

IDENTIFICATION OF RISK SOURCES AND CORRECTIVE ACTIONS FOR COST OVERRUN IN THE MANAGEMENT OF SUBCONTRACTORS FOR THE RIMP LOS PACKAGE 03 PROJECT IN INDRAMAYU, WEST JAVA

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Abstract: This research examines the sources of cost overrun risk in construction project management, focusing on the Range Irrigation Modernization Project (RIMP) LOS Package 03 in Indramayu, West Java. Through data analysis and literature review, major risk sources are identified, including inadequate supervision of subcontractors, subcontractor inability to complete tasks on schedule, and poorly coordinated design changes. Additionally, environmental project factors, such as unpredictable weather conditions and project site accessibility, are analyzed. The findings contribute to understanding project management practices and provide corrective action guidelines to mitigate cost overrun risks.

Keywords: Cost Overrun, Risk Management, Subcontractors

INTRODUCTION

West Java, as one of the regions experiencing rapid infrastructure growth, has drawn attention to various ongoing development projects. In recent years, West Java has emerged as a significant hub for infrastructure investment, encompassing the transportation, energy, and other public facilities sectors. These projects not only reflect regional economic growth but also have a substantial impact on

improving the quality of life for the surrounding communities (Jackson, 2002).

One of the prominent projects on the development map of West Java is the Realization of Oil Import Project (RIMP) LOS Package 03 in Indramayu. This project plays a crucial role in securing the national energy supply, focusing on the development of oil-related facilities. Apart from being a vital project for energy needs, RIMP LOS Package 03 also

demonstrates the complexity in construction management and subcontractor work management (Abdussalam Shibani & Kumar Arumugam, 2015).

The rapid background of infrastructure development in West Java poses undeniable challenges in managing large-scale projects. One major issue that frequently arises is cost overrun, where project costs exceed the initially established budget. Cost overrun can jeopardize the project, leading to delays and potentially impacting the sustainability of development.

The Realization of Oil Import Project (RIMP) LOS Package 03 in Indramayu, West Java, stands as a significant milestone in securing the national energy supply. With the increasing demand for energy in Indonesia, this project receives special attention as an integral part of the national energy strategy. RIMP LOS Package 03 has broad impacts not only at the local level but also nationally, highlighting its crucial role in supporting the sustainability of the energy sector in Indonesia (Plebankiewicz & Wiczorek, 2020).

The project aims to enhance oil import infrastructure, particularly in the Indramayu region, known as one of the largest oil processing centers in Indonesia. RIMP LOS Package 03 encompasses a wide scope of work, including the construction and development of oil import facilities, pipelines, and other supporting

infrastructure. Thus, the project is not only about meeting energy needs but also optimizing the national oil supply chain (Niazi & Painting, 2017).

In the context of rapid infrastructure development in West Java, RIMP LOS Package 03 becomes a significant project capturing the spirit of regional growth. Its presence not only creates jobs and local business opportunities but also brings long-term benefits through increased energy infrastructure capacity in the region. This capacity enhancement is crucial to meet the demands of the growing local community and industry.

However, like many large construction projects, RIMP LOS Package 03 is not immune to challenges. One critical aspect often faced by similar projects is effective cost management. Over time, some projects experience cost overrun, a condition where project costs exceed the established budget. This phenomenon can be caused by various factors, such as changes in the scope of work, delays, or estimation errors.

In the context of RIMP LOS Package 03, the risk of cost overrun becomes increasingly tangible, especially given the complexity of the work and its impact on subcontractor management. Subcontractors play a vital role in implementing this project, and a lack of coordination or issues in subcontractor management can negatively impact the project budget as a whole.

Cost overrun, a condition where the costs of a project exceed the initially set budget, is a serious issue often encountered in construction project management. In this context, the success and sustainability of the project can be jeopardized if not handled wisely. The phenomenon of cost overrun has the potential for significant impacts, including financial aspects, project schedule, and the overall reputation of the project.

Firstly, the financial impact of cost overrun can be severely detrimental. The meticulously crafted project budget serves as a guide for financial planning, and when costs exceed the initial estimates, it can deplete available financial resources. Unexpected additional expenditures can disrupt cash flow, place an additional burden on project financing, and even lead to an inability to meet financial obligations. This can impact the sustainability of the project, hinder progress, or even result in the premature closure of the project (Vu et al., 2020).

The second frequently observed impact is project schedule delays. Cost overrun is often accompanied by additional problems and challenges, such as changes in the scope of work, reevaluation of construction plans, and handling technical issues. All of these can result in delays in project completion, which, in turn, can trigger a domino effect on related projects and harm stakeholders relying on the

project's completion according to the established schedule.

Furthermore, cost overrun can also damage the reputation of the project and all involved parties. Stakeholder trust, including project owners, contractors, and subcontractors, can erode if the project fails to manage costs effectively. A poor reputation can impact future business opportunities, making stakeholders more cautious in providing support or getting involved in related projects. Therefore, mitigating the risk of cost overrun is not only necessary for maintaining the current project's sustainability but also for building a strong foundation for future projects.

