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OPERATIONAL RISK MANAGEMENT OF PRODUCTION IN PDAM SEMARANG CITY

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Abstract *- Risks is the part of human life. Everybody in this world cannot avoid risks. Every activities always connected and associated to the risks. Even its small thing like walking in pedestrian has risk like falling or tripping or big thing like government policy, which is related to lives of many people. One that associated in the lives of many people is water, water cannot be separated from human life because every person in the world needs water to live. One of the companies that provide clean water for people is PDAM or Perusahaan Daerah Air Minum. PDAM is local owned company that has function to supply clean water for citizen of the region, in this case is city. Semarang City also has its own PDAM to meet the needs of its residents of clean water. In carrying out its function, PDAM Semarang also cannot be separated from risks. One of the main part in PDAM Business is production. Without production, PDAM Semarang will not be able to provide clean water for Semarang City residents. This study has three objectives, to determine, analyze and mitigate the operational risks in production of PDAM Semarang especially in Water Treatment Installation 1 who served in Sampangan, Semarang. The results of this study can be used as material for evaluation for PDAM Semarang to face these kind of risks in the future so the company can minimize the impact and losses of the risks. The method used in this study is Monte Carlo Simulation. This analysis is used to predict potential probability and severity of each risk. The probability and severity of each risks simulated compared to the probability and severity for the past 4 years. By comparing the risks simulated and history risks, the writer can determine whether the risk have major impact or not for production. The results reveal that some risks have low probability and severity such as flooding, high water turbidity, production machines problems, red raw water, sedimentation and blackout. These risks can be accepted and retained by PDAM Semarang City because they got low impact. Risk that has high probability and low severity is high cost employee when holiday, this risk recommended to be transferred to contractor or outsourcing company so PDAM doesn't get impact anymore. For the risk that has high probability and severity is pipe distribution leak will be recommended to be reduced.*

Key words: Operational risk management, Monte carlo simulation, PDAM Semarang City, Risk mitigation

Introduction

Risk is uncertainty about the shape or state of uncertainty about a situation that would occur later with the decision taken under consideration at this time. In everyday life we cannot be separated from the name risk. There is the risk of fire, accidents and other risks on. We cannot avoid the risk, and we can only mitigate and reduce risks that will arise. Water is one of the elements that are important in human life. Without water humans would not be able to live and make ends meet. The human need for clean water cannot be denied anymore. Almost all humans need clean water to meet their needs ranging from drinking, bathing, cleaning, washing clothes and so forth. Therefore, the management and provision of clean water for an area is one of the vital elements in the life of society. "Perusahaan Daerah Air Minum" or commonly called "PDAM" is a local owned company that serves as a provider of clean water for people in a certain area. Semarang course also has its own PDAM for managing and providing

clean water for the citizens of the city of Semarang. PDAM Semarang has a function to process water into clean water that is ready to be used for the citizens of the city of Semarang.

Business processes of PDAM Semarang has risks that must be faced, it its financial risk and operational risk. PDAM Semarang has no market risk, or more precisely the risk here is very small due to PDAM Semarang is the only company in the business of providing clean water to the homes for the citizens of the city of Semarang. No other competitor in this field. There are financial risk in the form of late payments from consumers while on operational risks exist in the form of production failure due to flooding, drought or because of malfunction of the pump which is used to treat the water. According to information from the PDAM itself a factor that led to the failure of production and greater impact on the company because of the resulting loss is greater than the loss of another good sector or financial market risk. This will be my focus in my research this time.

Literature Review

Risk Definition

Risk has been a part of human life. Since the beginning of his birth he has been confronted with risks. Ancient man for example, face the risk of natural origin such as the threat of wild animals, environmental conditions and unpredictable weather and natural disasters. Humans who live on the slopes of the volcano at risk for developing volcanic eruptions as well as the threat of hot lava and rocks. Similarly, fishermen on the beach facing the risk of wind, storms and the most horrible of a very large wave sweep. People today have a risk that more and more complex, not only from nature but also of human life itself. Humans create and develop technology which aims to facilitate human life while providing the ease and benefits of these technologies also lead to disaster. For example, the invention of firearms that can cause human or kill each other between transportation modes invention also can cause death due to an accident.

