory approvals, poor planning, and ineffective communication are also significant bureaucratic challenges that contribute to project delays and increased costs. These issues are compounded when project requirements are misinterpreted, resulting in rework and project errors (Basar & Basar, 2023). One study emphasized that planning is a critical component in avoiding project delays, highlighting the need to manage resources, manpower, and funding effectively to achieve quality outcomes (Makdani, 2016). Similarly, Srivastava et al. (2016) explored the challenges in fast-track construction projects, noting that project management focuses on coordinating activities, while construction management ensures the on-site execution of quality standards.

In the Philippines, the Infrastructure Flagship Projects (IFPs) are part of the government's "Build Better More" (BBM) program, which aims to enhance the country's infrastructure landscape to promote economic growth and improve infrastructure resilience. These projects are part of the government's broader strategy to modernize the country's infrastructure, boost economic growth, and create job opportunities. In FY 2023, the Philippine Government allotted approximately 1.2 trillion pesos for various infrastructure development. The budget allocation focused on various sectors, including transportation, energy, water supply, and public works projects. On the following year, an increase of 180 billion pesos was allotted to the infrastructure budget to sustain the implementation of projects stated in the medium-term fiscal framework. Meanwhile, there are 185 Infrastructure Flagship Projects with 35% (65 projects) currently ongoing and only 3 completed since 2022. The majority of these projects (130) are region-specific, while 40 are interregional and 15 are nationwide (Statista Research Department, 2024). It shows that there are unavoidable intervening factors causing the delay of construction project due to complexities and scale of construction work. However, the government jacked up its infrastructure spending in 2023, hitting P1.2 trillion and effectively surpassing its programmed allocation on the back of faster disbursement for major transport and road projects. The national government disbursement performance reported that state infrastructure expenditure picked up by nearly 20 percent in 2023 from P1.02 trillion in 2022 (Simeon, 2024).

The Commission on Audit (COA) has reported significant delays in the public sector projects in the Philippines due to inadequate planning and supervision (Marcelo, 2023). The COA highlighted serious defects from these projects resulting from poor quality materials and insufficient oversight. However, Panti (2023) reported that the construction arm of the government, the Department of Public Works and Highways, pointed out several reasons of delays which include the following top ten: (1) Unfavorable site conditions caused by adverse weather condition; (2) Road Right-of-Way (RROW) acquisition problems/issues; (3) Relocation/obstruction of public utilities and communication facilities (Maynilad, Meralco, and the like); (4) Pending issuance of permit/clearance from local government units, the Department of Environment and Natural Resources, the Department of

Education, and from other agencies; (5) Modification and/or changes in feasibility studies, plans, detailed engineering design and program of works; (6) Slow/unsatisfactory performance of the contractor; (7) Accessibility of the project site is dependent on the completion of the other project; (8) Demolition of remaining/existing structures and other clearing related issues; (9) Delays in approval of time suspension/extension and variation orders; and (10) Insufficient workforce/manpower, materials and equipment resources provided by the contractors.

Effects of Construction delay

Delays in construction projects are a significant issue that can have far-reaching consequences. According to Ajayi and Chinda (2022), delays can lead to increased costs, time overruns, and reduced project quality. These delays often result in financial losses due to extra labor costs, equipment rentals, and potential penalties. Additionally, delays can strain relationships between clients and contractors, leading to disputes and legal challenges. The impact of delays is not limited to financial aspects; they can also cause reputational damage and affect the overall success of the project. In regions prone to extreme weather conditions, such as hurricanes and severe storms, delays are further exacerbated, leading to extended project timelines and increased costs. The study by Akhund et al. (2019) highlights that delays in construction projects can result in missed deadlines, which in turn affect subsequent contracts and client relationships. Furthermore, delays can lead to arbitration, litigation, and even project abandonment, making it crucial to address these issues proactively. In the Philippines, delays in public sector projects are often attributed to adverse weather conditions, logistical challenges, and issues with Right-of-Way acquisition (Cabahug et al., 2018).