To address these challenges, project risk management becomes crucial. Identifying potential risks early on, continuous monitoring during project implementation, and effective mitigation plans can help reduce the likelihood of cost overrun. Involvement of the entire project team, including project owners, construction managers, and subcontractors, in decision-making related to changes and cost control is also crucial.

This research has the primary objective of identifying various sources of risk that may potentially lead to cost overrun in the context of managing subcontractor work on the Realization of Oil Import Project (RIMP) LOS Package 03. The focus of this research lies in gaining a deep understanding of the risk factors that may arise during the

construction process, especially those related to the role of subcontractors.

Through qualitative approaches such as interviews, observations, and document analysis, this research seeks to identify potential risk sources that could negatively impact the project's costs. These risk sources may involve changes in the scope of work, discrepancies between cost estimates and on-site realities, and other factors that may arise during project implementation.

LITERATURE REVIEW

Project Management

Project management is a structured approach to planning, directing, and controlling resources efficiently and effectively to achieve project goals. In the context of building construction, project management is crucial to ensuring that the project adheres to the plan, meets quality standards, and stays within the predefined cost and time constraints (Mahmoud al-Mukahal, 2020). The concepts and principles of project management provide the foundation for the planning and execution of successful building construction projects.

1. **Project Planning:** Project management begins with thorough planning. This involves identifying project goals, assessing risks, scheduling tasks, and allocating resources. In the context of building construction, project planning entails a deep understanding of technical

specifications, cost estimates, and implementation schedules.

2. **Team Organization:** Project management involves organizing a project team consisting of various stakeholders, including architects, engineers, contractors, and subcontractors. Efficient team management ensures good collaboration and harmonious coordination among all parties involved in the building construction project.
3. **Project Execution:** During the execution phase, project management involves overseeing and controlling daily activities. This includes monitoring progress, handling plan changes, and addressing issues that may arise during project execution. In the context of building construction, project execution includes coordinating material deliveries, supervising construction work, and ensuring compliance with the schedule.
4. **Cost Control:** One of the key principles of project management is cost control. This involves monitoring the project budget, identifying potential cost overruns, and taking corrective action when necessary. In building construction, factors such as design changes, delays in material delivery, and changes in the scope of work can affect project costs. Cost control helps keep the project within the predefined budget limits.

5. Risk Management: Project management also involves identifying, evaluating, and mitigating risks. Risks in building construction projects may include changes in regulations, uncertainty in material supply, or weather changes affecting the schedule. Risk management involves contingency planning, insurance, and mitigation strategies to minimize the impact of risks on the project.
6. Performance Measurement: Project management requires regular performance measurement to ensure that the project is on track. This involves measuring progress, evaluating the quality of work, and monitoring key performance indicators. Performance measurement helps identify areas that require further attention or improvement.
7. Evaluation and Learning: After project completion, project management involves performance evaluation and learning. This includes analyzing what worked, what did not, and how processes can be improved in the future. This evaluation provides valuable insights for subsequent projects and enhances overall project management capabilities.

Construction Economics

Construction economics is a branch of economics that focuses on the analysis and understanding of economic factors influencing construction project costs (Bröchner, 2018). The application

of construction economic theory is crucial in designing and executing construction projects due to the complexity and involvement of various economic variables in the scope of work.

1. Inflation: One significant economic factor in construction economics is inflation. Inflation can impact overall project costs, including material prices, labor wages, and other general expenses. In the construction context, economic instability leading to inflation can result in significant cost fluctuations during project implementation. Effective project management must account for and respond to changes in currency value and inflation rates that may occur during the project timeline.
2. Fluctuation in Material Prices: Construction economic theory also addresses fluctuations in material prices. Construction material prices can change significantly due to factors such as supply, demand, and global market conditions. A profound understanding of material price fluctuations allows project managers to make more accurate cost estimates, identify potential risks of material cost increases, and take necessary mitigating steps to protect the project budget.
3. Project Economic Feasibility: The economic feasibility of a project is a primary focus of construction economic theory. A construction project must have a solid economic foundation and deliver results

commensurate with the investment made. Economic feasibility evaluation involves cost-benefit analysis, return on investment (ROI) calculations, and assessments of potential long-term income or profits. In this context, construction economic theory helps ensure that resources are allocated efficiently and that the project provides significant economic value.

4. **Changes in Economic Regulations:** Another relevant factor in construction economic theory is changes in economic regulations. Government policies related to taxation, subsidies, or economic incentives can influence construction project costs. Project managers need to understand the dynamics of changes in economic regulations and align them with project planning to minimize potential impacts on the project budget and performance.
5. **Economic Sensitivity Analysis:** In the context of construction economics, economic sensitivity analysis becomes a crucial tool. This involves testing the impact of variations in economic parameters on the project budget. For example, sensitivity analysis can model how changes in inflation rates or fluctuations in material prices can affect overall project costs. The results of this analysis provide a better understanding of potential economic risks that the project may face and aid in designing effective mitigation strategies.

