wjert, 2021, Vol. 7, Issue 2, 147-XX. *Original Article* ISSN 2454-695X

World Journal of Engineering Research and Technology

WJERT

www.wjert.org Impact Factor Value: 5.924

IDENTIFICATION OF RISK MANAGEMENT IN THE DEVELOPMENT OF A REGIONAL DRINKING WATER SUPPLY SYSTEM (SPAM) PASIGALA CENTRAL SULAWESI PROVINCE

Abdul Wahab*[1], Dr. Tutang Muhtar K.[2] and I. Gede Tunas[3]

[1]Postgraduate Student of Civil Engineering Department, Tadulako University, Palu.

[2,3]Lecturer at the Postgraduate Department of Civil Engineering, Tadulako University, Palu Soekarno Hatta Street Km. 9 Palu 94118.

Article Received on 29/01/2021 **Article Revised on 19/02/2021** **Article Accepted on 09/03/2021**

***Corresponding Author**
Abdul Wahab
Postgraduate Student of Civil Engineering Department, Tadulako University, Palu.

ABSTRACT

The construction of the Pasigala regional SPAM mega project in its implementation may also carry risks, both large and small, which must be taken seriously. This is related to the impact of the risks that arise which can hinder and harm the project executor in terms of cost, time, quality and scope of work. The objective of this research is to identify risk management in the development of the Pasigala Regional Drinking Water Supply System (SPAM), Central Sulawesi Province. This type of research is a case study. Data analysis was performed through validity testing, reliability testing, risk variable analysis, probability and impact analysis, and risk response. The results show that there are 6 risks that fall into the high category, these risks are the quality of drinking water is not as expected, the Water Treatment Plant (IPA) has never functioned according to the planned capacity, the raw water transmission pipe is not according to its designation, the design of the raw water production unit that has not been able to overcome turbidity due to sedimentation, natural disasters in the location area, and damage to the ecosystem around water sources. The response of expert respondents regarding this risk is to build settling tanks / mud bag and at a pressure of > 70 meters for PVC and HDPE pipes and for steel pipes if the pressure is > 100 meters it is necessary to make a Press Release Tub (BPT), and filter tub, make repairs, install an appropriate raw water transmission pipe. with the plan / design, however this is done if the repair budget is sufficient, performs repairs in several water filter facilities, strengthens and reconstructs a number of damaged transmission pipe buildings, and conducts socialization or education to the public, which is planned to be assisted by agencies competent in the environmental field.

KEYWORDS: Identification, Risk Management, SPAM Development, Pasigala.

INTRODUCTION

Topographically, Palu Sigi Donggala (Pasigala) is an area with a descending contour which is gravitationally advantageous to support the drinking water distribution system. Most of the drinking water for household consumption in this area comes from the supply of the Drinking Water Company (PDAM), from wells. Sources of raw water currently used to meet the drinking water needs of the Pasigala people include ground water in the form of deep wells, surface water in the form of a Water Treatment Plant (IPA), and some using springs. In 2009, the state, through the Ministry of Public Works and Public Housing (PUPR), launched a Drinking Water Supply System (SPAM) mega project in Central Sulawesi. This work is carried out in multi-years . The SPAM mega project in the cities of Palu, Sigi and Donggala, hereinafter referred to as SPAM Pasigala.

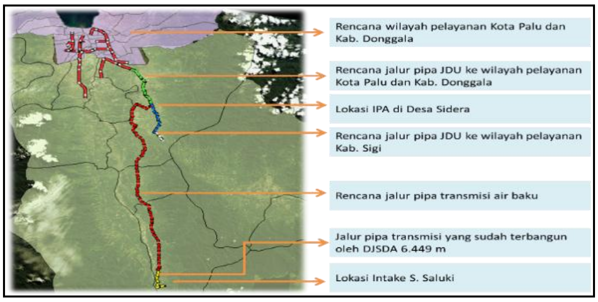

Figure 1: Map of the Pasigala Regional SPAM Plan.

