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IMPLEMENTATION OF PDAM TIRTANADI RISK MANAGEMENT INFORMATION SYSTEM WITH ENTERPRISE RISK MANAGEMENT (ERM) APPROACH

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ABSTRACT

PDAM Tirtanadi plays a role in providing clean water in North Sumatra. This research aims to apply Enterprise Risk Management (ERM) to improve the operational risk management of PDAM Tirtanadi, as well as designing a web-based pipe and water flow risk management system. The research methodology uses R&D with risk identification, risk color level, and COSO documents. By implementing an ERM-based Operational Risk Management Information System, PDAM Tirtanadi is expected to significantly improve its operational resilience. This will enable the company to anticipate and mitigate risks before they have a serious impact, thereby minimizing service disruptions and financial losses. Hopefully, this approach will result in increased operational efficiency, reduced costs, and improved customer satisfaction.

KEYWORDS *PDAM Tirtanadi, Risk Management ERM, Pipe leakage, Web-based system, COSO*

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INTRODUCTION

Regional Drinking Water Company (PDAM) Tirtanadi is one of the BUMDs (Regional Owned Enterprises) that plays an important role in providing clean water for the people of North Sumatra. As an entity responsible for the basic needs of the community. Fluctuations in raw water quality due to river pollution and climate variability often result in customer complaints about water turbidity.

Implementation of the Operational Risk Management Information System with an Enterprise Risk Management (ERM) approach is a very relevant solution. Enterprise Risk Management (ERM) is a holistic approach to identifying (Ishak & Abdillah, 2021; Miftah et al., 2022; Susilo & Mahrozi, 2020)

Operational problems in pipe leaks water quality fluctuations, power outages, cyber attacks To overcome these risk management and ERM (Enterprise Risk Management). Challenges faced by risk management: Lack of integrated

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information systems in managing risks, difficulty in identifying, measuring, and monitoring risks systematically, risks of pipe leaks, water pollution, or distribution system failures that can have a major impact on customers, and limitations in managing risk data and reporting to management in real-time.

The Enterprise Risk Management (ERM) approach is a systematic method that covers all aspects of risk in an organization. ERM (Enterprise Risk Management) enables PDAM Tirtanadi to: Integrate risk management into work units, Map risks by category (Operational, Strategic, Compliance, Financial, etc.), Use data for predictive analysis and risk-based decision making, and Increase transparency and accountability in risk management.

To optimize the ERM approach, PDAM Tirtanadi needs to implement a technology-based Risk Management Information System. This system will assist in: Risk Identification: Collecting and documenting potential risks and their sources, Risk Mitigation: Developing strategies to reduce or avoid risks. Monitoring and Evaluation: Conduct real-time monitoring and automated reporting to ensure the effectiveness of mitigation strategies.

Assessing and managing risk across the organization, In contrast to traditional risk management which tends to focus on individual risks and specific departments, ERM views risk as a whole, recognizing that risks can arise from multiple sources and influence each other. The Committee of Sponsoring Organizations of the Treadway Commission (COSO) defines ERM as "a process influenced by the board of directors, management, and other personnel, applied in an enterprise-wide strategic setting, designed to identify potential events that could affect the entity, and manage risks to be within its risk appetite, to provide reasonable assurance regarding the achievement of the entity's objectives" (Atikah & Corralynn, 2023; Sefty, 2022).

Under the ERM approach, PDAM Tirtanadi can optimize resource allocation by prioritizing risks based on their potential impact on strategic objectives. For example, if analysis shows that pipe leaks in certain areas have a greater financial and reputational impact.

This research is important for several reasons. First, as an essential public service provider, PDAM Tirtanadi's failure to manage operational risk can have a direct impact on the health and welfare of the community. Second, in an era of technological disruption and climate change, public utility companies face an increasingly complex and dynamic risk landscape, demanding a more sophisticated risk management approach. Third, while ERM has been widely implemented in the private sector, its adoption in BUMDs is still limited.

This research can contribute to a better understanding of the role of information technology in risk management. By demonstrating how information systems can integrate data from different domains to support better decision-

making, this research can encourage further innovation in this field. Addition, the research findings can assist regulators and policy makers in formulating more effective risk management guidelines for BUMDs.

By implementing an ERM-based Operational Risk Management Information System, it is expected that PDAM Tirtanadi can significantly improve its operational resilience. This will enable the company to anticipate and mitigate risks before they have a serious impact, thereby minimizing service disruptions and financial losses. Hopefully, this approach will result in increased operational efficiency, decreased costs, and improved customer satisfaction.

