Development of a Risk Management Plan for the construction of the Karian – Serpong water conveyance

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Abstract. The Karian - Serpong raw water channel construction project is a pipeline construction project to supply drinking. This water channel flows raw water from the Karian Dam in Lebak Banten to the Water Treatment Plant (WTP) located in the Serpong area. This airway project has a higher composition in its implementation, urgently needs management planning, so that the project can run well and be completed, it does not require delays. This study aims to identify risks, analyze the impact and risk response and compile them into a Risk Management Plan as a supporting document in the implementation of the construction of the Karian - Serpong water conveyance. The study was conducted using the method of Literature Study with Meta-Analysis of research that had been done before on similar construction projects. The results of this study found the supply of materials and equipment needed in the pipeline construction project was the dominant factor influencing the time performance in the pipeline development project. Environmental conditions are protests from residents around the project and the condition of busy traffic around the project is also a dominant factor affecting the speed of project implementation. As a risk response in this research is the equipment and materials must be done well before the project runs, during the project must be controlled and ensured always available in the project following with the needs of the project. Communication and coordination with residents around the project must be done well, traffic around the project must also be regulated properly so as not to regulate pipeline construction projects. It is hoped that later this Risk Management Plan can be useful for contractors in managing risks during project implementation and providing input to the Ministry of Public Works and Public Housing for subsequent implementation of similar projects.

1. Introduction
As we know that the need for clean water in Jakarta is very much. Base on data in 2019, there were about 21% of the population in Banten and 63% of the population in Jakarta are connected to an organized piped water supply system. In Jakarta, 37% of the population uses groundwater to meet their needs for clean water. To meet the needs of raw water in Jakarta and Banten, the Ministry of Public Works and Public Housing built a dam in Karian, Lebak Regency, Banten Province. Currently the dam is under construction and will be completed in 2021. In supporting its function as a source of raw water for clean water needs in Tangerang Regency, Tangerang City, South Tangerang City, and DKI Jakarta, the Karian Dam will be equipped with a Raw Water Bearer Channel Serpong – Karian Conveyance.
System / KSCS that connects the intake of the Dam Karian is located in Lebak Regency Banten to a Water Treatment Plant (WTP) in Serpong, South Tangerang City [1].

In water construction project, the phenomenon of delays in infrastructure development is an obstacle that often occurs. The causes of project delays can be seen from several sides including material, labor, equipment, costs or capital, design changes, relationships with related agencies, scheduling and control, slow monitoring and testing procedures, environment, contractual issues, and the absence of consultant managers who professionals [2]. The factors that have the potential to cause project delays are incomplete drawings and specifications, changes in planning during the implementation process, poor managerial in contractor organizations, work plans that are not neatly arranged/integrated, contractor failures in carrying out work [3]. The study in Kenya found out that stakeholder communication positively and significantly influences irrigation project performance [4]. Regarding the hilly area project in India, the most sensitive risk group can be identified as an environmental and geological risk, execution risk, and resource risk [5]. The result of the study of pipe construction in Bahrain indicated that inadequate project planning, budgeting, and scheduling, scope variation, and late materials delivery were the main delay causing factors [6]. Design and study, land acquisition, financing, licensing, and equipment have a large impact on project performance [7].

The KSCS project, which has a high complexity, has a high-risk potential at the implementation stage because of the scope of the project's work area is very broad with unpredictable natural conditions. To anticipate the occurrence of risks during the implementation phase of the project it is necessary to anticipate before the project starts. Project risk management planning is urgently needed so that the impact on potential risks can be minimized or even eliminated so that it does not result in project delays. Therefore, research is needed to analyze and identify potential risk factors at the project implementation stage so that a KCSC project risk management plan is produced so that the project can run well and not experience delays.

Risk Management Plan (RMP) is needed to prevent the occurrence of risks and/or reduce the impact of risks that arise at the project implementation stage so as not to cause adverse impacts on project implementation [8]. Having a good Risk Management Plan at the project implementation stage can improve the project's time performance so that the project can be completed on time and not experience delays to prevent significant impacts as described above.