The Pasigala SPAM mega project was built through a cooperation agreement between the central government, provincial and district / city governments Number 24 / NKB / D / 2014, dated 17 December 2014. In the agreement stated that the Pasigala Regional SPAM (Palu, Sigi, Donggala) will be used in 2016, through the utilization of the Saluki River raw water source, where the unit production is in Oloboju Village, Sigi Regency which is a interconnected to all clean water supply services for household and industrial needs, including the Special Economic Zones in Palu, Sigi and Donggala. More than Rp. 500 billion of the state budget has been disbursed to the construction of SPAM Pasigala, but the first trial failed. The pipe is broken, the resistance of the pipe is not able to withstand the speed of water with a capacity of 300 liters per second. Until now, Pasigala SPAM has not functioned properly and has added value to the Pasigala community, this is due to several aspects that have become obstacles in the implementation of the Pasigala Regional SPAM, Central Sulawesi Province.

The September 28 disaster destroyed the entire network of clean water installations throughout the Pasigala area, including the Pasigala SPAM, of course, and clean water has become a major, crucial and fundamental problem. After the disaster, SPAM Pasigala, one of the top priorities in the recovery program in Pasigala. But when the first trial failed. The pipe is broken, the resistance of the pipe is not able to withstand the speed of water with a capacity of 300 liters per second. Of course, this incident is one of the risks caused by technical errors in construction. Then another problem is the frequent occurrence of flooding which is followed by the accumulation of sediment in the raw production unit, this causes a high level of turbidity of raw water. Meanwhile, the Water Treatment Plant (IPA) has never functioned according to planned capacity due to problems with transmission pipes that are not in accordance with the plan / design, and the management of bulk water services has not been implemented because SPAM Pasigala has not been clearly regulated in the Regional Regulation regarding service rates. the.

The construction of the Pasigala regional SPAM mega project in its implementation may also carry risks, both large and small, which must be taken seriously. This is related to the impact of the risks that arise which can hinder and harm the project executor in terms of cost, time, quality and scope of work. Rahman (2016) states that operational risk is the potential for loss due to human error or failure of processes and controls in daily operations. Operational risk management aims to anticipate potential losses that have occurred or are about to occur due to inadequate or malfunctioning of internal processes, human error factors, system and technology weaknesses or various external factors that may negatively affect operations.

Sugiyanto (2018), states that risk analysis is needed in all organizations, regardless of small or large scale, profit or non-profit orientation. Management must be able to manage risk optimally in order to achieve its objectives. Risk management is important to be carried out, considering that risk is an event that has consequences and can hinder the construction process. The obstructed construction implementation can interfere with the three aspects mentioned above. It is hoped that the risks can be identified, analyzed, handled, and minimized as best as possible and can be taken into consideration for risk analysis in other jobs.

According to Ramli (2010), risk management is very important for the continuity of a business or activity. If a disaster occurs, such as fire or damage, the company will suffer huge losses, which can hinder, disrupt or even destroy business continuity or operations. Risk management is a tool to protect the company from any possible harm.

Risk management is one of the most crucial activities in implementing infrastructure development projects today. It cannot be denied that the increasingly complex times have made the implementers have to face increasingly complex challenges. Rahman (2016) reveals that these challenges can stem from the problems of globalization, scarcity of quality personnel, technological evolution, product differentiation, consolidation, and increasingly stringent regulations. If risk management is not implemented, it is likely that various kinds of risks will arise and threaten the viability of a project. Therefore the title of this research is "Identification of Risk Management in the Development of Regional Drinking Water Supply System (SPAM) of Pasigala Regional, Central Sulawesi Province".

LITERATURE REVIEW

Construction Project

Projects have become so widespread in today's world that individuals and organizations are constantly involved in various projects. Almost all projects are distinguished from two main aspects: inherent characteristics and environmental conditions (Kahraman, 2008).

Fortunately, in recent years, many scholars have discovered the importance of discussing the complex- ity of new project management and seeking to identify various aspects of project complexity and provide appropriate solutions for them (Lu et al., 2015). However, the maturity of management science projects in terms of complexity is still very low and compared to other project areas, management knowledge is not quite advanced. Most studies only in this regard provide some basic conceptual model or identify a number of factors of complexity in the project. Therefore, more studies and efforts are needed to provide a comprehensive framework for integrated management and control of complex projects (Lessard et al., 2014).

