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Research Paper

Optimizing Project Management System in Construction Development: A Case Study of the Upper Cisokan Hydro Electric Power Plant

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Abstract- *This study explores project management challenges in the Upper Cisokan Hydro Electric Power Plant (UCPS HEPP) project, focusing on delays and inefficiencies in stakeholder engagement and execution processes. Key issues identified include delays in completing the Contractor's Environmental and Social Management Plan (C-ESMP), late preparation of detailed programs, the inability to provide timely financial statements, contractor's performance, including inadequate skills and systems. The study employs both qualitative methods, including observations and semi-structured interviews with key stakeholders to identify root causes and recommend solutions. Utilizing the PMBOKGuide's principles and AHP model, the study suggests that enhancing contractor skills, improving systems, and ensuring compliance with international standards are critical for project success. The findings provide practical insights for improving project management practices in similar large-scale infrastructure projects, particularly in emerging markets.*

Keywords- Project Management, UCPS HEPP, PMBOKGuide, Infrastructure Projects, AHP.

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I. INTRODUCTION

Background

Planning, scheduling, and controlling are the famous project management activities in construction field that are commonly used by practitioners in implementing various type of construction management knowledge.

Planning, in general, can be best described as the process of choosing the goals of the organization and setting up the policies, procedures, and programs needed to achieve those goals[1]. It necessitates a deep understanding of construction techniques along with the skill to envision individual work components and determine their interrelationships[2]. Scheduling aims to align the resources of equipment, materials, and labor with project tasks over time where effective scheduling can prevent production bottlenecks, ensure timely procurement of necessary materials, and guarantee the project's prompt completion[3].In essence, a schedule is the operational document that emerges from aligning the organization's available resources with the preliminary plan[4]. Controlling involves creating a system to measure, report, and forecast deviations in the project's scope, budget, and schedule. Its purpose is to identify and anticipate deviations, allowing for corrective actions to be taken[5].

[6] stated thatin large-scale projects, numerous stakeholders are involved, leading to complex relationships among them and an increase in work sequences. The duration required to complete the tasks and various uncertainty factors during implementation can result in unwanted deviations in project execution.

Business Issue

This research is made as a case study of project management activities on civil work packages of a hydro power plant project, which uses the Pink Bookof Fédération Internationale des Ingénieurs Conseils (FIDIC)as the contract condition, where the contracted parties are PLN as the Employer or the owner, CDW JV as the Contractor. The other parties involved are PLNE-NNIW JO as the Engineer or known as the supervision consultant, and the World Bank as the financing institution or known as the project lender. Contract that uses FIDIC Red Book or FIDIC Pink Book requires Engineer to administrate the contract [7].

In this research, this project case study uses Fidic Pink book as the condition of contract, or known as [8]. It defines the roles of Employer, Engineer, and Contractor. The Employer, who is named in the contract, is responsible for providing the financial arrangements and granting the Contractor access to the site. The Engineer, appointed by the Employer, acts as the representative with authority to give instructions, review, and approve the work carried out by the Contractor, while ensuring compliance with the contract. The Contractor is tasked with executing the works in accordance with the Engineer's instructions and is responsible for the adequacy, stability, and safety of all operations on-site.

The project name is Upper Cisokan Hydro Electric Power Plant (UCPS HEPP) 4x260 MW capacity as stipulated in PLN Electricity Supply Business Plan (RUPTL)2021-2030 issued by Government of Indonesia. The project is very important because UCPS contributes to achieve target of an energy mix from renewable energy above 23% by 2025[9].

From the project site office perspective, this project has gone through a very long and arduous process to get to the point where it finally started. Starting from the feasibility study report in 1995, detailed design in 2012, civil work packages contract awarded in 2015, and finally in 2023 the physical works is realized.

This project is divided into several scope of works namely civil works, metal works, transmission line works, electro-mechanical works. This study only focuses on the civil works because they are the only ongoing scopes while the other scopes are still in procurement process.The civil work projects are separated into two contract packages, namely Package 1 Lot 1A and Package 1 Lot 1B. Both contract packages were awarded to CDW JV. The main scope of Package 1 Lot 1A is to construct two dams, upper dam and lower dams, while the main scope of Package 1 Lot 1B is to excavate the waterways (intake, two headrace tunnels, two surge tanks, two penstocks, four tailrace tunnels, outlet), the powerhouse, switchyard.