The purposes of this study are 1. Implementing ERM into the Operational Risk Management Information System with an Enterprise Risk Management (ERM) approach to improve PDAM Tirtanadi's ability to identify, assess, and manage its operational risks. 2. To design and build a Web-based PDAM Tirtanadi Pipe and Water Flow Leakage Risk Management System.

RESEARCH METHOD

In this Research Method, we will explain how to use Simple R&D Methods, COSO Documents, Risk Identification, and Systems used using the Waterfall System as follows:

How the Simple R&D Diagram Reseach and Development Method Works Using a Spiral Model:

1. Costumer Communication

Identification and communication Involve all interested parties, from the top management of PDAM Tirtanadi to field officers, to understand their needs, concerns, and expectations regarding the Risk Management Information system. In identifying the main risks faced by PDAM Tirtanadi, such as the risk of pipe leaks, natural disasters and water quality problems.

2. Planning

In Planning, Determining the Scope is determining the basic features that will be developed in the first iteration. Planning also estimates the cost, time, and resources needed.

3. Risk Analysis

The Risk Analysis will evaluate the risks that have been identified and prioritize the risks, such as the Risk Management of Pipeline Leakage and Water Flow of PDAM Tirtanadi. Risk Analysis requires the development of a Mitigation Strategy that will be planned to reduce the impact of these risks, for example by creating emergency procedures or improving system security.

4. Engineering

In Engineering, it is necessary to develop a Protype, Making a Simple Prototype of the Information system to be developed. This prototype can be a mockup or a very basic version of the system. For Prototype Testing it must be tested to ensure that the developed features are working properly and according to the user's needs.

5. Construction and Release

System Development in Construction and decommissioning must be developed in a complete manner based on the results of prototypes and testing. In its implementation, the system is implemented on a small scale, for example to get feedback from users.

6. Costumer Evolution

To get Feedback from Customer Evaluations, collect feedback from users regarding the system that has been developed. In Customer Evaluation has a Performance Evaluation to evaluate the system has achieved the goals set at the planning stage. Customer Evaluation can identify New Risks that will identify new risks that arise during the development and implementation process.

Here's a Simple R&D Method using the Spiral model:

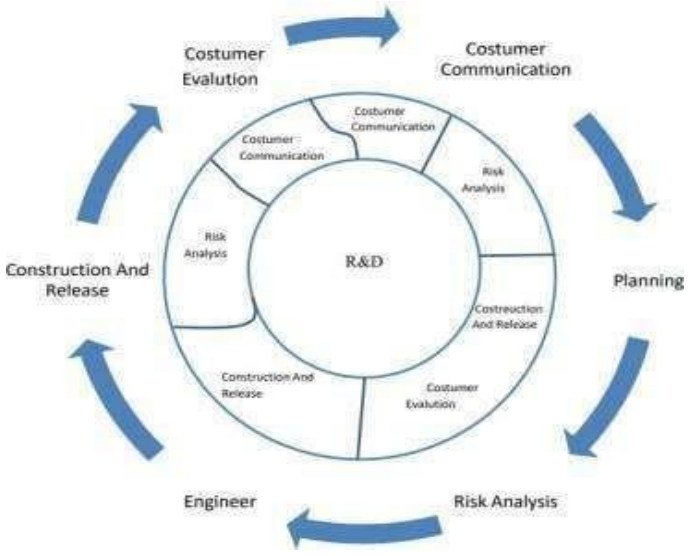


Figure 1. Simple R&D method using a spiral model
(Boehm,B.W. , Agustus, 1998)

Document COSO (*Commitee of Sponsoring Organization of the Treadway Commission)*

Figure 2. COSO Fremework PDAM Tirtanadi Document

There are several explanations from the COSO Fremework PDAM Tirtanadi Document. The above are:

1. Control Environment

Control Environment is: Internal Control established by top management and reflected in the organization's policies, structures, procedures, and practices. The Control Environment is also a cornerstone of a control system Internal.ini includes intentions, risk awareness, and organizational integrity. This environment ensures that policies and procedures. Regarding the risk management of pipe leakage and water flow, it is implemented consistently. The purpose of this Control Environment is to define the internal control atmosphere set by top management and reflected in the Organization's Policies, Structures, and Practices. Examples are: Establishment of policies regarding periodic maintenance of pipelines, formation of a special team to handle the risk of leaks, and development of a code of ethics for employees related to reporting leakage events.