Project management is an important task that requires the best people for this responsibility. The most qualified project manager allocation is a complex subject, as there are many issues that need to be addressed. Recently, complexity management has become another important aspect of project management, which must be carefully considered. Therefore, in this study the problem is the structure of the relationship between project complexity and project manager benefit criteria that has been examined (Makui , et al., 2018).

Definition of Risk

According to ISO 31000 as quoted by Mardjono (2015), risk has a neutral nature because the consequences associated with risk can increase the achievement of goals (i.e. positive consequences) or can limit or reduce the achievement of goals (i.e. negative consequences).

Risk management

Risk assessment and risk management as a scientific field is still young, no more than 30-40 years old. From this period we see the first scientific journals, papers and conferences covering the basic ideas and principles of how to assess and manage risk appropriately (Av a en, 2016). Huda (2019), revealed that a risk specification due to risk management consists of: low labor productivity, low work productivity, lack of understanding of the health and safety aspects of work in the field, work accidents, lack of communication between workers and workers in disputes or disputes. The results showed that the risk management aspect had a positive and significant impact on project risk.

Risk Management is part of the operational strategies of most of the world's leading banks and QIB is interested in considering issues related to Risk Management. This research has conducted a preliminary study to examine some of the basic elements of risk management that can be applied to QIB so that a hypothetical model can be developed that can be tested and used to make recommendations to strategic bank managers. In this context, the following dimensions of risk management are important to discuss in detail (Nair, 2014).

Risk management has become one of the main concerns of executives and professionals involved with projects today, especially after the financial crisis that shook the world in 2008. The results of ex-post project assessments or even verification of business opportunity losses for companies clearly indicate that this evidence is becoming stronger (Junior, 2013).

According to ISO 31000, the risk management process consists of several stages, as described in the following figure.

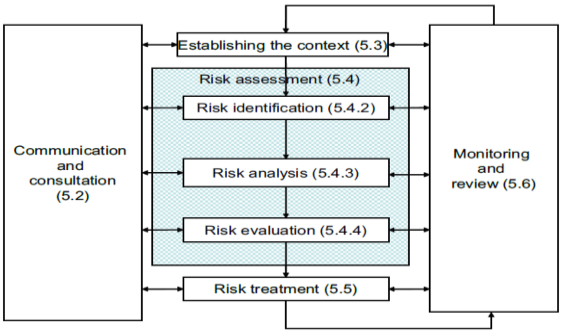

Figure 2: Components of the Risk Management Process (Ramli, 2010).

This seems to imply that undervalued risk, in the sense that no premium is earned from managing it - only the potential for loss is reduced, is a key driver in current risk management practices, while managing valued risk, which is part and parcel of the decision-making process associated with future growth. in the future, not yet fully embedded in national change organizations and the innovation process (Taran, 2013).

RESEARCH METHODS

Location and Time of Research

The location of the research was carried out at the construction of the Pasigala Regional Drinking Water Supply System (SPAM), Central Sulawesi Province. Where the project is built along 42.18 km. Research time starts in October 2020.

Figure 3: Map of the Pasigala Regional SPAM.

Types of research

The type of research to be carried out is a case study at the Pasigala Regional SPAM. Researchers will go directly to the object to be studied and will carry out an in-depth analysis related to the implementation of risk management in the implementation of the project.

Data analysis technique

Data analysis in this study used quantitative statistical analysis techniques SPSS software , with several processes as follows:

1. Analysis of Risk Variables

This analysis is used to identify relevant risk factors. These risk factors will increase which come from the experiences of the respondents and are not included in the literature study. From the data, it is found that the risk variables are relevant or not relevant to the project. The data was obtained from several respondents. To get results that represented the answers of several respondents, an analysis was carried out using the Guttman scale. According to Sugiyono in Isnaini (2016), when Guttman is a scale used to get firm answers from respondents, there are only two intervals such as "agree-disagree"; "Yes No"; "True False"; "Relevant-irrelevant"; "Positive-negative"; "Never-never" and others ". This measurement scale can produce questions in the form of multiple choice or check lists, with the answers being made the highest score (agree) one and the lowest (disagree) zero.