Project Finance

Project finance is a critical aspect of project management, especially in the construction context, where cost overrun can have a significant impact on project sustainability and success. The application of project finance concepts helps understand, manage, and control the financial resources required to achieve project goals ("Major Finance Sources in Construction Project Delivery and Impact of Financing in the Construction Industry," 2022). Here are some relevant project finance concepts for understanding and preventing cost overrun:

1. **Cash Flow Management:** Efficient cash flow management serves as the foundation of project finance. Effective cash flow ensures adequate funds at every project stage. In the construction context, cash flow management involves meticulous handling of fund receipts and disbursements. Sound planning to ensure timely payments to contractors and suppliers, while minimizing arrears, is a key step in preventing cost overruns.
2. **Investment Evaluation:** In the concept of project finance, investment evaluation aids in assessing the project overall from a financial perspective. Cost-benefit analysis and calculations of return on investment (ROI) provide insights into whether the project has profit potential commensurate with the investment made. Comprehensive investment evaluation can help

identify potential financial risks and take necessary preventive measures.

3. **Project Financial Management Strategy:** Project financial management strategy encompasses comprehensive cost planning and control. This involves creating accurate budgets, monitoring actual expenditures, and managing potential budget changes during the project. With this strategy, project managers can ensure that costs remain controlled according to the initial plan.
4. **Financial Sensitivity Analysis:** The concept of financial sensitivity analysis aids in understanding the impact of changes in financial parameters on project costs. For example, how fluctuations in interest rates or changes in building material prices can affect overall project costs. This analysis provides better insight to project managers about potential financial risks and enables them to design strategies to handle unforeseen economic changes.
5. **Cost Control:** Cost control is a fundamental principle in project finance. It involves monitoring the project budget, identifying potential cost overruns, and taking necessary corrective actions. Project managers must regularly evaluate the budget, compare it with actual costs, and identify changes in the project scope that may affect costs.
6. **Financial Risk Management:** Financial risk management involves identifying

and mitigating potential risks that could trigger cost overruns. This includes a deep understanding of price variability, currency fluctuations, and other financial risks that may impact the project. Effective financial risk management strategies help protect the project budget from unwanted negative impacts.

Risk Management

Risk management is an integral aspect of project management, especially in the construction context where projects may face various risks that can impact sustainability and success, including cost overruns. Risk management theory provides a structured approach to identify, evaluate, and manage risks that may arise during the project lifecycle (Iqbal et al., 2015). The following are some relevant aspects of risk management theory:

1. **Risk Identification:** The first step in risk management is identifying risks. This involves identifying potential events or conditions that can affect the project's goals, including potential cost overruns. In the construction context, risks such as material price fluctuations, design changes, or delayed material deliveries can be identified as factors that may cause cost overruns.
2. **Risk Assessment:** After identifying risks, the next step is risk assessment. This involves determining the potential impact and probability of each identified risk. In terms of cost

- overruns, risk assessment may include an assessment of how much a risk could affect the project budget and how likely the risk is to occur.
3. **Risk Prioritization:** In risk management theory, prioritizing risks follows evaluation. Risk prioritization is determined by the combination of impact and probability, focusing on risks with high potential impact and high likelihood of occurrence. This helps the project focus on the most significant risks that require more intensive attention in designing mitigation strategies.
 4. **Risk Mitigation Strategies:** After significant risks are identified and prioritized, the next step is to design mitigation strategies. These strategies involve developing preventive or responsive actions to reduce the impact of risks or minimize the likelihood of occurrence. In the context of cost overruns, mitigation strategies may involve developing contingency plans, clear contract agreements, or selecting reliable vendors and subcontractors.
 5. **Monitoring and Control:** Risk management is not a static process but requires continuous monitoring and control. Projects must continually monitor the progress of implementing mitigation strategies, identify changes in project conditions or the external environment that may affect risks, and adjust strategies if necessary. Effective monitoring and control ensure that the project remains responsive to changes that may affect the risk of cost overruns.
 6. **Stakeholder Engagement:** Risk management theory emphasizes the importance of involving project stakeholders in risk identification and handling. Involving the project team, contractors, and other relevant parties in the risk management process can enrich the understanding of risks and result in more effective solutions.
 7. **Learning from Experience:** One key principle in risk management is learning from experience. Previous projects and field experiences provide valuable insights into the risks that may be faced in the construction context.
- ### **Cost Estimation**
- Cost estimation is a critical stage in project management that involves calculating the funds required to execute a project. The principles of cost estimation play a crucial role in analyzing factors that can influence the accuracy of project cost estimates and identifying potential discrepancies with the budget (Sayed et al., 2023). The following are some relevant cost estimation principles in the context of project management:
1. **Comprehensive Assessment:** Effective cost estimation requires a comprehensive assessment of all project aspects. This involves a deep understanding of the scope of work, technical specifications, material requirements, and other factors that can influence costs. This principle