Looking at the above facts it can be concluded that human beings cannot be separated from the name of risk. Almost all human activities involve risk. There is a saying that those who dare to take risks to be able to survive, but in fact there are people who dare to take risks, and some are afraid to take risks. Therefore, to succeed in life, everyone should be able to manage the risks with either one of them, among others, the management of risk.

"Risk is uncertainty about future events" (Ricky W. Griffin and Ronald G. Siegel).

Risk Type

There are various types of risks, ranging from the risk of fire, losses, exchange rate fluctuations, changes in interest rates and so forth. One way that risk is to look at the type of risk. Risks can be classified into two types: pure risk and speculative risk. Pure risk is risk of losses but there is no possibility of profit. Example of pure risk is physical asset risk, employees risk and legal risk. Speculative risk is risk with possibility of losses and profits. Example of this risk is credit risk, market risk, liquidity risk, compliance risk, reputation risk, strategy risk and my study topic, operational risk.

Operational Risk

Risks caused by the operations of the company are not running as a function of the company. Operational risks associated with how to manage the company properly. Companies with poor management system, contains the risk of losing money. Operational risk any company different from the others depend on the scale of business, the type and shape. Operational risk is the risk type of the oldest, yet least understood compared with other risks. Actually, the company is already familiar with the operational risk has been a long time but with different names. The company has long been aware of the risk and anticipated although not with the name of risk management. For example, the company is always improving systems, procedures and business processes through quality management. In the

context of risk management, these efforts can be seen as an attempt to manage or lower the operational risk. Operational risk is divided into three: Human, System and External.

Risk Management

Risk management is a process of managing risks that includes the identification, evaluation and control of risks to risks that can disrupt business continuity a Company. Risk itself is a possible event or situation that could threaten the company in achieving the goal or vision of the company or the risk is the possibility of loss.

"Risk is set of policies, procedures that belongs to organization to manage, monitor, and control organization exposure to risk." (SBC Warburg, The Practice of Risk Management, Euro money book, 2004)

"Enterprise Risk Management is a comprehensive framework, integrated to manage credit risk, market risk, economic capital, risk transfer to maximize the value of the company."(Lam, James, Enterprise Risk Management, Wiley, 2004)

The point is risk management helps the company to achieve its goals and to prevent or anticipate things that are not desirable to the company.

Risk identification

Risk identification can be done in 2 ways with qualitative and quantitative. The way that I use is the quantitative method is to look at secondary data from the company concerned.

Risk identification is done by identifying the risks of any risk faced by an organization or company. Many of the risks faced by the company as one that is operational risk. One technique is to identify risk search or search the source of the risk.

Risk Measurement

The next step is to measure these risks and evaluate these risks. The purpose of risk evaluation is to understand better the characteristics of the risk. If we gain a better understanding of the risk will be more easily controlled. A more systematic evaluation is performed to measure the risk.

Risk measurement calculate the effect of the risk in the company. And with the result of risk measurement, company can mitigate and minimalize the effect and the impact of the risk to the company performances.

- Monte Carlo Simulation

  "Monte carlo simulation is a computerized mathematical technique that allows people to account for risk in quantitative analysis and decision making. Monte carlo performs risk analysis by building models of possible results by subtituting a range of values-a probability distribution- for any factor that has inherent uncertainty. It then calculates the results over and over, each time using a different set of random values from the probability functions. Depending upon the number of uncertainties and the ranges specified for them, a monte carlo simulation could involve thousands or ten of thousands of recalculation before it is complete. Monte carlo simulation produces distributions of possible outcome values." (How Monte Carlo Simulation works – Palisade.com)

  Monte Carlo Simulation is a risk analysis technique where the possibilities of events occurring in the future simulated in a computer. Resulting in the estimated rate of return and risk indices. (Brigham dan Ernhardt, 2005),

  Below are the stages of monte carlo simulation (Mun, 2010)

  - Defines the assumptions of the input
    In this step, you must determine the distribution of the data.
  - Defines the outpur prediction
    After you defines the distribution of the data, you decide the outcome or the results that you expect from the simulation
  - Run the simulation

After that, you run the simulation with the input and the output that you expect. You can run the simulation 1000 or 10.000 times.