2. Probability and Impact Analysis

An analysis is carried out to determine the level or magnitude of the risk and impact on the continuity of the project, namely cost, time, quality and risk response carried out. The data obtained from the questionnaire part 2 were analyzed to obtain representative results from several respondents. The first step is to carry out an analysis using a *severity index* and then categorize it based on the probability of impact. The calculation of probability and impact uses the *Severity Index* formula as follows: (Al-Hammad, 2000).

$$SI = \frac{\sum_{i=0}^{4} a_i x_i}{4\sum_{i=0}^{4} x_i}\ (100\%)$$

Where:

ai = constant rating

xi = probability of the respondent

i = 0, 1, 2, 3, 4, 5,…, n

x0, x1, x2, x3, x4 are the respondents' probability responses

a0 = 0, a1 = 1, a2 = 2, a3 = 3, a4 = 4

x0 = probability of the respondent "very low," then $a_0 = 0$

x1 = probability of respondent "low," then $a_1 = 1$

x2 = probability that the respondent is "high enough," then $a_2 = 2$

x3 = probability of the respondent "high," then $a_3 = 3$

x4 = probability that the respondent is "very high," then $a_4 = 4$

The classification of the rating scales on *probability* and impact is as follows (Majid and McCaffer, 1997):

1: Very Low / Small (SR / SK) = 0.00 <SI <20.0

2: Low / Small (R / K) = 20.0 <SI <40.0

3: Fair / moderate (C) = 40.0 <SI <60.0

4: Height / Large (H / B) = 60.0 <SI <80.0

5: Very High / Large (ST / SB) = 80.0 <SI <100.

The scale used in measuring the potential risk to the probability and impact of risk is a Likert scale using a range of numbers 1 to 5, as follows:

Assessment of the risk *probability* (P): 1 = very low, 2 = low, 3 = medium, 4 = high, 5 = very high.

Assessment of impact (*impact*) the risk (I): 1 = very little , 2 = a little, 3 = moderate, 4 = large, 5 = very large.

Table 1: Risk Level Matrix.

Sangat Tinggi (5)	5 M	10 H	15 H	20 E	25 E
Tinggi (4)	4 L	8 M	12 H	16 E	20 E
Sedang (3)	3 L	6 M	9 H	12 H	15 H
Rendah (2)	2 L	4 L	6 M	8 M	10 H
Sangat Rendah (1)	1 L	2 L	3 L	4 L	5 M
Probabilitas / Dampak	Sangat Kecil (1)	Kecil (2)	Sedang (3)	Besar (4)	Sangat Besar (5)

Information: L: *Low* with a risk value of 2 - 5, M: *Medium* with a risk value of 5 10, H: *High* with a risk value of 12 - 20.

3. Risk Response

To find out how a determined response is to a risk, a literature review and interviews are conducted with contractors, consultants and *owners* of several respondents who have been previously selected, regarding risk responses to risks that have been obtained from previous risk analyzes. The risk variables responded only to the risk in the high category, which is the risk with the highest probability of occurrence and the greatest impact.

RESULTS AND DISCUSSION

Risk Management in the Development of the Pasigala Regional Drinking Water Supply System (SPAM), Central Sulawesi Province

Identification of Risk Variables

The relevant information is that the risk variable is likely to occur in the project or has already occurred, while the irrelevant information is that the risk variable does not have the possibility to occur or never occur in the Pasigala SPAM development project. For positive or agreeable answers, they are given a score of 1, while for negative or not given a score of 0. The score of the answer is then totaled, if the total score is more than half of the total number of respondents, the answer is positive and vice versa (Situmorang, 2018). The results of risk identification can be seen in table 6 below.

Table 6: Preliminary Survey and Expert Respondent Assessment.