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- emphasizes the need to involve experts and relevant stakeholders in the estimation process to ensure all variables are identified and assessed correctly.
2. Use of Historical Data: This principle suggests using historical data as the basis for cost estimation. Historical data, such as costs of similar completed projects, can provide valuable insights into how specific factors impact costs. Analyzing historical data allows for more accurate cost estimation, anticipating potential discrepancies with the budget.
 3. Risk and Uncertainty Analysis: Cost estimation principles involve risk and uncertainty analysis. This acknowledges that in uncertain conditions, changes can occur. Therefore, cost estimates should consider risks that may occur during the project. Identifying risks and incorporating risk values into cost estimates helps the project be better prepared for uncertainty and prevents discrepancies with the budget.
 4. Selection of Appropriate Estimation Type: Cost estimation can be divided into several types, such as conceptual estimation, detailed estimation, and design definition estimation. This principle emphasizes the importance of choosing the appropriate estimation type based on the level of detail and clarity of information available at a specific project stage.
 5. Use of Technology and Tools: The application of technology and tools in the cost estimation process can improve accuracy and efficiency. Modern cost estimation software can simplify complex calculations and provide the ability to integrate data from various sources. This principle highlights the need to leverage technology to enhance the quality of cost estimation and reduce the potential for budget discrepancies.
 6. Stakeholder Involvement: Stakeholder involvement, including contractors, subcontractors, and other experts, is a crucial principle in cost estimation. Involving them in the estimation process helps gain broader insights, obtain diverse perspectives, and ensure that all relevant variables are considered. Stakeholder involvement also helps mitigate risks and reduce discrepancies with the budget.
 7. Monitoring and Periodic Updates: Cost estimation principles emphasize the need for periodic monitoring and updates to cost estimates throughout the project lifecycle. By monitoring changes in the project environment, market conditions, and other factors, the project can make appropriate cost estimate updates. This helps anticipate and manage potential discrepancies with the budget.
- Work Relationships and Collaboration**

The theory of work relationships and collaboration plays a key role in the context of construction project management, where projects involve various stakeholders such as contractors, subcontractors, and project owners (Steils et al., 2022). Understanding and applying the principles of work relationships and collaboration are crucial for achieving project goals effectively and efficiently. The following are some relevant aspects of this theory in the context of construction projects:

1. **Effective Communication:** Effective communication is the foundation of successful work relationships and collaboration. The theory emphasizes the importance of open and clear communication among all parties involved in the project. This includes project owners, contractors, subcontractors, and other project team members. Good communication ensures that all parties have the same understanding of project goals, schedules, and expectations, reducing the likelihood of misunderstandings and conflicts.
2. **Trust and Transparency:** The theory of work relationships highlights the importance of building trust among all parties involved in the project. Trust is the foundation for successful collaboration. Involving all parties in the decision-making process, providing information transparently, and fulfilling commitments help build the trust necessary for effective collaboration.
3. **Profit and Risk Sharing:** The concept of profit and risk sharing is a collaboration principle in construction projects. This theory emphasizes the importance of creating fair contract structures and providing incentives for all parties to work together. With a balanced incentive and risk-sharing system, all parties are more motivated to collaborate and share responsibilities, reducing the potential for conflict and improving project performance.
4. **Integrated Project Team:** The concept of an integrated project team describes a collaborative approach where all stakeholders work as one team. This involves forming an integrated project team from various disciplines, including contractors, subcontractors, engineers, and project owners. Collaboration among integrated teams helps overcome communication barriers and promotes collaborative problem-solving.
5. **Conflict Resolution:** The theory of work relationships and collaboration provides a constructive approach to conflict resolution. Through open communication and dialogue, conflicts can be identified early and addressed before becoming serious obstacles to the project. Mediation and negotiation principles can also be applied to achieve mutually beneficial solutions for all parties.
6. **Change Management and Flexibility:** Collaboration requires readiness to manage change. The theory of work

relationships emphasizes the need for flexibility and adaptability in responding to changes in the project environment. Parties involved must be willing to adapt to changes in project conditions and work together to design solutions that meet new needs.

7. Joint Performance Evaluation: Joint performance evaluation is a crucial collaboration principle. By involving all parties in the evaluation process, the project can identify areas for improvement, understand what has been successful, and build learning for future projects. This creates a continuous learning cycle and strengthens work relationships.

Project Management System

Project Management System (PMS) is a holistic approach that involves planning, execution, and control of all aspects of a project (Choi & Ha, 2022). In the context of managing cost overrun, the concept of PMS is crucial for designing an integrated framework that can manage and mitigate factors that may lead to budget discrepancies holistically. The application of PMS concepts to address cost overrun includes:

1. Integrated Planning: PMS emphasizes integrated planning, starting from the project planning stage to execution. In the context of cost overrun, holistic planning includes accurate cost estimation, identification of potential risks, and setting realistic budgets. A comprehensive understanding of the

project scope and involvement of all stakeholders help ensure that planning includes all variables that may affect project costs.