- Results intrepretation
  In the end, you intrepret and explain the data and the graph of the simulation outcome.

Risk Mapping

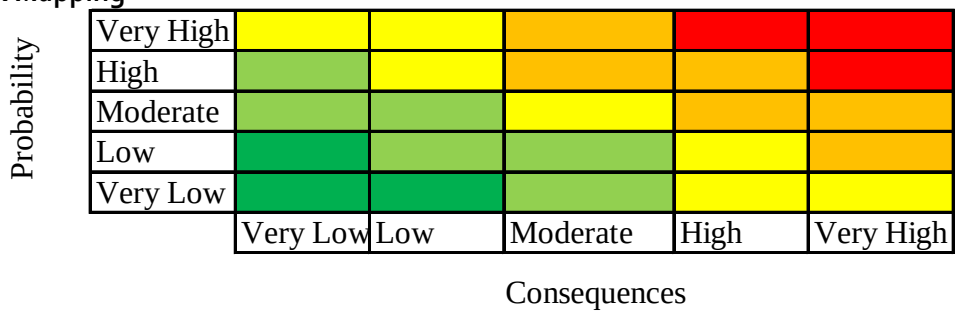


Figure 1. Risk Mapping

Note

Very high	: Immediate action, immediate and aggressive treatment.
High	: Immediate attention, the company was soon overseeing risk.
Moderate	: Periodic attention, the company conducts regular surveillance.
Low	: Companies can be more calm is by periodically monitoring the long term.
Very low	: No action required.

Risk Mitigation

After analyzing and evaluating the risks then the next step is to manage or mitigate those risks. If the organization fails to manage risk, the acceptable impact could be quite serious, for example, is a very big loss. Here's how to manage or mitigate the risks:

- Reduce the risk
  Minimizing risk is a way to enlarge any decision not high risk but limit it in order to reduce these risks are even getting bigger outside of the control of the management company. Make decisions beyond the understanding of Management Company then it is tantamount to doing its decisions speculation.
- Transfer the risk
  Diverting risk is the risk that we take for granted the way we turn the business of insuring most like to avoid unforeseen risks.
- Avoid the risk
  Not performing activity that could carry risk.
- Retain Risk
  In some situations, it would be better if we deal with the risks our self (such risks resist). For instance, people who think using the insurance complicated and expensive then the people themselves will bear the risk.

Methodology

Figure 2. Research Methodology

Research Step Explanation

Data Analysis

In this research, author used data production in the PDAM Semarang in the past 4 years. Data about what is happening in production and potential loss in the past 4 years. There are 3 steps in this research, first is risk identification, risk measurement and the last is risk mitigation.

Risk Identification

First, writer will collect data of the risk in the production of PDAM Semarang. After that, writer will identify and explain each risk based on source.

Table 1. Risk Identification

Risk Type	Risk Source	Risks
Operational Risk	Power Resources	Blackout
	Water Resources	Flooding
	Water Resources	High Water Turbidity
	Water Resources	Raw Water does not meet Production Standards
	Intake	Waste in the river
	Sedimentation and filtration Tanks	Sedimentation
	All Machines in Production System	Problems in Pump and Production Machines
	Distribution to Customer	Water Distribution Pipe Leak
	Human Resources	High cost employee when holiday

Risk Measurement

After identified the risk, writer will measure each risk with Monte Carlo Simulation. With Monte Carlo simulation, writer will know the probability and severity of each risk and know the impact to the PDAM Semarang. Below is the risk measurement results for each risk.