Apayao State College, as the lone higher learning institution provider in the province of Apayao, aims to enhance the learning environment through provision of safe, modern, and accessible facilities for students and staff. These projects support academic excellence, foster innovation, and improve overall campus life, ensuring that educational institution located in the countryside can meet the evolving needs of their stakeholders. As of June 30, 2024, the college has thirteen (13) several construction projects located in its four sites. It is noted that 38.46% of these projects are on track while the rest are delayed. Thus, this study will analyze the main factors in the delay of construction projects in the public sector particularly in Apayao State College and to develop effective strategies for mitigating these delays.

4. Result and Discussion

Main Factors in the Delay of Construction Project in the Public Sector

The most significant causes of delays in the construction of public sector projects, particularly in Apayao State College, were identified and ranked according to their impact. As indicated in table 2, the analysis revealed the top ten primary causes of delays as follows:

1. Delay in the Delivery of Materials with RII=0.870: Due to ASC's remote location in the mountainous Cordillera Region, 82.9 kilometers from Tuguegarao City, material delivery delays lead to extended project timelines. The challenging terrain exacerbates transportation difficulties, causing significant setbacks. Failure to supply materials on time results in idle human resources and delayed activities (Enshassi et al., 2009).
2. Force Majeure or Events Like Natural Disasters and Pandemic with RII = 0.850: Events like natural disasters and pandemics significantly impact project timelines. Conner, Apayao experiences extreme climatic conditions with a tropical climate and heavy rains, especially during the long wet season. Akomah and Jackson (2016) identified bad weather or heavy rain as major factors affecting road construction completion, posing harm to both the project and laborers' safety.
3. Shortage of Materials with RII = 0.830: Conner experienced significant material shortages during the COVID-19 pandemic (2020-2022) due to global supply chain disruptions. These disruptions led to delays in the production and transportation of raw materials. Sambasivan and Soon (2007) identified shortages in basic materials like sand, cement, stones, bricks, and iron as major delay causes. Manavazhi and Adhikari (2002) found that material and equipment shortages caused significant delays in highway projects in Nepal.
4. Shortage of Equipment with RII = 0.805: Contractors often manage multiple project sites, leading to equipment management issues, especially when major works are scheduled simultaneously. Sambasivan and Soon (2007) found that many contractors do not own necessary equipment and rent it when needed. During peak construction seasons, equipment is in short supply and often poorly maintained, leading to frequent failures and delays.

5. Decision-making From the Agency with RII = 0.795: This factor is associated with bureaucratic processes in the public sector, involving numerous committees that take action on certain issues during the construction stage. Ghosh et al. (2018) found that delays in decision-making at the site are critical factors contributing to the delay of construction projects.
6. Improper technical study of the project and inaccurate bid proposal submitted during the bidding period, and Problems with subcontractors due to their lack of capacity to execute the project with RII = 0.775: RA 9184, or the Government Procurement Reform Act of the Philippines, provides guidelines and instructions to bidders on preparing their financial and technical bid proposals. Inaccurate estimates and programs of work may lead to contractors requesting variation orders, which involve lengthy processes and justifications. Oo, Lim, & Runeson (2022) emphasized that accurate technical assessments and bid proposals are vital for informed bidding decisions, directly impacting the overall project timeline and efficiency. The study also revealed that subcontractor capacity issues are critical factors of delays. When subcontractors lack capacity, the primary contractor often has to carry over the project, leading to time overruns. Durdyev et al. (2019), Tamin et al. (2015), and Oo et al. (2022) provided evidence that subcontractor capacity issues are common causes of delays in construction projects.
7. Financial Difficulties Faced by the Contractor with RII = 0.770: This analysis aligns with the findings of Gundes et al. (2019), which show that insufficient funds and poor financial management are common challenges for contractors, leading to project delays and financial instability.
8. There are three factors ranked on the eight with RII = 0.755, these are: Failure of equipment, Long delay in progress payments by the agency, and ambiguities and mistakes in specifications and drawings. As mentioned earlier, contractors rent some equipment, which is often poorly maintained, resulting in equipment failure. Othman et al. (2022) highlighted in their study that equipment failure due to lack of maintenance and improper use is a significant factor contributing to project failures. Proper maintenance and operation of equipment are crucial to expedite project completion (Herz et al., 2021). Progress payments are based on the actual accomplishments of contractors. The billing process starts with inspection by the inspectorate committee, followed by the submission of required billing documents and materials testing documents from the contractors. This bureaucratic process extends the time until payment is released to the contractors' accounts. Xie et al. (2021) found that delays in progress payments can significantly hinder project timelines and productivity. Furthermore, Hosseini et al. (2019), Lim et al. (2022), and Krezdorn et al. (2021) highlighted in their studies that unclear specifications and drawings can lead to misunderstandings and errors, affecting project progress.
9. Work Suspension by the Agency, Insufficient Coordination Among the Parties, and Difficulties in Obtaining Government Permits and Certifications with RRI = 0.750 are significant factors in project delays. According to RA 9184, work suspension can occur under several conditions, including non-compliance with contract terms, discovery of defects, third-party liabilities, safety concerns, and financial issues. Work suspension may also be imposed due to policy changes or unforeseen site conditions, often resulting in significant project delays. With the presence of mostly subcontractors on the project site, communicating important project details to the main contractor is challenging. Insufficient coordination can lead to misunderstandings, duplicated efforts, and gaps (Othman et al., 2022). Besides the regular permits required before commencing a project, other certificates mandated by institutional agencies, such as the Environmental Clearance Certificate (ECC), are necessary to certify that there is no significant negative impact on the surrounding natural environment.