2. Control Activities

Control Activities are: Actions taken to reduce risk to an acceptable level. Control Activities are also a specific type of activity designed to reduce risk. These actions must be taken to mitigate the risk of pipe and water leaks, such as routine maintenance, installation of leak sensors, and infrastructure repairs. These are operational measures aimed at mitigating the impact of the risks that have been identified. The purpose of Control Activities is to ensure that risk is managed effectively. Examples: Establishing standard operating procedures (SOPs), conducting internal audits and providing training to employees.

3. Information and Communication

Information and Communication is: A process that ensures relevant information about risks is communicated effectively throughout the organization. Relevant information and communication must be identified, captured, and communicated in a timely manner. Information and Communication is also an efficient and transparent flow of information between the Organization level and the internal party related to pipeline leaks. This system includes real-time reporting of leak incidents and dissemination of important information to management and technical authorities. The usefulness of Information and Communication is to ensure that relevant information about risks is communicated effectively at PDAM Tirtanadi. Examples in PDAM Tirtanadi are making periodic reports, regarding the condition of pipelines and leakage events, holding training for employees on risk handling procedures, and building an integrated information system to manage risk data.

4. Monitoring Activities

Monitoring Activities is an internal control system that must be continuously monitored and evaluated. Monitoring is also a process to Monitor the Performance of the Control System that will take corrective action if needed. In Process Activity Monitoring, it monitors control activities to ensure their effectiveness in preventing or overcoming pipe leaks. Included in this case are Internal audits, analysis of data from sensors, in Continuous supervision. The use of Activity Monitoring is: Monitoring the performance of the Risk Management System continuously. An example of Activity Monitoring at PDAM Tirtanadi is to monitor the performance of key performance indicators (KPIs) related to the risk of pipeline leaks, such as the number of leakage events, the duration of repairs and repair costs.

5. Operations

An operation is an operation that includes daily activities that support the implementation of strategic objectives. Operations include daily activities related to water distribution and infrastructure maintenance of PDAM Tirtanadi. The use of Operations is to carry out optimal water distribution operations by paying attention to the risks that exist Examples in PDAM Tirtanadi are: Carrying out routine inspection procedures on the pipeline network to detect potential problems before major leaks such as water distribution disruptions or pipe damage, identified and managed to ensure smooth operations.

6. Reporting

Reporting is the process of conveying information related to risks, both internal and external. Process of Submission of Information related to risks and performance of risk management to management or regulators. This can be a monthly or real-time report on the leakage status of water flow pipes, and the control measures that have been taken. The purpose of Reporting for PDAM Tirtanadi is to ensure transparency in reporting leak incidents and repairs made to stakeholders. An example in PDAM Tirtanadi is Using a digital reporting system that contains a complete report on the condition of the pipeline and the repairs made.

7. Complience (Kepatuhan)

Compliance is: Ensuring that PDAM Tirtanadi complies with applicable regulations and standards related to water risk management, including national water regulations and authorities and environmental laws. The usefulness of Compliance in PDAM Tirtanadi is Compliance with government regulations related to clean water distribution and pipe installation standards. Example in PDAM Tirtanadi Ensuring that PDAM Tirtanadi complies with regulations on permissible pipe leakage standards as well as arch requirements related to water resources management.

8. Entity Level

Entity Level is Risk Management that is applied throughout the Organization at PDAM Tirtanadi. Entity Level refers to the management of Risk at the level of the organization as a whole. The Risk Management Approach here includes general policies, risk management strategies, and decision-making guidelines that affect PDAM Tirtanadi. The Entity Level is At the Entity Level, PDAM Tirtanadi manages the risk of pipeline leakage throughout the distribution network that is managed. An example of the Entity Level of PDAM Tirtanadi is a Risk Management Policy that is implemented comprehensively, covering pipe leaks and all supporting infrastructure for water distribution.

9. Division

Division is Risk Management that focuses on one division or a specific part of the organization in PDAM Tirtanadi. Each division in PDAM Tirtanadi, such as the technical, operational, or financial division, has responsibilities in Risk Management according to their respective functions, such as maintaining the pipeline infrastructure involved in repairs at PDAM Tirtanadi. The usefulness of the Division of PDAM Tirtanadi is that Each Division in PDAM Tirtanadi is responsible for managing risks related to its operational function. An example of a division at PDAM Tirtanadi is the operational division directly responsible for pipe-

line maintenance, while the IT division manages the pipeline Leakage Information System.