PLN, the Employer, were having a situation where the project is facing delay of commencement of works as the project was effectively started in September 2022 but the physical work was started in July 2023. The reason for this is because the World Bank required his approval on a document called Contractor's Environmental and Social Management Plan (C-ESMP) prior to the execution of physical works. C-ESMP was prepared by the Contractor, reviewed by the Engineer and approved or no objected by the World Bank. The C-ESMP was the last outstanding condition for starting the works, which was finally approved on 5 July 2023[10]. C-ESMP is document is intended as a guideline by the Contractor to protect the environment (both on and off the site) and tolimit damage and nuisance to people and property resulting from pollution, noise andother results of his operations.This issue has been addressed by [11] by proposing an Project Management Office at project site office. The area of improvement proposed by [11]focus on efforts on how to start work. But now since the physical works has been commenced this research tried to see also from the elements of project management activities.

In May 2024, after almost one year of effective physical works, PLN noticed delay of percentage work progress that was written in the monthly progress report of Mei 2024. The progress of Package 1 Lot 1A was3.30% of the 4.38% plan, and Package 1 Lot 1B was 2.45% of the 5.44%. The deviation was-1.06% for Lot 1A and -2.93% for Lot 1B.

From several sources reported that problems in projects often occur. [12] mentioned that in construction projects, discrepancies often emerge between the planned schedule and the actual field progress. Delays in construction projects are typically caused by inadequate planning, poor consultant performance, inefficient management, owner influence, bureaucratic hurdles, and substandard contracts[6].Alaghbari et al. (2007), as cited in [13] stated that the primary risk factors for delays include financial and economic issues, inexperienced and unskilled contractors, consultants delaying work supervision, slow decision-making, employing unsuitable consultants for issuing instructions, and material shortages.

The project management practices in construction projects, especially in large-scale projects like the Upper Cisokan Hydro Electric Power Plant, require robust planning, scheduling, and controlling mechanisms to ensure successful completion. According to[14], effective project management involves integrating various knowledge areas, such as scope, time, cost, quality, and stakeholder management, to align project objectives with stakeholder expectations.

II. Literature Review

According to [15], project management activities involve three primary phases: planning, scheduling, and controlling. Under traditional contracts [16] studied that mainly delays happened due to poor site management, delayed payments, contractor inexperience, and design changes, highlighting the need for better management practices and timely financial processes to mitigate these delays.Another research conducted by [17] concluded that the use of a fuzzy logic-based risk assessment model effectively identifies and mitigates critical delay risks in remote power plant maintenance projects, highlighting the need for proactive planning, skilled manpower, and efficient communication to minimize project delays.

Time, Cost, and Quality

In the construction project management, the balance among time, cost, and quality remains a never-ending challenge. Achieving the optimal trade-off between these three critical objectives has been the focus of numerous studies, as construction managers strive to deliver projects that meet stringent quality requirements, within a specified budget, and on schedule [18].

Project Management Body of Knowledge (PMBOK)

The PMBOK Guide, explain in [14]is a globally recognized standard offering a comprehensive framework of processes, best practices, and guidelines to help project managers effectively manage projects within the constraints of scope, time, cost, and quality. [19] further emphasize PMBOK's role in guiding project management by organizing processes and knowledge areas for planning, executing, and controlling projects. The study highlights that applying network theory to PMBOK enhances the management of complex interdependencies, optimizes document development sequences, and improves overall project coherence, particularly in large and complex projects.

Terminology of Employer, Engineer, Contractor

In this research, the project case study follows the [8] as contract condition, where the Employer arranges financing and grants site access, the Engineer, appointed by the Employer, oversees and approves the Contractor's work to ensure contract compliance, and the Contractor is responsible for executing the work while ensuring on-site safety, stability, and adequacy.