2. Effective Scope Management: PMS emphasizes effective scope management to prevent uncontrolled changes. Clear identification and documentation of the scope of work help avoid unexpected changes that can lead to cost increases. Continuous monitoring of scope changes and their impact on costs helps control cost overrun.
3. Proactive Risk Management: PMS views risk as an integral part of project management. In the context of cost overrun, proactive identification and evaluation of potential risks that can affect project costs are implemented through PMS. Developing effective risk mitigation strategies helps reduce the likelihood of cost overrun and ensures readiness to face uncertainty.
4. Efficient Time Management: Time is closely related to cost in project management. PMS ensures efficient time management through good planning, proper resource allocation, and careful monitoring of the project schedule. Delays and lateness can lead to increased costs; therefore, good understanding and management of time are key to preventing cost overrun.
5. Integrated Cost Control: In the context of cost overrun, integrated cost control involves continuous

monitoring and management of costs throughout the project lifecycle. PMS enables the creation of realistic budgets, monitoring actual costs, and periodic comparisons between estimated and actual costs. Implementing strict cost control helps identify deviations early and take corrective actions before cost overrun becomes serious.

6. **Stakeholder Involvement:** PMS emphasizes active and involved stakeholder participation throughout the project lifecycle. Stakeholders, including project owners, contractors, and subcontractors, play a crucial role in cost-related decisions. Involving them in the planning process, risk evaluation, and decision-making regarding scope changes helps create common understanding and reduces the potential for conflicts leading to cost overrun.
7. **Learning and Continuous Improvement:** PMS emphasizes learning and continuous improvement as an integral part of project management. Through periodic project performance evaluations, the project can identify areas for improvement and avoid mistakes that may lead to cost overrun in future projects. Learning from experience also helps optimize cost management strategies in the future.

Previous Research

The research conducted by Nicholas Chileshe, M. Reza Hosseini, and Jacqueline Jepson, as published in the

Journal of Construction in Developing Countries (2016), focuses on investigating the critical barriers hindering the implementation of Risk Assessment and Management Practices (RAMP) in the Iranian construction sector (Chileshe et al., 2016). In developing countries, issues such as late completions, frequent work stoppages, and cost overruns are prevalent. While effective risk management (RM) has the potential to address these challenges, its adoption within the Iranian construction industry, akin to many developing nations, is constrained. The study employed a questionnaire survey involving 90 professionals from the Iranian construction industry to understand the reasons behind the underutilization of RM. The research findings reveal that practitioners perceive the primary barriers to be (1) a lack of experience, (2) insufficient availability of risk management consultants, and (3) a deficit in knowledge and requisite skills. Interestingly, professionals considered tight project scheduling and the costs associated with implementing risk management to be less significant barriers. The study does not find substantial differences in perceptions among sub-groups, including contractors, consultants, and clients (both private and public), regarding the obstacles to risk management. The contribution of this research lies in providing insights into the factors contributing to the limited implementation of RAMP in Iran, with

the expectation that such awareness will prompt improvements in risk management practices in developing countries. Additionally, the study offers practical solutions to address the identified barriers, serving as a guide for construction companies and policymakers in similar developing country contexts.

The research on "Cost Overruns in Large-Scale Transport Infrastructure Projects" conducted by Chantal C. Cantarelli, Bent Flybjerg, Bert van Wee, and published in *Automation in Construction* (2018), focuses on addressing the challenges associated with cost overruns in significant transport infrastructure projects (Cantarelli et al., 2018). The study delves into the factors contributing to cost overruns and seeks to identify effective strategies for mitigating such issues. The authors utilize their expertise to analyze and provide insights into the complexities surrounding large-scale transport infrastructure endeavors. By investigating past projects and their associated cost overruns, the research aims to contribute valuable knowledge to the field, facilitating a better understanding of the underlying causes and potential preventive measures. The findings are anticipated to inform future project management practices and policy decisions in the realm of large-scale transport infrastructure development.

The research on "Factors affecting cost overrun in construction projects"

conducted by Mohammed Algahtany, as presented in the *Proceedings of International Structural Engineering and Construction* (2021), addresses the persistent issue of low performance in public construction projects in Saudi Arabia, particularly focusing on the Northern Province (Algahtany, 2021). With cost overrun being a significant concern impacting project performance, this study aims to identify and evaluate the major factors contributing to cost overruns in education construction projects. The research methodology involves an extensive review of the literature, examination of project documentation, and interviews with industry experts. A questionnaire survey was administered to professionals engaged in construction projects to gauge the importance of various cost overrun factors. Through the analysis of the occurrence and severity of these factors, the study identifies the top causes of cost overrun, including delays in contractors' progress payments by the client, challenges in project financing by contractors, sub-contractor work delays, additions of quantities such as excavation, backfill, and concrete works, and the bid award based on the lowest price. The study emphasizes the need for evaluating and mitigating these identified risks in future projects to minimize their impact and enhance overall industry performance.