10. Operating Unit

An operating unit is a more specific Risk Management unit that has a specific function in the organization. Operating Unit Handling specific areas of PDAM Tirtanadi's operations. The usefulness of the Operating Unit (Functional Unit) is at the level of the Functional Unit, the operational risk of leakage is managed according to the technical expertise possessed. An example of an Operating Unit in PDAM Tirtanadi is a technical unit that is responsible for pipe maintenance, using certain tools and methods to detect leaks early.

11. Function

Functional is an activity that is directly related to the achievement of the organization's operational goals. Function (Operational) focuses on technical activities that are carried out on a daily basis to ensure that clean water runs smoothly. The Risk Management System seeks to support operations by identifying and reducing risks that can disrupt water flow or cause leaks. The usefulness of Function (Operational) in PDAM Tirtanadi is Operational Risks such as pipe leaks, managed through effective maintenance and monitoring measures. An example of Function (Operational) at PDAM Tirtanadi is a routine inspection of the PDAM Tirtanadi pipeline network to avoid large pipe leaks that interfere with water distribution.

Risk Identification and Risk Level ERM (Enterprise Risk Management)

1. Understanding Risk Identification in ERM (Enterprise Risk Management)

Risk Identification is the first step in the implementation of ERM (Enterprise Understanding Risk Identification in ERM (Enterprise Risk Management).

2. Risk Color Levels and Criteria

Table 1. Risk Color Levels and Criteria

No,	Risk Level	Criteria	Color
1.	Very High	Very Big Impact, Very High Proof	Red
2.	High	Big Impact, High Probability	Orange
3.	Medium	Medium, Medium Availability	Yellow
4.	Low	Low, Low Probability	Green

3. Benefits of Using Risk Color Levels
   a. Visualization: Facilitates understanding the severity of risks
   b. Prioritization: Helps in prioritizing risk management
   c. Communication: Facilitate Communication about Risks to various Parties.
4. Example of Risk Indentation at PDAM Tirtanadi
   a. Risks related to Infrastructure
      a) Pipe leaks
      b) Pump malfunction
      c) Corrosion on Pipes
   b. Risks related to resources are: Lack of Raw Resources
   c. Operational risks
      a) Maintenance Delays
      b) IT System Disruption
      c) Water Pollution
   d. External risks
      a) Natural Disasters Like Floods and Earthquakes
      b) Climate Change
      c) Changes in Regulations
   e. Factors affecting the Risk Level
      a) Impact: How Much Risk Impact on Organizational Goals
      b) Probability: Possible Risk
      c) Duration: Length of time it takes to overcome the risk
      d) Speed Method: How quickly the risk can occur

Waterfall System Development

1. Understanding the Waterfall Method

The Waterfall method is one of the most classic models of system development. This model follows a sequential approach, where each phase must be fully completed before moving on to the next phase. In the context of developing a risk management information system (ERM) for PDAM Tirtanadi, the Waterfall method can be adapted with several adjustments.

2. Waterfall Method Stages in ERM (Enterprise Risk Management) Implementation

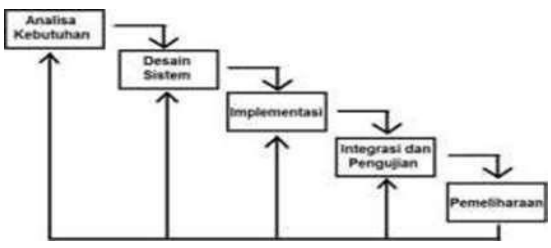


Figure 3. Waterfall Method

Below are some explanations of the Waterfall System Development stages in the implementation of ERM:

a. Requirements Analysis
   1) Requirement Identification: Identifying the specific needs of PDAM Tirtanadi related to risk management.
   2) Requirement Identification: Identifying the specific needs of PDAM Tirtanadi related to risk management.

b. System Design
   1) System Architecture: Designing the overall structure of the system.
   2) Database Design: Designing the database structure to store risk information.

c. Implementation
   1) System Development: Building the system based on the prepared design.
   2) Configuration: Configuring the system according to the needs of PDAM Tirtanadi.

d. Integration and Testing

   Comprehensive System Testing: Testing the interaction between modules and ensuring the system functions properly.

e. Maintenance

   Performance Improvement: Enhancing system performance periodically.