10. Delay in Mobilization/Start of the Project with RII = 0.745: Most of the projects started late beyond the stated notice to proceed or the NTP. Delays in mobilization can set a project off course from the start, leading to cascading delays and potential project failures (Herz, 2021)

Table 2. Ranking of Causes of Delays

Factors of delays	Percentage of respondents scoring					RII	Rank
	5	4	3	2	1		
Contractor Related							
Shortage of manpower in the area	40.00	15.00	22.50	20.00	2.50	0.740	11
Presence of unskilled laborers	12.50	22.50	42.50	20.00	2.50	0.645	20

Shortage of materials	**37.50**	**45.00**	**15.00**	**0.00**	**2.50**	**0.830**	**3**
Delay in the delivery of materials	**60.00**	**20.00**	**17.50**	**0.00**	**2.50**	**0.870**	**1**
Fluctuation in the price of Materials	0.00	27.50	50.00	15.00	7.50	0.595	21
Modifications in specifications of materials	12.50	50.00	27.50	7.50	2.50	0.725	13
Shortage of equipment	**47.50**	**20.00**	**22.50**	**7.50**	**2.50**	**0.805**	**4**
Failure of Equipment	**35.00**	**17.50**	**40.00**	**5.00**	**2.50**	**0.755**	**8**
Lack of administrative personnel of contractor.	27.50	30.00	12.50	27.50	2.50	0.705	17
Delay in mobilization/Start of project.	**25.00**	**35.00**	**30.00**	**7.50**	**2.50**	**0.745**	**10**
Lack of competent technical professionals and staff including safety officer assigned to the project	35.00	20.00	22.50	20.00	2.50	0.730	19
Improper technical study of the project and inaccurate bid proposal submitted during the bidding period.	**30.00**	**37.50**	**22.50**	**10.00**	**0.00**	**0.775**	**6**
Ineffective planning and scheduling of the project by the contractor.	32.50	20.00	30.00	15.00	2.50	0.730	12
Inadequate experience of contractor.	27.50	30.00	20.00	20.00	2.50	0.720	14
Lack of effective quality control by the contractor.	27.50	27.50	27.50	15.00	2.50	0.725	13
Use of unacceptable construction methods, materials, and techniques by the contractor which may lead to work suspension.	27.50	17.50	35.00	12.50	7.50	0.690	18
Financial difficulties faced by the contractor	**35.00**	**35.00**	**12.50**	**15.00**	**2.50**	**0.770**	**7**
Problems with subcontractors due to their lack of capacity to execute the project.	**40.00**	**27.50**	**15.00**	**15.00**	**2.50**	**0.775**	**6**
Agency Related							
Delays in site preparation and turnover to contractor.	17.50	35.00	30.00	15.00	2.50	0.700	16
Work suspension by the agency	**32.50**	**22.50**	**35.00**	**7.50**	**2.50**	**0.750**	**9**
Too many change orders from the agency.	40.00	20.00	12.50	25.00	2.50	0.740	11
Slow decision making from the agency.	**47.50**	**22.50**	**12.50**	**15.00**	**2.50**	**0.795**	**5**
Inference by the agency in the construction operations.	7.50	20.00	30.00	35.00	7.50	0.570	23
Long delay in progress payments by the agency.	**35.00**	**27.50**	**22.50**	**12.50**	**2.50**	**0.760**	**8**
Insufficient coordination among the parties by the agency.	**35.00**	**32.50**	**7.50**	**22.50**	**2.50**	**0.750**	**9**
Ambiguities and mistakes in specifications and drawings	**42.50**	**15.00**	**25.00**	**15.00**	**2.50**	**0.760**	**8**
Delay in the approval of contractor's submission by the agency.	35.00	12.50	32.50	17.50	2.50	0.720	14
Slow response by the agency engineer regarding testing, request for inspection, and inquiries of contractor.	27.50	22.50	22.50	25.00	2.50	0.695	17
Force majeure or events like natural disasters and pandemic.	**40.00**	**50.00**	**7.50**	**0.00**	**2.50**	**0.850**	**2**
Difficulties in obtaining government permits and certifications.	**32.50**	**20.00**	**45.00**	**0.00**	**2.50**	**0.760**	**9**
Changes in Government regulations and laws.	7.50	22.50	27.50	35.00	7.50	0.575	22