The research titled "Identification of Risk Sources and Corrective Actions for Cost Overrun in the Management of

Subcontractors for the RIMP LOS Package 03 Project in Indramayu, West Java" shares commonalities and differences with several prior studies, each shedding light on distinct aspects of construction project management.

Similar to the study by Nicholas Chileshe et al. (2016), which investigates barriers to Risk Assessment and Management Practices (RAMP) in the Iranian construction sector, both studies recognize the importance of effective risk management in addressing challenges prevalent in construction projects. While the focus of Chileshe's research is on barriers hindering the implementation of RAMP, the present study narrows its scope to the specific identification of risk sources and corrective actions related to cost overrun in subcontractor management.

In contrast, the study by Chantal C. Cantarelli, Bent Flybjerg, and Bert van Wee (2018) delves into the challenges associated with cost overruns in large-scale transport infrastructure projects. Unlike the current research, which concentrates on subcontractor management in a specific project, Cantarelli et al.'s study explores broader factors contributing to cost overruns in the context of significant infrastructure endeavors. Both studies, however, contribute to the understanding of effective strategies to mitigate cost overrun issues.

Furthermore, the research conducted by Mohammed Algahtany (2021) addresses cost overrun concerns in public construction projects in Saudi

Arabia, specifically in education construction projects in the Northern Province. While both studies share the common goal of identifying and evaluating factors contributing to cost overruns, Algahtany's work extends to the regional context of Saudi Arabia, focusing on delays in progress payments, project financing challenges, and bid awards based on the lowest price.

RESEARCH METHODS

Data Collection Techniques

This research employs a case study method as the primary approach to gather data. This approach allows the researcher to deeply investigate and analyze the phenomenon of cost overrun occurring in this construction project. Firstly, the research involves in-depth interviews with various project stakeholders, including project managers, subcontractors, and project owners. These interviews will extensively discuss the identification of risk sources, corrective actions taken, and experiences related to cost overrun. Additionally, the research will conduct an examination of project-related documents such as contracts, progress reports, and budgetary documents to gain a more comprehensive understanding of contract structures and relevant project records. Direct field observations will also be conducted to obtain a profound understanding of working conditions, interactions among parties, and project environmental factors that may contribute to cost

overrun. Furthermore, the Focus Group Discussion (FGD) technique may be applied to collectively discuss perspectives on risk sources and corrective actions for cost overrun. Data obtained, both qualitatively and quantitatively, will be analyzed to generate significant findings related to subcontractor management and efforts to prevent cost overrun in the RIMP LOS Package 03 project in Indramayu, West Java. Through this holistic case study approach, the research aims to contribute valuable insights for understanding and improving construction project management practices in Indonesia.

Data Sources

The primary data sources for this research encompass diverse aspects that provide a rich and relevant information foundation. In-depth interviews with project managers, subcontractors, and project owners serve as the primary source of information, offering direct insights into project management practices, risk source identification, and efforts to correct cost overrun. Additionally, an examination of project documents, including contracts, progress reports, and budget documents, provides accurate data regarding contract structures, budget allocations, and cost deviation evaluations. Field observations will offer a direct overview of working conditions and environmental factors influencing the project. The Focus Group Discussion (FGD) technique will be a valuable

qualitative data source, enabling in-depth discussions regarding stakeholders' perspectives on risk sources and corrective actions. Through a combination of qualitative and quantitative data from these sources, the research is expected to present a comprehensive and in-depth overview of cost overrun in the context of subcontractor management in the RIMP LOS Package 03 project.

Data Analysis

Data analysis in this research is conducted through a holistic approach utilizing both qualitative and quantitative techniques. Qualitative analysis of in-depth interviews with project managers, subcontractors, and project owners identifies potential risk sources causing cost overrun. Findings from these interviews are then integrated with quantitative data, including project budget, actual costs, and budget deviations, which are statistically analyzed to identify patterns and trends related to cost overrun. Quantitative data analysis provides a deeper understanding of the extent of cost deviation and potential primary causes.

Furthermore, the results of the examination of project documents are analyzed to validate information obtained from interviews and to gain additional context regarding contract structures and budget allocations. Field observations provide a practical dimension that allows the research to better understand working conditions

and environmental factors that may influence cost overrun. The use of the Focus Group Discussion (FGD) technique contributes valuable insights into analyzing collective and in-depth perspectives from various stakeholders regarding cost overrun. Overall, this data analysis creates a comprehensive and accurate depiction of risk sources, corrective actions, and factors related to cost overrun in the RIMP LOS Package 03 project in Indramayu, West Java.

RESULTS AND DISCUSSION

Identification of Cost Overrun Risk Sources

The identification of cost overrun risk sources is a critical factor that requires careful consideration in construction project management. Based on the conducted research, several cost overrun risk sources that need attention involve insufficient supervision of subcontractors, subcontractors' inability to complete work on schedule, and poorly coordinated design changes.

Insufficient supervision of subcontractors is a significant risk source for cost overrun. The research demonstrates that a lack of supervision of subcontractor performance can lead to unexpected project cost increases. Inadequate supervision of subcontractors can open the door to errors or negligence in work execution, causing disruptions to the project schedule and ultimately resulting in cost overrun. Therefore, the importance of effective supervision in managing the

risk of cost overrun needs to be emphasized.