Symbol	Risk Variable	Relevant	Irrelevant	Relevant
R1	Increase in material prices	4	1	Relavan
R2	There was a delay in work schedule	2	3	Irrelevant
R3	Errors in estimating and planning cost budgets	4	1	Relavan
R4	Increased costs for non-technical factors	3	2	Relavan
R5	Difficult and unpredictable field conditions	4	1	Relavan
R6	Uncertainty in material availability	0	5	Irrelevant
R7	Security conditions on site	3	2	Relavan
R8	Poor quality of implementation	5	0	Relavan
R9	Poor management of operational and maintenance activities	5	0	Relavan
R10	The quality of drinking water is not as expected	4	1	Relavan
R11	Method of implementation that is not / less precise	3	2	Relavan
R12	Internal conflict in management	0	5	Irrelevant
R13	There are people who are not responsible	0	5	Irrelevant
R14	The Water Treatment Plant (IPA) has never functioned according to planned capacity	5	0	Relavan
R15	Difficulty in procuring materials	4	1	Relavan
R16	High rate of material breakdown	0	5	Irrelevant

R17	Errors in applying standard construction methods	0	5	Irrelevant
R18	Does not follow the work staging procedure	4	1	Relavan
R19	The raw water transmission pipe does not match its designation	4	1	Relavan
R20	Waste of material on site	4	1	Relavan
R21	Inefficient use and cutting of material shapes	2	3	Irrelevant
R22	Careless handling of materials	3	2	Relavan
R23	Little coordination	4	1	Relavan
R24	Administration and documentation system for operational and maintenance activities	0	5	Irrelevant
R25	Low evaluation and decision-making systems	5	0	Relavan
R26	Low material control	4	1	Relavan
R27	There are equipment / materials that must be imported	0	5	Irrelevant
R28	The performance of the equipment used is not good	2	3	Irrelevant
R29	The design of the raw water production unit has not been able to overcome turbidity due to sedimentation	4	1	Relavan
R30	Equipment malfunction	5	0	Relavan
R31	Lack of equipment	5	0	Relavan
R32	The occurrence of a natural disaster in the location area	5	0	Relavan
R33	The occurrence of national security instability	2	3	Irrelevant
R34	There was a demonstration of resistance from the community	1	4	Irrelevant
R35	There is an unstable ground movement	5	0	Relavan
R36	There is a change of local officials	0	5	Irrelevant
R37	Damage to the ecosystem around water sources	5	0	Relavan
R38	Weaknesses in resolving disputes between certain parties	0	5	Irrelevant

Source: Primary Data Processed, 2020

From the results of the analysis described in the table above, it is known that there are 24 risk variables that are considered relevant, and as many as 14 risk variables that are considered irrelevant, thus for the next stage there are 24 risk variables that can be further processed in the main survey activity.

Risk Variable Analysis

a. Probability Assessment

Obtained the Severity Index value is 57, then the probability category of the risk variable for material price increases is sufficient (40.0 <SI <60.0). Based on the data obtained through distributed questionnaires, the results of the risk probability assessment analysis for all risk variables using the Severity Index (SI) method can be seen in the following table.

Table 7: Risk Probability Assessment.

No.	Risisko Variable	Probability					Total	SI Value (%)	Category
		SR	R	S	T	ST			
1	Increase in material prices	0	6	10	14	0	30	57	C
2	Errors in estimating and planning cost budgets	5	8	13	3	1	30	39	R
3	Increased costs for non-technical factors	7	12	8	3	0	30	31	R
4	Difficult and unpredictable field conditions	6	18	6	0	0	30	25	R
5	Security conditions on site	1	7	9	12	1	30	54	C
6	Poor quality of implementation	5	21	4	0	0	30	24	R
7	Poor management of operational and maintenance activities	5	13	11	1	0	30	32	R
8	**The quality of drinking water is not as expected**	**0**	**1**	**10**	**19**	**0**	**30**	**65**	**T**
9	Method of implementation that is not / less precise	5	15	9	1	0	30	30	R
10	**The Water Treatment Plant (IPA) has never functioned according to planned capacity**	**0**	**5**	**10**	**13**	**2**	**30**	**60**	**T**
11	Difficulty in procuring materials	0	10	10	10	0	30	50	C
12	Does not follow the work staging procedure	4	14	9	3	0	30	34	R
13	**The raw water transmission pipe does not match its designation**	**0**	**0**	**11**	**17**	**2**	**30**	**68**	**T**
14	Waste of material on site	0	8	14	8	0	30	50	C
15	Careless handling of materials	5	13	11	1	0	30	32	R
16	Little coordination	2	10	17	1	0	30	39	R
17	Low evaluation and decision-making systems	6	13	11	0	0	30	29	R
18	Low material control	0	6	15	9	0	30	53	C
19	**The design of the raw water production unit has not been able to overcome turbidity due to sedimentation**	**0**	**2**	**15**	**7**	**6**	**30**	**64**	**T**
20	Equipment malfunction	0	18	12	0	0	30	35	R
21	Lack of equipment	4	11	14	0	1	30	36	R
22	**The occurrence of a natural disaster in the location area**	**0**	**4**	**10**	**12**	**4**	**30**	**63**	**T**
23	There is an unstable ground	0	10	12	8	0	30	48	C