Analytical Hierarchy Process (AHP)

The selection of an appropriate project delivery method, as demonstrated by [20], requires a systematic evaluation of a project's unique characteristics using the Analytical Hierarchy Process (AHP), ensuring alignment with project goals for optimal cost efficiency, risk management, and timely completion. Similarly, [21] highlighted the importance of a self-assessment model for risk management maturity in public construction projects in Indonesia, which enhances project outcomes and organizational resilience. Additionally, [22]) emphasizes that the AHP model offers a systematic approach for project owners to choose a delivery method that aligns with specific project characteristics, owner needs, and preferences, ensuring the method supports the project's goals and requirements.

Project Management Software

In terms of project management software [15] emphasize the importance of using advanced project management tools such as Microsoft Project, Primavera P6, etc. for effective planning, scheduling, and resource allocation to optimize project outcomes and enhance overall operational efficiency. [23] concludes that Primavera P6 is an essential project management tool that significantly enhances planning, monitoring, and control in construction projects, leading to reduced delays, optimized resource management, and cost savings, thereby addressing the limitations of conventional project management methods. [24] studied that the use of Primavera P6 in project management significantly enhances the planning, monitoring, and controlling of construction projects, leading to improved efficiency and cost-effectiveness by optimizing schedules and identifying critical issues, as demonstrated through a case study that reduced project duration by nearly five months compared to traditional methods.

The objectives of this study were to observe the causes of delays in UCPS HEPP project management activities, identify challenges, problems and their root causes, and to recommend effective project management that can be used by the Employer as to anticipate, mitigate, and minimize bigger problems in the future.

Research Scope and Limitation

The research will primarily focus on a case of management challenges at hydroelectric power plant project faced by PLN UIP JBT, with an emphasis on project management activities in a civil works of a hydroelectric power plant project, particularly due to the project delays.

III. METHODOLOGY

Research approach

This research used qualitative method as a case study approach to examine project management activities in a hydro power project. Case studies were chosen because they allow in-depth analysis of specific and complex phenomena within a particular context.

In this study, a qualitative approach was used through observation and in-depth interviews with three Employers, two Engineers, and one Contractor to understand the root causes of observed issues in the hydroelectric power project. The theoretical foundation is based on[25]. [25]emphasizes the importance of gaining a deep understanding of the meanings that individuals or groups attribute to the issues.

This research also uses an approach to get a comprehensive and simple yet effective picture of the problem at hand that occur in the various phases of the project, including planning, scheduling, and controlling.

Data Collection Process

Observation

Observations were conducted during project meetings, site visits, and daily operations. The collected data included detailed notes, team dynamics, and procedural adherence. Observations provide critical context of the element of planning, executing, and controlling such as: document preparation, field activities, measurement for payment. Observations also inform subsequent development of interview questions and helping to ensure that interviews target relevant issues.

Knowing that the project progress had a minus variance, observation was conducted to categorized problems from theC-ESMPand progress delay symptoms. There are eight problems observed as shown in Table 1.

Table 1.
Problems observed (Author, 2024)

No	Problems
1	The World Bank requires his no objection for Contractor Environmental and Social Management Plan (C-ESMP) document prior to any construction activities. Contractor needs long time to complete the C-ESMP that delays the physical works for 300 days (starting from September 2022 until July 2023).
2	Contractor was late in preparing his detailed program that causes Engineer and/or Employer could not assess and control progress report.
3	Currently the progress was delayed
4	For the purpose of payment, the Contractor is still not able to provide monthly statement or invoice as stipulated in the contract, the Contractor can only provide multiple months statement.
5	The Engineer was late in providing Cost Engineer and Planner (Schedule Engineer) that causes challenges in evaluating Contractor's Statement and Contractor's Detailed Program.
6	Contractor claims due to delay of issuance of Drawings.
7	Currently there are may be 10 Contractor's claims that are still in open case. At least one or two claims could have been closed.
8	Contractor tends to work without prior permission from the Engineer and Employer.