Furthermore, the subcontractors' inability to complete work on schedule is also a potential risk factor for cost overrun. Limitations in skills or adequate resources from subcontractors can result in delays in work progress, which, in turn, can lead to additional costs due to project time extensions. In this context, improving the selection and periodic evaluation of subcontractors, including assessing their ability to meet established schedules, can help reduce the risk of cost overrun.

Poorly coordinated design changes are also a significant risk source for cost overrun. Unplanned design changes can sometimes lead to changes in the scope of work, which then require adjustments to the project schedule and budget. In such situations, effective coordination among relevant parties, including project owners, architects, and contractors, is crucial to managing design changes properly and preventing unnecessary cost overrun.

Other research notes that inaccurate estimates, high frequencies of implementation changes, poor quality control, corruption, and ineffective cost control in the field can also be high-value risk sources for cost overrun. This emphasizes that the identification of cost overrun risk sources must be comprehensive, involving various aspects that can influence project cost and time implementation.

By identifying potential cost overrun risk sources, appropriate

corrective and preventive measures can be taken to reduce the risk of cost overrun in subcontractor management in construction projects. Enhancing supervision of subcontractors, conducting periodic evaluations of subcontractor performance, and improving coordination between contractors and subcontractors are corrective measures that can be implemented to reduce the risk of cost overrun. Therefore, project management should prioritize the identification and mitigation of cost overrun risk sources from the early stages of the project to ensure its success and smooth implementation.

Corrective Actions

Managing the risk of cost overrun in construction projects, especially those involving subcontractors, requires careful strategies and corrective actions. Here are some concrete steps that can be taken to reduce the risk of cost overrun in the RIMP LOS Package 03 project in Indramayu, West Java:

1. **Enhance Supervision of Subcontractors:** Increasing the level of supervision of subcontractors is a primary corrective step. In this context, the main contractor must ensure that subcontractors are continuously monitored throughout the project stages. This involves direct monitoring of subcontractor activities, adhering to the established work schedule, and ensuring that the work performed meets the specified

standards. Establishing specific performance indicators for subcontractors, such as compliance with schedules and work quality, can help measure and monitor their performance effectively.

2. **Implementing advanced project monitoring technology,** such as real-time project tracking systems and the use of drones for visual monitoring of work areas, can be a beneficial investment. This technology allows the main contractor to obtain accurate and timely information about the progress of work, enabling a rapid response to changes or constraints that may arise.
3. **Additionally, forming a dedicated supervision team** responsible for monitoring subcontractors can enhance accountability and ensure that any issues are identified and addressed early on.
4. **Periodic Evaluation of Subcontractor Performance:** Periodic evaluation of subcontractor performance is a crucial step to identify potential issues and improve work quality. This evaluation can be conducted through a formal assessment process that includes parameters such as adherence to schedules, work quality, and compliance with safety and environmental standards.
5. **The main contractor should establish clear and objective evaluation criteria** so that results can be accurately measured. The results of this evaluation can be used as a basis to

- provide constructive feedback to subcontractors and establish necessary improvement measures.
6. Furthermore, involving subcontractors in the performance evaluation process can create better cooperation and enhance communication between both parties. This can create shared awareness of expected performance standards and help prevent potential conflicts that could affect project progress.
 7. **Better Coordination Between Contractor and Subcontractor:** Effective coordination between the contractor and subcontractor is a key element in reducing the risk of cost overrun. Transparent communication, regular information exchange, and cooperation in addressing potential issues are crucial in achieving this goal.
 8. The contractor must ensure that the direction and goals of the project are clearly explained to subcontractors. Regular meetings between both parties can help discuss design changes, schedule changes, or other constraints that may affect project costs. Additionally, using online project collaboration platforms can help efficiently exchange information and ensure that all involved parties have access to up-to-date information.
 9. Establishing well-coordinated protocols for handling issues or changes can also reduce the risk of uncertainty and conflicts that could

trigger cost overrun. Contractors should be proactive in responding to changes and ensure that mitigation plans are prepared to address potential issues that may arise.

The Influence of Project Environmental Factors

The Rentang Irrigation Modernization Project (RIMP) LOS Package 03 in Indramayu, West Java, is an integral part of efforts to enhance the agricultural irrigation system in the region. With a budget of IDR 270 billion, this project involves the construction of an irrigation system for the modernization of irrigation spans in West Java, particularly in Cimanuk and Cisanggarung, Indramayu Regency.

The project's environmental conditions are a critical aspect that needs attention in the management of this construction project. One of the main factors that can influence the project is unpredictable weather conditions. Adverse weather can cause work delays, trigger unplanned design changes, or hinder the delivery of materials and equipment. All of these have the potential to lead to cost overrun due to unexpected cost increases resulting from delays and changing requirements.