Potential Effects of Construction Delays in the Implementation of Construction Projects

Table 3 presents the ranking of effects of delays according to both the agency and contractors. The analysis of construction delays in public sector projects reveals significant impacts on project outcomes.

The most pronounced effect is time overrun, identified as the top concern among respondents with a Relative Importance Index (RII) of 0.845. This suggests that delays severely impact project timelines, corroborating findings by Sambasivan and Soon (2007), who observed that time overruns are a common issue in construction

projects in developing countries.

Cost overrun ranks second, with an RII of 0.785, indicating that financial repercussions are nearly as critical as time delays. This finding aligns with Flyvbjerg et al. (2003), who found that public sector projects frequently exceed their budget due to various delays and unforeseen complications.
Disputes, with an RII of 0.715, are the third most significant effect. This emphasizes the importance of clear communication and effective management strategies to mitigate conflicts, consistent with Assaf and Al-Hejji (2006), who reported that disputes are a major consequence of delays in construction projects.
Both arbitration and abandonment score an RII of 0.705, ranking fourth. These effects highlight the more extreme consequences of prolonged delays, where projects face the risk of being left incomplete or requiring legal intervention to resolve disputes.
Lastly, litigation, with an RII of 0.630, while less frequent, still represents a significant impact. This finding supports Frimpong et al. (2003), who noted that legal actions are sometimes the last resort when disputes over delays cannot be amicably resolved.

Table 3. Ranking of Effects of Delays

Effects of delays	Percentage of respondents scoring					RII	Rank
	5	4	3	2	1		
Time Overrun	47.50	27.50	25.00	0.00	0.00	0.845	1
Cost Overrun	32.50	27.50	40.00	0.00	0.00	0.785	2
Arbitration	20.00	20.00	52.50	7.50	0.00	0.705	4
Abandonment	27.50	27.50	20.00	20.00	5.00	0.705	4
Dispute	20.00	40.00	25.00	7.50	7.50	0.715	3
Litigation	12.50	12.50	60.00	7.50	7.50	0.630	5

Difference between the perception of contractors and agency on the factors of delay in construction projects
The Mann-Whitney U Test was employed to determine if there is a significant difference in the perception of construction delays between agency and the contractors. In Table 4, the U-value of 153.00 and a p-value of 0.207 indicate that there is no significant difference in the perception of construction delays between the agency and contractors. This suggests that both groups perceive delays similarly, which is an important insight to reduce conflicts and improve teamwork, as there's a mutual understanding of the issue at hand. This finding aligns with the study by Frimpong et al. (2003), who also found no significant difference in the perception of delays between different stakeholder groups in construction projects. Their research highlights the importance of collaborative approach to address delays and improve project outcomes.