Semi-Structured Interviews

Following the problems that were observed, interviews were conducted with three Employers, two Engineers, and one Contractor to gather information from the respondents about the rootcauses of the problems, who is responsible for these issues, and their frequency of occurrence of the problems. The interviewswere conducted in different period of time because each respondent had different time availability. The qualitative approach focused on a deep understanding of the respondents' experiences and perspectives, allowing the researcher to interpret the meaning of the data collected and provide relevant and effective recommendations.

After collecting the data, the interview resultswererestructured to identify the main patterns and themes that emergedso can eventually be analyzed for determining the appropriate project management systems to address the most frequent issues and select suitable project management systems.

Respondents List

Respondents were selected based on their direct involvement in the project and their capacity to provide insights into the management issues being studied. The respondents in this study include:

- **Employer**: Three individuals responsible for oversight and strategic decisions within the project.

a. *Senior Manager of Operation & Construction/ Acting General Manager* is responsible for evaluating overall project development control, and coordinating technical administration activities, oversees the planning and implementation of work programs related to construction operations, and ensuring the availability of work programs and project completion plans based on contracts

b. *Manager of Project Control* is responsible for planning the execution of development work activities, evaluating construction progress,managing proposed contract amendments, coordinates with consultants or Engineer&contractors, overseeing the commissioning test preparations and ensuring smooth project handovers.

c. *Assistant Manager of Project Control*involves supervising project construction work, contract control, and construction administration. He also monitors monthly progress, handles the completion of pending project items, and coordinates communication with stakeholders to facilitate project completion.

- **Engineer**: Two individuals involved in engineering services, project administration, and site supervision.

a. *Project Director*responsible for managing the consultant teams. His responsibilities include representing the consultant team for all services to PLN, ensuring quality management, advising on technical matters, and securing approvals from PLN. He is pivotal in technology transfer and experience sharing in construction management with PLN staff

b. *Project Manager*oversees the overall management of the engineering consultant teams. He maintains close communication and liaison with PLN and other stakeholders, coordinates team activities, and ensures the smooth submission of required documents and reports. His role is critical in managing communications among PLN, the World Bank (WB), contractors, and consultants or Engineer

- **Contractor**: One individual responsible for the physical execution of the project.

*Deputy Manager/ Acting Project Manager*oversees the construction of objective structures as per the plans and specifications, ensuring that the project is completed safely, within the required time frame, and within budget. His responsibilities include planning and organizing all construction activities, reviewing drawings and specifications for constructability, and establishing cooperative relationships with subcontractors and other team members to achieve project goals.He is committed to executing construction work according to tender documents, standards, and the Employer's requirements

Analysis Process

The analysis process for this study outlines a systematic approach to identifying and addressing project management challenges in a hydroelectric power project. Figure 1 provide visualization to understand the process and the analysis.

The process begins with the Data Collection Process, which involves two primary methods: Observation and Semi-Structured Interviews. Observations are conducted initially to establish the context and surface-level issues within the project environment. This phase is crucial for understanding the dynamics and identifying preliminary problems. Following this, semi-structured interviews are conducted with key stakeholders, including three Employers, two Engineers, and one Contractor. These interviews delve deeper into the issues identified during observations, allowing respondents to provide detailed insights and perspectives. The combination of observation and interviews ensures a comprehensive data collection that captures qualitative aspects of the project challenges.

The next phase involves the quantification of interview results, where the qualitative data gathered from interviews is analysed to identify the number and frequency of distinct problems. This step is critical for prioritizing the issues based on their impact and prevalence. The quantified data is then subjected to a thorough analysis and recommendation development process. This involves synthesizing the findings to identify effective project management systems for addressing the identified issues. The goal is to propose practical solutions that can enhance project management practices, ensuring timely and efficient project delivery. This process is

aligned with the comprehensive methodological approach discussed earlier, providing a structured pathway from data collection to actionable recommendations, and ensuring that all aspects of the project management challenges are addressed comprehensively.