2. Methods
The method in this study uses a literature analysis that is consistent with the research topic. Literature material that is used as a source is literature relating to the construction process of water pipelines in Indonesia and abroad. The researcher in this paper used a method with analyzing academic articles through a literature review (meta-analysis) system [9].

![Figure 1. Research methodology.](image)

2.1. Research question
The first step in this research is determining the research question. Research questions in this study are:
- What are the dominant risk factors that influence the timing of project implementation?
- What are the risk response to the dominant risk factor?

2.2. Literature review
At the literature review stage, researchers use the literature relating to similar projects [10]. Based on literature studies at the waterway construction stage, many risk factors occur and affect project
performance. Risk factors for the construction of raw water pipeline Karian - Serpong are divided into several categories: people, material, equipment, environment, method, and management. The following are risk factors in the construction of water channel construction taken from several literature studies on water channel construction.

2.3. Meta analysis
After compiling possible risk factors, an analysis is carried out based on the results of previous studies on water channel and water pipeline construction projects. Based on this analysis, it is found that the dominant risk factor in similar projects.

2.4. Risk response
Dominant risk factors are analyzed to obtain risk responses from each dominant risk factor. Based on these data, a Risk Management Plan document can finally be made on the construction of the Serpong Karian raw water channel project which affects time performance.

The scope of this research is only at the construction stage of Karian Serpong raw water channel construction. The risk factors analyzed in this study are limited to the risk factors that influence the time performance of the project. This research is based on a literature study of research that has been done before.

3. Results and discussion
In previous studies, the risk factors that occur during the construction phase are analyzed so that a dominant risk factor is obtained which has the potential to cause delays in project performance. Based on the results of a research literature study that has been done before, there is the highest risk factors greatly affect the performance time of the Karian Serpong raw water construction project.

| No | Risk Factor                                                   | Portion |
|----|--------------------------------------------------------------|---------|
| 1  | Environmental risk (community protest, existing utilities, traffic) | 16.67%  |
| 2  | Material risk                                               | 16.67%  |
| 3  | Equipment risk                                              | 13.33%  |
| 4  | Budgeting risk                                              | 10.00%  |
| 5  | Incomplete drawing, specification & planning                 | 10.00%  |
| 6  | Scheduling, control, & monitoring                           | 10.00%  |
| 7  | Communication / relationship (stakeholder)                   | 6.67%   |
| 8  | Poor managerial in contractor organization                   | 3.33%   |
| 9  | Contractor failure                                          | 3.33%   |
| 10 | Execution risk                                              | 3.33%   |
| 11 | Scope variation                                             | 3.33%   |
| 12 | Labor                                                       | 3.33%   |
|    |                                                               | 100%    |
The three highest risk factors greatly affect the performance time of the Karian Serpong raw water construction project are environmental risk, material risk and equipment risk. The risk response are:

3.1. Environmental risk

3.1.1. Community protests occurred around the project site [11]. Risk Response:
- Conducting socialization to the community around the project about the pipeline project development plan, explaining the project objectives and project schedule [12]
- Socialization to residents around the project must be carried out before the project starts so that all existing problems can be resolved before the project starts.
- It is hoped that through socialization the community must understand the aims and objectives of the project and must be a mutually beneficial solution.

3.1.2. The existing utilities in job sites (PLN, Telkom, Pertamina, and others) [12]. Risk Response:
- Communication with parties who use project land must be done in the planning process so that it can collaborate with existing utilities [13]
- Communicating and coordinating with the owner of utilities regarding the planned construction of raw water channels [14]
- Request utility data and maps to the utility owner
- Provides safe signs of utilities before the excavation process begins

3.1.3. There is traffic disruption around the project site [11]. Risk Response:
- Before the project starts modification of traffic flow must be made so that it does not interfere with project implementation and traffic flow is not interrupted [15]
- If there is no traffic modification, then the project boundary must be made and traffic signs installed

3.2. Material

3.2.1. Delay in procurement of materials needed in the project [6]. Risk Response:
- Supplier performance measurement and evaluation
- Project and supply chain department corporation and feedback
The supplier selection should be based on many important criteria (reputation, quality of service, supplier commitment).