Table 4. Difference between the perception of contractors and agency on the factors of delay in construction projects.

Variables	**Categories**	**N**	**Sum of Ranks**	**U - value**	**Z - value**	**p - value**	**Decision**
Construction Delays	Agency	19	343.00	153.00	1.262	0.207	Accept Null Hypothesis
	Contractor	21	477.00				

Difference between the perception of contractors and agency on the effects of delay in construction project

Table 5 presents the difference between the perception of contractors and agency on the effects of delay in construction project. It is revealed that the U-value of 194 and a p-value of 0.880 indicate that there is no significant difference in the perception of the effects of delays between the agency and contractors. This suggests that both parties experience and evaluate the impacts of delays similarly. This shared understanding can lead to more cohesive and aligned strategies to manage and reduce the effects of delays in construction projects.
The result is supported by Giri (2023), who also found no significant difference in perceptions of delay impacts between different stakeholder groups in the construction industry. Giri's findings emphasize the importance of joint efforts in addressing and mitigating delays to improve project performance and outcomes.

Table 5. Difference between the perception of contractors and agency on the effects of delay in construction project

Variables	Categories	N	Sum of Ranks	U - value	Z - value	p - value	Decision
Effects of delay	Agency	19	384	194	0.151	0.880	Accept Null Hypothesis
	Contractor	21	436				

Relationship between the perception of contractors and agency on the effects of delay in construction projects

The analysis in table 6 reveals a significant correlation between construction delays and their effects on project outcomes, with a Spearman's rho value of 0.675 and a p-value of <0.001, indicating a strong positive relationship at the 0.05 significance level. This suggests that as the extent of delays increases, the negative impacts on construction projects become more pronounced.

This finding is consistent with Sambasivan and Soon (2007), who also reported a significant positive correlation between delays and their adverse effects on construction projects, including cost overruns, time overruns, and disputes. Similarly, Amoatey and Ankrah (2017), in their study of construction projects in Ghana, found that delays were significantly associated with increased project costs and extended completion times.

The strong correlation underscores the critical need for effective delay management strategies to mitigate the adverse effects on project outcomes. It highlights the importance of timely interventions, clear communication, and proactive planning to minimize delays and their negative impacts.

Table 6. Relationship between the perception of contractors and agency on the effects of delay in construction projects

Variables	Mean	rho	Level of Significance	p-value	Significance
Construction delays	3.645	0.675	0.05	<0.001	significant
Effects of delays	3.715				

Conclusion

Based on the results and findings of the study, it has been determined that there are ten major factors contributing to delays in the construction of public sector projects, acknowledged by both contractors and agency. The primary factor is the delay in the delivery of materials, followed by force majeure events such as natural disasters and pandemics. The third factor is the shortage of materials, and the fourth is the shortage of equipment. Fifth, slow decision-making from the agency significantly contributes to delays. The sixth factor encompasses improper technical studies of the project, inaccurate bid proposals submitted during the bidding period, and problems with subcontractors. Financial difficulties faced by the contractor make up the seventh factor. Eighth, delays are exacerbated by equipment failures, long delays in progress payments by the agency, and ambiguities and mistakes in specifications and drawings. The ninth factor includes work suspension by the agency, insufficient coordination among parties, and difficulties in obtaining government permits and certifications. Lastly, the tenth factor is the delay in the mobilization and start of the project.

The study further identified several key effects of construction delays on public sector projects, acknowledged by both contractors and agency. The most significant impact is time overrun, which greatly affects project timelines. Following this, cost overrun emerges as another critical consequence, posing significant financial challenges. Disputes are also a major effect, highlighting the need for better communication and management strategies. Arbitration presents more extreme outcomes, where projects may be left incomplete or require legal intervention. Lastly, litigation, though less frequent, still represents a substantial impact, often being the final recourse in resolving disputes.