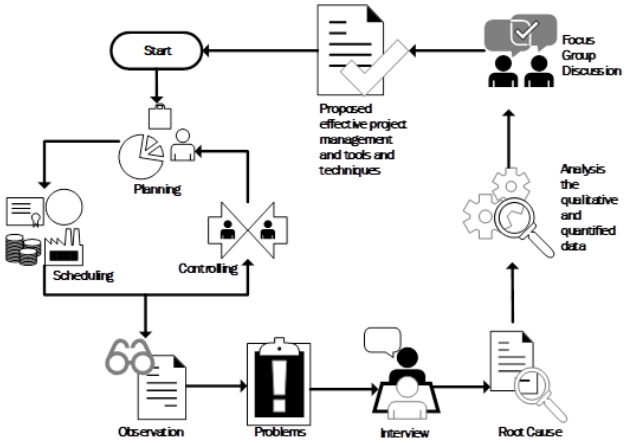

Fig 1. Analysis process (Author, 2024)

Detailed qualitative data on the issues observed and interviewed with a specific group of respondents are designated to provide an initial understanding and diverse perspectives and insights into the project management challenges.

The qualitative data from interviews is quantified to identify the number of distinct problems and the frequency with which they occur. This step helps in understanding the scope and severity of the issues.

The final step involves analyzing the quantified data to identify the most effective project management systems to fill the gap because of the problems. The aim is to recommend practical solutions to address the identified problems and improve overall project management.

IV. ANALYSIS AND RESULTS

The data collection process, comprising initial observations and subsequent semi-structured interviews, provided a comprehensive understanding of the root causes behind the project management challenges. This chapter delves into the detailed analysis of these issues, categorizes them, and presents the findings to recommend effective project management practices.

Root cause analysis

1. Delay in completing C-ESMP
One of the primary issues identified was the delay in completing the C-ESMP, which resulted in a 300-day delay in physical works. The World Bank's stringent requirements and the contractor's lack of experience and expertise in meeting these standards were significant contributing factors. This issue was highlighted by all interviewed parties, emphasizing the need for more robust preparation and the involvement of experts familiar with World Bank guidelines from the project's inception.

2. Late preparation of Detailed Programs
The contractor's late preparation of detailed programs prevented the Engineer and Employer from assessing and controlling progress effectively. This delay was due to the unavailability of experienced personnel and inadequate support from the contractor's head office. The interviews revealed that the contractor's inability to interface milestones with other project packages further complicated progress tracking and reporting.

3. Delayed project progress
The overall project progress was delayed due to multiple factors, including delays in C-ESMP approval, unavailability of quarries, and poor field coordination. The interviews underscored the need for better planning and coordination among all parties to mitigate such delays. Periodic monitoring and catch-up programs were recommended to address these issues.

4. Inability to provide Monthly Statements
The contractor's inability to provide monthly statements as stipulated in the contract was another significant issue. This was attributed to the contractor's internal system limitations and lack of experience. The interviews suggested re-evaluating the contract provisions to allow for more manageable payment processes and improve the contractor's cash flow.

5. Late mobilisation of cost engineer and planner
The Engineer's delay in providing a Cost Engineer and Planner posed challenges in evaluating the contractor's statements and detailed programs. Competitive remuneration standards and the difficulty in finding qualified candidates were the main reasons for this delay. It was recommended that the Engineer's company consider enhancing their talent acquisition and training programs to avoid such issues in future projects.

6. Delay in issuance of drawings
Delays in the issuance of drawings by the Engineer led to contractor claims and further project delays. The need for a streamlined process and clear communication between the Engineer and Employer was emphasized. Interviews highlighted the importance of periodic evaluations and a robust approval process to prevent such delays.

7. Contractor Claims
At the time of the interviews, there were around ten open contractor claims, with at least one or two that could have been resolved. The delays in addressing these claims were attributed to coordination issues and the need for a more efficient claims management process. Improving the role and performance of all parties involved in the claims process was deemed crucial.

8. Unauthorized work by Contractor
The tendency of the contractor to proceed with work without prior permission from the Engineer and Employer was another issue. This was due to inadequate understanding and adherence to the required permitting procedures. Strengthening the work permit management system and educating the contractor on its importance were recommended measures.

Quantification
Table 2 depict the matrix of problems, root causes, responsible parties, where they are quantified in a such way to give better analysisand to be a material for further synthesis.Meanwhile, the Figure 2 provide supplementary information to visualize the findings for easier understanding.