3.3. Equipment

3.3.1. Lack of equipment needed in the project [2]. Risk Response:
- Ensuring equipment needs before the project starts
- Immediately repair or replace damaged equipment, adjusted to the condition of the equipment and project conditions
- Perform daily control of the equipment to determine the condition of the equipment

3.3.2. Damage to the project equipment [11]. Risk Response:
- Immediately do repairs if there is equipment that is damaged so that the equipment can be used again
- Looking for alternative suppliers to carry out equipment repair

4. Conclusion

The Risk Management Plan is very important to anticipate potential risks in the Karian - Serpong raw water construction project. Based on the analysis of previous studies, it can be concluded that:
- Project equipment is very influential on project performance, delays in procurement of project equipment and damage to project equipment will hamper project performance
- Material procurement must always be controlled from the amount of material stock in the warehouse, material procurement should not wait for the material to run out
- Communication and coordination with utility users must be carried out before the project starts and during the project to avoid conflicts between utilities
- Traffic must be planned and arranged properly during the construction process so as not to interfere with the construction
- Communication and coordination with people around the project must be carried out before the project and throughout the project to maintain good relations with them

5. Limitations and future works

The study was conducted only at the construction stage and only reviewed risk factors that influenced the timing of project completion, especially in water pipe projects. This paper only analyzes risk factors based on a literature review on water pipeline projects but does not include project cost analysis. Research development for the future can be extended to project cost performance.

References
[1] Korea Rural Community Corporation 2011 Master Planning and Feasibility Study of the Karian Dam Serpong Water Conveyance and Supply System (RI Ministry of Public Works Vol. VI 5)
[2] Assaf S A and Al-Hejji S 2006 Causes of delay in large construction projects International Journal of Project Management 24 239-357
[3] Proboyo B 1999 Project delay time: classification and ranking Dimensi Teknik Sipil 1 1
[4] Norah M, Onyango J and Olango 2018 Influence of stakeholder communication on performance of kabonan-kapkamak irrigation project in elgeyo marakwet county Africa International Journal of Multidisciplinary Research 2(5) 60-67
[5] Nishaant H, Anad T, Sachin P P and Dayaamadan M 2018 Risk mitigation of construction projects in hilly areas International Journal of Recent Technology and Engineering 7 4S
[6] Reyadh M M M and Saad M A S 2019 Delay in pipeline construction projects in the oil and gas industry part 1 risk mapping of delay factors International Journal of Construction Engineering and Management 8(1) 24-35
[7] Hernoni S M, Agung W and Syafrudin 2015 Application of risk management in the development of the central java regional water supply system case study in the development of the regional bregas water supply transmission network Journal of MKTS 21 2
[8] Project Management Institute 2017 A Guide to The Project Management Body of Knowledge 6th edition Pennsylvania, USA
[9] Nicholas M Svetlana V K 2019 Meta analytic methodology for basic research : a practical guide Front Physiol 10 :203
[10] Hannah S 2019 Literatur review as a research methodology an overview and guidelines Journal of Bussiness Research 104 p333-339
[11] Ervin J M 2018 Development of risk management plan on clean water pipeline construction project Thesis University of Indonesia
[12] Imran H, Shazia A and Kashif R 2011 The impact of stakeholder communication on project outcome African Journal of Business Management 5 14
[13] Anita C 2014 Minimizing communication risk in construction a delphi study of the key role of project managers Journal of Civil Engineering and Management 20 6 p829-838
[14] Maurice O O and Makori M 2017 Influence of stakeholder participation on completion of water supply and sanitation projects in nairobi city county kenya The Strategic Journal of Business and Change Management 4 Iss 34 pp42-59
[15] Tatan R 2017 Risk study implementation stage construction project leuwigong dam irrigation network improvement project Infrastructure Journal 3 01