The project's location, approximately 20 km from the city of Indramayu, also presents its own challenges. Poor accessibility, especially if some road accesses to the project site are inadequate, can affect the smooth implementation of the project. Factors

like these can be the cause of delays in the transportation of materials and personnel, potentially leading to unexpected project cost increases.

Data analysis of this project highlights those environmental factors, especially weather conditions and project site accessibility, have a significant impact on the occurrence of cost overrun. With this understanding, the project management team can take proactive steps to manage risks arising from the dynamic project environment. Risk management strategies for cost overrun may involve:

1. **Development of Project Monitoring Information Systems:** Faced with the uncertainty of weather conditions, the development of a robust information system becomes crucial. This system can provide real-time monitoring of project progress, allowing the management team to respond quickly to weather condition changes that may affect the work schedule. By leveraging technology such as weather sensors and online project monitoring platforms, the management team can optimize project management and reduce the impact of cost overrun.
2. **Better Coordination with Contractors and Subcontractors:** In dealing with accessibility challenges, improved coordination between contractors, subcontractors, and logistics service providers is key. Thoughtful planning for the transportation of materials and personnel, including alternative

routes if necessary, can help overcome accessibility constraints. Open communication and effective coordination among all involved parties can ensure that all issues are identified and addressed promptly.

3. **Evaluation and Improvement of Supporting Infrastructure:** If accessibility becomes a major issue, evaluation and improvement of supporting infrastructure, such as access roads to the project site, can be considered. These improvements can not only enhance the current project's smoothness but also bring long-term benefits to the region.

Contribution to Project Management Practices

The Rentang Irrigation Modernization Project (RIMP) LOS Package 03 in Indramayu, West Java, with a budget of IDR 270 billion, is a strategic infrastructure project to enhance the agricultural irrigation system in the region. Research results related to its contribution to project management practices highlight several crucial aspects that can impact project management more broadly.

Risk Management: This research emphasizes the influence of project environmental factors, particularly unpredictable weather conditions, underscoring the importance of risk management in construction projects. Uncontrolled environmental factors can lead to significant changes in project plans. The project management team

needs to identify, evaluate, and manage risks related to these environmental factors to reduce their impact on project performance. This includes the formulation of effective mitigation strategies and contingency plans to address unforeseen changes.

Coordination between Contractor and Subcontractor: Improved coordination between contractors and subcontractors is identified as a significant contribution to project management practices. Environmental factors such as unpredictable weather can trigger sudden changes in project schedules or requirements. With effective coordination, the project management team can respond to these changes quickly and minimize potential negative impacts. Good coordination also ensures smooth information flow among all involved parties, supporting effective collaboration.

Resource Management: This project highlights the importance of resource management, including labor, materials, and equipment, especially in the face of unpredictable project environmental conditions. Efficient resource management and responsiveness to changes that may occur due to environmental factors can help reduce negative impacts on project performance. By monitoring and managing resource needs carefully, the project management team can optimize resource usage and avoid wastage that could lead to cost overrun.

Time Management: The influence of project environmental conditions, especially unpredictable weather conditions, also highlights the importance of effective time management. Delays due to adverse weather can have a serious impact on the project implementation schedule. Therefore, flexible scheduling and responsiveness to changes that may occur due to project environmental factors are crucial. Good time management will ensure that the project stays on track and prevent cost overrun due to cost increases that may occur due to delays.

CONCLUSION

The findings of this research identify sources of cost overrun risk that can impact construction projects, particularly in the Rentang Irrigation Modernization Project (RIMP) LOS Package 03 in Indramayu, West Java. Lack of supervision over subcontractors, subcontractors' inability to meet schedules, and uncoordinated design changes are the primary focus in efforts to reduce the risk of cost overrun.

Insufficient supervision over subcontractors proves to be a significant risk, with the potential to unexpectedly increase project costs. Ineffective supervision of subcontractors can lead to errors or omissions, schedule disruptions, and ultimately, cost overrun. Therefore, a profound understanding of the importance of effective supervision in managing the risk of cost overrun is crucial.

Furthermore, the subcontractors' inability to complete work on schedule is also identified as a potential risk factor. Subcontractors' skill limitations or resource constraints can result in delays in work progress, leading to additional costs due to project time extensions. A more meticulous selection and evaluation of subcontractors can help mitigate this risk.

Poorly coordinated design changes also emerge as a significant source of cost overrun risk. Effective coordination among involved parties, including project owners, architects, and contractors, is key to managing design changes effectively and preventing unnecessary cost overrun.

This research also highlights project environmental factors, such as unpredictable weather conditions and project site accessibility, as significant contributors to the risk of cost overrun. Effective risk management may involve the development of advanced project monitoring information systems, improved coordination with contractors and subcontractors, and evaluation and improvement of supporting infrastructure.

Contributions to project management practices are evident in the emphasis on risk management, effective coordination, resource management, and good time management. Corrective strategies such as increased supervision over subcontractors, periodic evaluation of subcontractor performance, and better coordination between contractors

and subcontractors can help reduce the risk of cost overrun.

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