Table 2. Detailed analysis and result (Author, 2024)

No	Problem	Root Cause	Caused by	Freq.
1	Delay in Completing C-ESMP	Contractor's lack of experience and expertise	Contractor	4
		Stringent World Bank requirements	World Bank	2
2	Late Preparation of Detailed Programs	Unavailability of experienced personnel; inadequate support from head office	Contractor	6
3	Delayed Project Progress	Contractor poor workmanship including delays in C-ESMP approval	Contractor	4
		Unavailability of quarries and disposal area	Employer	1
		Poor field coordination	Engineer	1
4	Inability to Provide Monthly Statements	Internal system limitations; lack of experience	Contractor	6
5	Late Provision of Cost Engineer and Planner	Difficulty in finding qualified candidates; competitive remuneration standards	Engineer	5
6	Delay in Issuance of Drawings	Lack communication between Engineer and Employer,	Employer	2
		lack of clear project guidelines	Engineer	3
7	Contractor Claims	Delay communication between Engineer and Employer	Engineer	1
		Need for more efficient claims management process	Engineer	4
		Contractor could not provide necessary evidence	Contractor	1

No	Problem	Root Cause	Caused by	Freq.
8	Unauthorized Work by Contractor	Inadequate understanding of required permitting procedures	Contractor	5

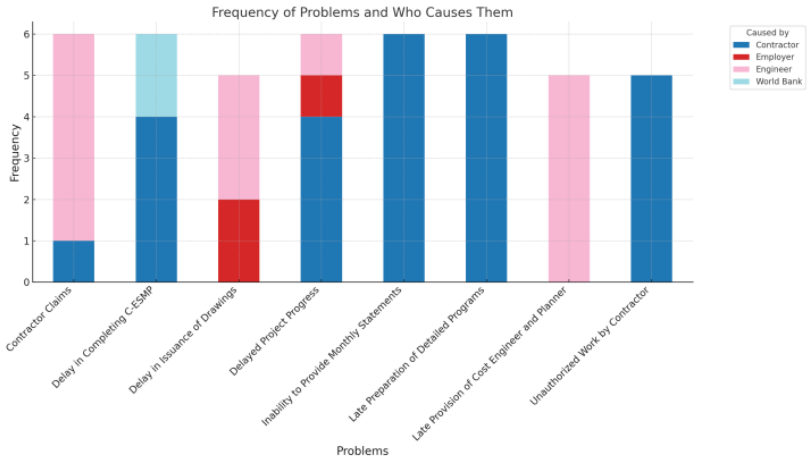

Figure 2. Frequency of problems caused by different categories (Author, 2024)

Analysis of results

According to Table 2, the Contractor emerges as the most responsible party, being directly implicated in multiple critical issues, including **delays in completing the C-ESMP**, **late preparation of detailed programs**, **inability to provide monthly statements**, and **unauthorized work**. These issues primarily stem from the contractor's lack of experience and internal system limitations, highlighting a significant need for capacity building and better internal processes.

The Engineer also holds substantial responsibility, particularly in the late provision of key personnel and issues related to the issuance of drawings. Coordination problems involving the Employer and the World Bank also contribute to some of the issues, although their impact appears to be less frequent compared to the contractor's contributions.

Contractor's shortcomings have been the most frequent and impactful, suggesting a focus on enhancing their skills, systems, and compliance with project requirements as critical areas for improvement. This should be complemented by better coordination and communication among all parties involved to address the project's challenges comprehensively.

V. DISCUSSION

Synthesize the Findings

The study of the UCPS HEPP project uncovers several critical issues caused by the Contractorin project management activities, primarily focused on delays, inefficiencies in stakeholder engagement, and gaps in the execution processes.

The delay in completing the C-ESMP resulted in a significant 300-day postponement of physical works. This delay was largely due to the stringent requirements imposed by the World Bank and the contractor's lack of experience in meeting these standards. Additionally, the contractor's late preparation of detailed programs hindered the project's ability to assess and control progress effectively. The overall project progress was delayed, influenced by factors such as the unavailability of quarries and poor field coordination. Moreover, the contractor's inability to provide monthly statements as stipulated in the contract, and the late mobilization of key personnel like the Cost Engineer and Planner, further exacerbated the project's challenges. Issues with the issuance of drawings and unauthorized work by the contractor also emerged as significant problems, indicating a lack of clear communication and procedural adherence among project stakeholders.