	movement								
24	**Damage to the ecosystem around water sources**	**0**	**2**	**13**	**12**	**3**	**30**	**63**	**T**

Source: Primary Data Processed, 2020

From the risks that have been obtained through probability calculations, plot it into the probability matrix above, then this data can be used in further analysis.

b. Impact Assessment

Based on the data obtained through the impact questionnaire on the impact of the risk of "material price increase", the data obtained were 0 respondents said the probability was Very Small (SK), 16 respondents said it was Small (K), 14 respondents said it was Medium (S), 0 respondents said it was Large (B) , 0 respondents stated very large (SB).

$$SI = \frac{((0x0)+(1x16)+(2x14)+(3x0)+(4x0))}{4 \times 30} x100$$

$$= \frac{11}{30} \text{ x } 100$$

$$= 37$$

Obtained the *Severity Index* value is 37, then the probability category of the risk variable for material price increases is Small (40.0 <SI <60.0).

Table 8: Risk *Impact* Assessment.

No.	Risisko Variable	Impact					Total	SI Value (%)	Category
		SK	K	S	B	SB			
1	Increase in material prices	0	16	14	0	0	30	37	K
2	Errors in estimating and planning cost budgets	0	6	15	9	0	30	53	C
3	Increased costs for non-technical factors	5	14	9	2	0	30	32	K
4	Difficult and unpredictable field conditions	0	15	5	10	0	30	46	C
5	Security conditions on site	0	8	12	10	0	30	52	C
6	Poor quality of implementation	7	23	0	0	0	30	19	SK
7	Poor management of operational and maintenance activities	10	10	7	3	0	30	28	K
8	**The quality of drinking water is not as expected**	**0**	**4**	**10**	**12**	**4**	**30**	**63**	**B**
9	Method of implementation that is not / less precise	2	12	13	3	0	30	39	K
10	**The Water Treatment Plant (IPA) has never functioned according to planned capacity**	**0**	**3**	**10**	**14**	**3**	**30**	**64**	**B**

11	Difficulty in procuring materials	0	12	14	4	0	30	43	C
12	Does not follow the work staging procedure	0	15	15	0	0	30	38	K
13	**The raw water transmission pipe does not match its designation**	**0**	**1**	**13**	**16**	**0**	**30**	**63**	**B**
14	Waste of material on site	0	6	13	11	0	30	54	C
15	Careless handling of materials	5	9	14	2	0	30	36	K
16	Little coordination	4	18	8	0	0	30	28	K
17	Low evaluation and decision-making systems	3	12	12	3	0	30	38	K
18	Low material control	5	11	11	3	0	30	35	K
19	**The design of the raw water production unit has not been able to overcome turbidity due to sedimentation**	**0**	**3**	**14**	**9**	**4**	**30**	**62**	**B**
20	Equipment malfunction	8	9	11	2	0	30	31	K
21	Lack of equipment	3	11	15	1	0	30	37	K
22	**The occurrence of a natural disaster in the location area**	**0**	**0**	**2**	**21**	**7**	**30**	**79**	**B**
23	There is an unstable ground movement	0	3	19	8	0	30	54	C
24	**Damage to the ecosystem around water sources**	**0**	**0**	**17**	**13**	**0**	**30**	**61**	**B**

Source: Primary Data Processed, 2020

From the risks that have been obtained through the *Impact* calculation, plot it into the impact matrix above, then this data can be used in further analysis.

Risk Analysis on *Probability* and Impact (*Impact*)

Risk analysis is done by multiplying the results of the probability assessment (P) with the results of the impact assessment (I) of each risk variable. The calculation results can be seen in Table 10.