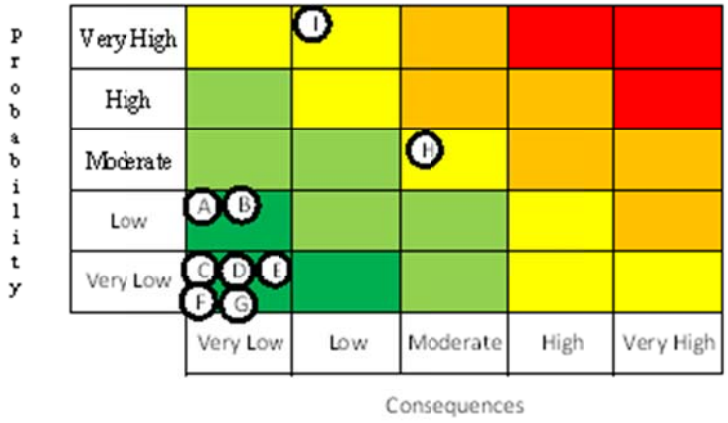
Table 2. Risk Measurement Results

Type of Risk	**Probability**	**Severity**
Blackout	Low	Very Low
Flood	Low	Very Low
High Water Turbidity	Very Low	Very Low
Sedimentation	Very low	Very Low
Production Machines Problem	Very Low	Very Low
Raw Water does not Meet Production Standards	Very Low	Very Low
Waste in The River	Very Low	Very Low
Pipe Distribution Leak	Very High	Moderate
High Cost Employee in Holiday Season	Very High	Low

Risk Mapping

After calculating the risk in risk measurement, the writer will put each risk in risk matrix. Writer put each risk based on probability and severity.

Table 3. Risk Mapping



Code	Type of Risk
A	Blackout
B	Flood
C	High Water Turbidity
D	Sedimentation
E	Production Machines Problem
F	Raw Water does not Meet Production Standard
G	Waste in The River
H	Pipe Distribution Leak
I	High Cost Employee in Holiday Season

Risk Mitigation

After put the risk in the risk mapping, writer will decide the risk mitigation for each risk. Writer will divide the risk mitigation in to 3 strategies. First is retain risk, reduce risk and transfer risk.

Table 4. Risk Mitigation Table

Risks	Risk Mitigation
Blackout	Retain Risk
Flood	
High Water Turbidity	
Sedimentation	
Production Machines Problem	
Raw Water does not Meet Production Standard	
Waste in River	
Pipe Distribution Leak	Reduce Risk

High Cost Employee in Holiday Season	Transfer Risk

The writer will divide the risk mitigation strategies to 3 strategies. The first is the risk with low probability and impact will be retained. The risk can still be tolerated by the company because the probability of the risk will happen and the severity that the company have to face is low. To the risk Blackout, Flooding, High Water Turbidity, Sedimentation, Production Machines Problem, Raw water does not meet production standard and Waste in the river will be recommended to be retained by the company. The company already make mitigation and prevention for the risk above. For Blackout risk, company already prepare generator set so that the company can still carry out the production despite the lack of the electricity to run the production machine. However, the company cannot do the maximum level of production because the limitation of the generator set. When the electricity is down and the generator set is turned on, not all the production machines operate because generator set is not be able to support the required engine power. For example, there are three pump machines for one shift production that operate when the electricity is on, but when the blackout and generator set is turned on, there is only one pump machines that can operate. The next is the risk that comes from the water resources, Flooding, High Water Turbidity, and Raw Water does not meet the production standards or Red Raw Water. The solution from the company for these risks is the increase and the decrease of the production capacity. When flooding happens, water that is entering Intake is higher than usual, the turbidity of the water is also rising. When this happens, the company will lowered the capacity of the production and increase the dosing coagulation, flocculation and chlorine to reduce the water turbidity level. The cost of this risk mitigation is the much increase of the production cost because of the increase of the dosing. There are some particular condition or case that makes the production stopped completely, such as the turbidity level over 10.000 NTU(Nephelometer Turbidity Unit), then production must be stopped because the production machines is not be able to eliminate the turbidity to purify the water. There is also risk of waste in the river. Waste or trash from the river can block water from river to enter the intake, if water is blocked and cannot enter intake company cannot conduct production because water is the main material of the production. PDAM Semarang has done some mitigation of this risk, one of ways to control is installing a screen to prevent waste from entering the intake. With this screen, company can minimalize the waste that block the water. The second way is carry out periodic cleaning river around the intake. This river cleaning can reduce the possibility of garbage blocking water entering the intake.