Link with Existing Literature

The challenges identified in this project align with broaderfindings in project management literature, particularly in the context of large-scale infrastructure projects. The [14]emphasizes the importance of integrating various knowledge areas, including scope, time, cost, quality, and stakeholder management, to achieve project objectives.

The observed delays and inefficiencies in the Upper Cisokan project underscore the critical role of effective stakeholder engagement and communication planning, as highlighted in theChapter 13 of[14]. The issues related to late preparation of detailed programs and the inability to provide timely financial statements align with the Chapter 6 and 7 of[14]. Furthermore, the delayed project progress due to factors like unavailability of quarries and poor field coordination highlights the need for proactive risk management and resource planning, as outlined in the Executing Process Group of [14] that link to several process group namely: integration management, quality management, and human resources management.

Table 3 shows the recommendation project management systems by PMBOK guide and their relevant outputs based on the analysis and the major findings and the Figure 2 visualizes the findings for easier understanding.

Table 3. Project Management System and Output (Author, 2024)

No	Knowledge Area	Project Management Process	Output
1	**Delay in Completing C-ESMP**		
	Project Quality Management	Plan Quality Management	Quality Management Plan
	Project Human Resource Management	Plan Human Resource Management	Human Resource Management Plan
2	**Late preparation of Detailed Programs**		
	Project Time Management	Develop Schedule	Project Schedule
3	**Delayed project progress**		
	Project Time Management	Control Schedule	Work Performance Information
			Project Management Plan Updates
	Project Communications Management	Control Communications	Work Performance Information
	Project Stakeholder Management	Control Stakeholder Engagement	Project Document Updates: Issue Log
4	**Inability to Provide Monthly Statements**		
	Project Human Resource Management	Plan Human Resource Management	Human Resource Management Plan

Business Solution - Priority of Project Management System by using AHP

The AHP model, in Figure 3, created based on the Employer's judgment and refined through discussions and Focus Group Discussions (FGD), aims to prioritize the most effective project management system for the UCPS HEPP project. Structured in the Super Decisions application, the model focuses on three critical factors—Time, Cost, and Quality—to evaluate the effectiveness of various management systems in addressing project challenges.Time factor emphasizes scheduling control and timely project completion to prevent delays, while the Cost factor focuses on controlling reimbursement plans and staying within budget. The Quality factor is crucial due to the stringent requirements set by the World Bank, ensuring the project meets high standards of environmental and social responsibility.

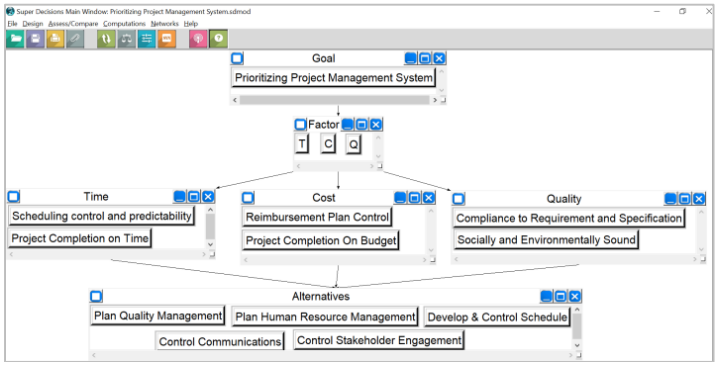

Figure 3. AHP Model of Prioritizing Project Management System (Author, 2024)

Based on Figure 4 the "Develop & Control Schedule" process emerged as the top priority in the AHP model, highlighting the critical importance of scheduling in ensuring timely project completion for the UCPS HEPP project. Given that delays in scheduling have caused significant setbacks, prioritizing this process allows the project management team to enhance scheduling practices and mitigate risks associated with project timelines.