Table 10: Probability x Risk Impact.

No.	Risisko Variable	P	I	PXI	Risk Category
1	Increase in material prices	3	2	6	*Medium*
2	Errors in estimating and planning cost budgets	2	3	6	*Medium*
3	Increased costs for non-technical factors	2	2	4	*Low*
4	Difficult and unpredictable field conditions	2	3	6	*Medium*
5	Security conditions on site	3	3	9	*Medium*
6	Poor quality of implementation	2	1	2	*Low*
7	Poor management of operational and maintenance activities	2	2	4	*Low*
8	**The quality of drinking water is not as expected**	**4**	**4**	**16**	***Hight***
9	Method of implementation that is not / less precise	2	2	4	*Low*
10	**The Water Treatment Plant (IPA) has never functioned according to planned capacity**	**4**	**4**	**16**	***Hight***
11	Difficulty in procuring materials	3	3	9	*Medium*
12	Does not follow the work staging procedure	2	2	4	*Low*
13	**The raw water transmission pipe does not match its designation**	**4**	**4**	**16**	***Hight***
14	Waste of material on site	3	3	9	*Medium*
15	Careless handling of materials	2	2	4	*Low*
16	Little coordination	2	2	4	*Low*
17	Low evaluation and decision-making systems	2	2	4	*Low*
18	Low material control	3	2	6	*Medium*
19	**The design of the raw water production unit has not been able to overcome turbidity due to sedimentation**	**4**	**4**	**16**	***Hight***
20	Equipment malfunction	2	2	4	*Low*
21	Lack of equipment	2	2	4	*Low*
22	**The occurrence of a natural disaster in the location area**	**4**	**4**	**16**	***Hight***
23	There is an unstable ground movement	3	3	9	*Medium*
24	**Damage to the ecosystem around water sources**	**4**	**4**	**16**	***Hight***

Source: Primary Data Processed, 2020

From the results of the risk analysis in the table above. obtained several risk variables that have a high value (Hight) compared to other risks, namely the medium-low category (Medium-Low). These risks are most likely to occur and have a significant impact on project work.

Response to High (*Hight*) Risk

The response is made only to the risk in the highest category. This is because this risk has a fairly large or frequent occurrence rate and can also have a major impact on Stakeholders and the implementation of the SPAM development project. The responses were obtained from the third survey of expert respondents.

There are six types of risks involved in the Pasigala SPAM development project. First, the quality of drinking water is not as expected, this is because the level of water turbidity is still quite high. From the test results, the water turbidity value is above the quality standard, which is 66 NTU. The high value of turbidity in raw water was caused by flooding in the Saluki River, plus the damage to the filter media at the intake made the water quality low. The response of expert respondents regarding this risk is to make a sealing tub / mud bag and at extreme slope elevations it is necessary to make a Pressure Release Body (BPT).

The next highest risk is the raw water transmission pipe not according to its designation, where the transmission pipe installed is HDPE PN-8 pipe which means that only for the need for clean water lines with a pressure of 8 Kg / cm 2, while the existence of an extreme pipeline network should use HDPE PN pipe. -12.5 (for the needs of clean water pressure of 12.5 Kg / cm 2). So that the response of expert respondents to this risk is to make repairs, install raw water transmission pipes in accordance with the design, but this is done if the repair budget is sufficient.

The design of the raw water production unit that has not been able to deal with turbidity due to sedimentation, as explained in the previous section, is sourced from the Pasigala SPAM raw water from the Saluki River, Gumbasa District, Sigi Regency. This area sometimes experiences flooding every year, as a result the production unit channel is clogged with tree branches and garbage in the form of leaves accompanied by silt, this disturbs the water distributed to the Pasigala area. The response from expert respondents to this risk is to make improvements in several water filter facilities.

Then the occurrence of natural disasters in the project site area, as it is known that the Pasigala SPAM is located above the Palu-Koro Fault or local fault, so that natural disasters in the form of earthquakes followed by liquefaction have hampered a number of activities, even damage has also occurred in the construction of the piping system that has been built in a number of regions. In addition, floods that often occur every year at the construction site of the transmission pipeline are also one of the causes of this big risk in the SPAM construction project. The response from expert respondents to this risk is to strengthen and reconstruct a number of damaged transmission pipelines.