Lastly, a significant relationship was noted between the delays of construction between its effects to the success of the project. It can be concluded that as the extent of delays increases, the negative impacts on construction projects become more evident. This analysis provides a robust basis for further research and policy recommendations aimed at improving project management practices in the construction industry. By addressing the root causes of delays and their effects, stakeholders can enhance project performance, reduce costs, and improve overall project success rates.

Recommendations

The study identified key factors contributing to delays in the implementation of public sector projects and their impacts on overall project success. To conduct an in-depth exploration of construction delays and capture the complexity of the issue, thereby providing actionable insights that can lead to more effective solutions, the following combination of research methods is recommended: case studies, interviews, focus group discussion (FGD), and document analysis. Each method complements the others, offering a comprehensive understanding of construction delays. Case studies and document analysis provide detailed historical and contextual data, while interviews and focus group discussions offer personal and collective insights.

Further, in the light of the findings and conclusions of the study, the following policy recommendations are forwarded to enhance project efficiency, reduce costs, and ensure timely project completion:

Transportation of Construction Materials: The agency may consider including an 18-wheeler delivery truck as a required equipment to facilitate the transportation of construction materials from nearby cities or provinces. This requirement may be assessed during site visits and included in the post-qualification criteria for winning bidders.

Provision of Storage Facilities: The agency may consider including the provision of a warehouse in their program of works (POW), allowing contractors to store necessary materials. Regular checks of warehouse inventory levels may be conducted to accurately forecast materials purchases.

Equipment management: As part of the resource assessment during post-qualification, the agency may require contractors to submit a detailed schedule of equipment utilization. Additionally, contractors may be mandated to bring the declared equipment to the project site. The agency may limit the contractor to pullout these equipment from the project site until their usage for the project is complete. This ensures availability of needed equipment at all times and that delays and interruptions in the project timeline is prevented.

Contract Termination Review Committee (CTRC): The agency may establish a Contract Termination Review Committee (CTRC) to address critical issues and concerns within the project. This committee will play a vital role in reviewing potential contract terminations and providing informed recommendations, ensuring that decisions are made fairly and transparently in accordance with Republic Act No. 9184. By creating the CTRC, the agency enhances its capacity to effectively manage and resolve contractual disputes, thus improving the overall integrity and efficiency of project execution.

Pre-Bid Conference Attendance: The agency may require prospective bidders to attend, either in-person or virtually, the pre-bid conference. During this meeting, the implementing unit will present and discuss every detail of the project comprehensively. This ensures that prospective bidders gain a thorough understanding of the project, equipping them with the necessary information to make informed decisions in preparing their financial and technical bid proposals.

Limiting Subcontracting: The agency should prohibit 100% subcontracting of the project to other entities, except in cases where the contractor lacks expertise in a specific component of the project. This ensures that the primary contractor retains overall responsibility and oversight, maintaining project quality and consistency while allowing for specialized tasks to be handled by experts.

Enhancing NFCC Measures: To ensure the awarding of projects to capable contractors, the agency may enhance their measures for determining the Net Financial Contracting Capacity (NFCC) of the contractors. Additionally, the agency may streamline the collection of information from other agencies by utilizing digital platforms, such as Google Forms, to request project status updates. This approach ensures prompt and efficient responses, facilitating a thorough assessment of the contractors' capabilities.

Equipment Service Life: To ensure that the equipment committed to the project remains in good condition, the agency may establish a threshold for the "useful life" or "service life" of the equipment. This period represents the time span during which the equipment is expected to perform optimally and deliver value before becoming less efficient or requiring replacement. The recommended maximum service life for construction equipment is approximately seven to ten years. By setting this standard, the agency can maintain high performance and reliability in project execution.

Timely Progress Payments and Quality Control: The agency may ensure timely progress payments to avoid unnecessary delays. Comprehensive reviews and quality control measures must be implemented to eliminate ambiguities and mistakes in project specifications and drawings. Clear protocols for work suspension may be established to minimize disruptions. Enhanced coordination among all parties involved is essential, facilitated through regular meetings and effective communication channels. Streamlining the process for obtaining government permits and certifications, usually done before the commencement of the project, will prevent bureaucratic delays. Finally, detailed mobilization plans with clear timelines should be developed to ensure projects start on schedule.

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