The next is the risk with very high probability but low impact to the loss of the company, high cost employee when holiday season comes like Christmas or Ramadan, employees want to take a break from the work or the take vacation and meet and spend the time with family but the production must be going because clean water is needed every day and every time by the people in Semarang City and the company oblige their employee to do the work every day in a year. Writer advice the risk transferred to other, specifically to be transferred to the contractor or outsource so the company will not get the impact with the probability of occurrence and not get the loss potential but the cost still low. The last is the risk with the very high probability and moderate impact for the loss, pipe distribution leakage, the writer recommend the risk to be reduced, at least meet the Indonesia's PDAM Leakage Rate Standard which mean 33%, the risk cannot be accepted because the impact for the long and short term, it gives the company so much money to loss. Loss of water in PDAM is divided into 3, the first one is technical, the second is non-technical or administrative and the third is combination of technical and non-technical. Example of technical water loss is leak in pipe distribution, the second for administrative water loss is the lack of accuracy in reading water meter, and the third is the combination of technical and non-technical water loss is theft of water by citizens. PDAM Semarang has several policies to reduce water loss rate, for lack of accuracy in reading water meter, PDAM Semarang command their

recording water meter employee to take a photo of the water meter and immediately send the picture taken via short message service to main office to be recorded directly. So if there is a problem, there will be a record and picture to solve that. For pipe distribution leak PDAM also has done mitigation, PDAM create water loss reduction team called Tim Penanggulangan Kehilangan Air (PKA), main function of this team is to manage and to handles leak in distribution pipe that PDAM has. PDAM Semarang also replace old pipes and leak pipes with new one periodically but because the pipe is very expensive, PDAM Semarang sometimes prefer to patch the leaking pipe and old pipe despite the old pipe is not good to be used anymore and the time to be replaced has already come.

Conclusion and Recommendation

After knowing the problems and risk faced by the company, the writer provide recommendations to manage problems and risks and to increase the company performance in the future. Recommendation from writer is PDAM Semarang makes a division inside the company that in charge of organizing and managing the risks, both operational and financial risk. That will be long term recommendation, but because it will take some time to make division and it's hard to legalize because government thing, in short time the writer recommend to apply risk management to mitigate risks in the future so that the company will know and will be able to manage to minimalize and mitigate the risks then risks will not have large impact for company. By doing risk management, PDAM Semarang will be able to do better performance and will get more revenue because it can minimalize the loss received by the company.
The second recommendation from the writer is to give priority to minimize the risk that have a large probability and severity such as leaking in distribution pipes and high cost employee in holiday and give less prioritize for risk that have low probability and severity. Improve the mitigation that has been done by the company before. Increase more of the surveillance of Water Loss Reduction Team or Tim Penanggulangan Kehilangan Air (PKA) so the rate of water loss will be reduced and the loss can be avoided by the company. Increase the budget allocation to turn the old distribution pipe to new one, with this change, the leak in pipe distribution will be reduced also.

References

DR. Dewi Hanggraeni, S. M. (2010). *Pengelolaan Risiko Usaha.* Jakarta: Lembaga Penerbit Fakultas Ekonomi UI.

Dr. Mamduh M. Hanafi, M. (2009). *Manajemen Risiko.* Yogyakarta: UPP STIM YKPN.

Irham Fahmi, S. (2013). *Manajemen RIsiko Teori,kasus dan Solusi.* Bandung: Alfabeta.

Nugroho, L. A. (t.thn.). Analisis Risiko Terhadap Pendapatan pada PT Taman Wisata Candi (TWC) Borobudur, Prambanan, dan Ratu Boko Yogyakarta. 15.

PDAM Kota Semarang. (2011). *Seabad Pelayanan Air Minum di Kota Semarang.* Semarang: PDAM Kota Semarang.

PDAM Tirta Moedal Kota Semarang. (t.thn.). Diambil kembali dari www.pdamkotasmg.co.id

Ramli, S. (2011). *Manajemen Risiko dalam Perspektif K3.* Jakarta: Dian Rakyat.

Semarang, P. K. (t.thn.). *Pemerintah Kota Semarang*. Diambil kembali dari semarangkota.go.id