The last highest risk is damage to the ecosystem around the water source, such as the result of forest encroachment activities by the community around the Saluki River as a source of raw water, as a result flooding in the area begins to occur frequently in the rainy season. In connection with this problem, the response from expert respondents to this risk is to make efforts to disseminate or provide education to the community which is planned to be assisted by competent agencies in the environmental sector.

CLOSING

Conclusion

After conducting a risk analysis using a probability matrix table and the impact on these risk variables, the dominant risk is obtained. From this analysis, 6 risks fall into the high category, the risks are that the quality of drinking water is not as expected, the Water Treatment Plant (IPA) has never functioned according to the planned capacity, the raw water transmission pipe did not meet the minimum requirements/technical specifications, the design of the raw water production unit is unable to overcome turbidity due to sedimentation, natural disasters in the location area, and damage to the ecosystem around water sources. The response of expert respondents regarding this risk is to build settling tanks / mud bag and at a pressure of > 70 meters for PVC and HDPE pipes and for steel pipes if the pressure is > 100 meters it is necessary to make a Press Release Tub (BPT), and filter tub, make repairs, install an appropriate raw water transmission pipe. with the plan / design, but this is done if the repair budget is sufficient, repairing several water filter facilities, strengthening and reconstructing a number of damaged transmission pipe buildings, and conducting socialization or providing education to the community, which plans will also be assisted by agencies competent in the environmental field.

Suggestion

1. There is a need for more understanding and attention to risk management because no matter how small the possibility of a risk may occur, if this risk occurs, the resulting impact can disrupt the ongoing construction process and can have a negative impact during project implementation. For this reason, preventive steps are also needed to anticipate and be able to minimize these risks.
2. For further research, it is possible to analyze the risks in different locations, different types of work or in a quantitative way in order to get better and more accurate results.

BIBLIOGRAPHY

1. Avaen, Terje. Risk assessment and risk management: Review of recent advances on their foundation. European Journal of Operational Research, 2016; 13(25): 1-14.

2. Huda, Miftahul. Analysis Of Factors That Affect The Risk Of Implementation Of Underpass Project Construction In Mayjen Sungkono Surabaya. International Journal of Civil Engineering and Technology (IJCIET), 2019; 10(06): 483-493.
3. Junior, Roque Rabechini. Understanding the Impact of Project Risk Management on Project Performance: an Empirical Study. J. Technol. Manag. Innov. 2013, Volume 8, Special Issue ALTEC, 2013; 64-78.
4. Kahraman, C. (Ed.). Fuzzy multi-criteria decision making: theory and applications with recent developments. Journal Springer Science & Business Media, 2008; 16(6): 1-12.
5. Lessard, D., Sakhrani, V., & Miller, R. House of Project Complexity — understanding complexity in large infrastructure projects. Engineering Project Organization Journal, 2014; 4(4): 170-192.
6. Lu, Y., Luo, L., Wang, H., Le, Y., & Shi, Q. Measurement model of project complexity for large-scale projects from task and organization perspective. International Journal of Project Management, 2015; 33(3): 610- 622.
7. Makuia, Ahmad, Pooria Moein Zadeha, Morteza Bagherpoura and Armin Jabbarzadehb. A structural equation modeling approach to examine the relationship between complexity factors of a project and the merits of project manager. Journal of Project Management, 2018; 3(2): 1–12.
8. Mardjono A. *Project Management*. Bogor: Ghalia Indonesia, 2015.
9. Nair, Girish K. Influence of Risk Management on Performance: An Empirical Study of International Islamic Bank. International Journal of Economics and Financial Issues, 2014; 4(3): 549-563.
10. Sugiyanto. *The Implementation Of Risk Management And Its Effect On Good Cooperative Governance And Success*. Journal of Indonesian Economy and Business, 2018; 33(3): 243 - 256.
11. Taran, Yariv. Incorporating Enterprise Risk Management in the Business Model Innovation Process. Journal of Business Models 2013; 1(1): 38-60.