Name	Graphic	Ideals	Normals	Raw
Control Communications		0.535124	0.186208	0.062069
Control Stakeholder Engagement		0.288159	0.100271	0.033424
Develop & Control Schedule		1.000000	0.347972	0.115991
Plan Human Resource Management		0.592107	0.206037	0.068679
Plan Quality Management		0.458404	0.159512	0.053171

Figure 4. The result of priorities of project management system (Author, 2024)

Novelties of the Study

This study provides unique insights into the specific challenges faced in large-scale hydroelectric projects within emerging markets, such as Indonesia, and especially within PLN projects.

The detailed analysis of the Upper Cisokan Hydro Electric Power Plant project reveals specific nuances in project management practices that are not extensively covered in existing literature. For instance, the study highlights the critical role of international financiers, such as the World Bank, in imposing stringent requirements that can significantly impact project timelines and execution. The need for specialized expertise to navigate these requirements is a crucial finding that underscores the importance of capacity building within the contractor's team.

Moreover, the study's emphasis on the practical challenges of aligning project activities with international standards offers valuable lessons for other large-scale infrastructure projects across Indonesia and similar emerging markets in the region. The comprehensive analysis of the root causes of delays, including the role of bureaucratic processes and the necessity for better communication and coordination among stakeholders, adds depth to the understanding of project management in complex environments. The challenges of aligning international standards with local practices, managing complex stakeholder relationships, and navigating bureaucratic hurdles are common in many Indonesian projects.This study not only confirms existing theories but also contributes new knowledge by providing a detailed case study of a high-profile infrastructure project in an emerging market, offering practical recommendations that can be applied to improve project management practices in Indonesia.

VI. CONCLUSION

This study examined the project management practices and challenges encountered in the UpperCisokan Hydro Electric Power Plant (UCPS HEPP) project, a significant infrastructure initiative in Indonesia. The analysis revealed critical issues, such as substantial delays in project progress, primarily due to the protracted completion of the Contractor's Environmental and Social Management Plan (C-ESMP), late preparation of detailed programs, and the failure to provide timely monthly statements. These challenges were further compounded by stringent requirements from international financiers like the World Bank, the

contractor's lack of experience, and poor coordination among key stakeholders, including the Employer, Engineer, and Contractor.

The findings of this study underscore the crucial role of comprehensive project planning, robust stakeholder engagement, and efficient communication processes in managing large-scale infrastructure projects. The recurring issues with the contractor's performance, including inadequate skills and systems, highlight the need for enhanced capacity building and stricter adherence to project requirements. Utilizing the PMBOK Guide's principles, the study suggests that improving the contractor's skills, systems, and compliance with project management standards is essential. This can be achieved through targeted training, better resource allocation, and a more rigorous application of project management methodologies.

The study's impact is significant as it provides practical recommendations for enhancing project management practices in similar projects. The emphasis on integrating PMBOK theories into the project's execution process offers a structured approach to addressing the identified shortcomings. Employer believes that a scheduling is the most critical aspect of improvement ofproject management process. The process of Develop and Controlling Schedule requires human resources capacity and a proper scheduling software practice as the most critical aspect thatis considered to be able tooptimize the effectiveness and balance ofcost, time and quality thatsubsequently can mitigate delays and enhance overall project outcomes. This research contributes to the broader project management literature by providing a detailed case study of a high-profile project in an emerging market, offering insights and solutions that can be applied to similar contexts globally.

Suggestion for future research

To improve project management practices in large-scale infrastructure projects, especially for project planning, it is recommended to adopt an integrated approach that emphasizes early and continuous stakeholder engagement, especially with institutions like the World Bank. In the aspect of project scheduling and controlling, the use of advanced scheduling tools, such as Primavera P6, could be use to ensure accurate project planning and tracking. Project Management Offices (PMO) as an entity would become a centralized oversight, manage resources, and facilitate communication. Future research to review contractor performance by focusing individually or collectively on stakeholder management, developing and control schedule, managing overall project management system into PMO entities would be beneficial to measure and control project performance and also ensuring that the objectives within the stipulated time, cost, and quality parameters are met.

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