RESULT AND DISCUSSION

Based on the pipe leakage data that occurred, the following are the planning steps needed to manage risk with the Enterprise Risk Management (ERM) approach:

1. Problem Identification:
   a. Identify patterns location leakage, type pipe type, root cause, and extent of damage.
   b. This analysis will help understand the risks that often occur
2. Handling Priority:
   a. Determine areas with very high levels of damage for immediate repair.
   b. Focus on pipes with significant leakage impact
3. Information System Creation

   Information systems are designed to process data into easily understandable reports and assist in risk mitigation.
4. Risk Management

   The ERM approach is used to assess the impact of risks and implement high priority corrective actions on significant risk areas.
5. Monitoring and Evaluation

   Monitoring real-time is carried out to analyze leakage trends and the effectiveness of mitigation measures.

Table 2. PDAM Tirtanadi Pipe Leakage Data

No.	Leak Location	Pipe Type (Brand, Length, Thickness)	Leak Date	Causes of Leakage	Level of Damage	Impact of Leakage	Repair Status
1.	Jl. Melati XIV 10/33/181	PVC Wavin, 6m, 8mm	20-12-2024	High Pressure	High	Distribution Disruption	Under Repair
2.	Jl. Veteran Gg. Manunggal 30-A	PVC Vinylon, 8m, 6mm	18-12-2024	Corrosion	High	Water Loss	Finish
3.	Jl.Veteran Gg. Manunggal 31/48	PVC Wavin, 6m, 8mm	15-12-2024	High Pressure	Medium	Water Loss	Finish
4.	Jl. Veteran Gg. Manunggal 32	PVC, Wavin, 10m, 12mm	05-12-2024	Incorrect Installation	Low	Pressure Reduction	In Planning
5.	Jl. Setia Budi 75-A	PVC Vinylon, 8m, 6mm	10-12-2024	Corrosion	High	Distribution Disruption	Finish
6.	Jl. Gajah Mada Gg.Rukun 18/16	PVC Wavin, 6m, 8mm	25-11-2024	Land Movement	High	Distriution Disorder	In Planning
7.	Jl. Gajah Mada Gg.Rukun 16	Cast Iron, Galvanized, 10m, 12mm	17-12-2024	Incorrect Installation	High	Distribution Disruption	In Planning
8.	Jl. Peringgan 47/55	PVC Vinylon, 8m, 6mm	19-12-2024	Land Movement	Very High	Distribution Disruption	Under Repair
9.	Jl. Veteran Psr VIII/280-A	Cast Iron, Galvanized, 10m, 12mm	17-12-2024	Corrosion	Medium	Water Loss	In Planning
10..	Jl. Peringgan 20/7	HDPE, Vinyl, 8m, 6mm	23-11-2024	Land Movement	Very High	Distrib usion Disorder	Finish
11	Jl. Buku 10	PVC, Wavin, 6m, 8mm	12-01-2024	Corrosion	Medium	Water loss	Under Repair
12.	Jl. Matahari VIII 06/33/153	HDPE, Vinilon, 8m, 6mm	08 -01-2024	High Pressure	Medium	Distribution Disruption	Finish
13.	Jl. Darussalam Gg. Sempurna 2	PVC Wavin, 6m, 8mm	12 -01-2024	Land Movement	Medium	Distribution Disruption	Under Repair
14.	Jl. Orde Baru 10- A	HDPE, Vinilon, 8m, 6mm	16 - 01 - 2024	Corrosion	Low	Water Loss	Finish
15.	Jl. Gatot Subroto 144-E	PVC, Rucika, 12 m, 6 mm	16-01-2024	Corrosion	Medium	Distribution Disruption	Under Repair
16.	Jl. Notes Lr Church	PVC, Rucika, 16 m, 12 mm	17-01-2024	Corrosion	High	Water Loss	Under Repair
17.	Jl. Sei Sibundong	Cast Iron,	18-01-2024	Corrosion	Medium	Water Loss	Under

	25/28	Galvanized, 8 m, 7 mm				Repair
18.	Jl. Setia Budi 4	PVC, Wavin, 10 m, 5 mm	19-01-2024	Corrosion	Low	Distribution Disruption	Finish
19.	Church Street 62-C	HDPE, Supralon, 12 m, 10 mm	20-01-2024	Corrosion	Medium	Distribution Disruption	Under Repair
20..	Jl. Mesjid 104-B	Iron Cast, Galvanized 6 m, 8 mm	21-01-2024	Land Movement	Medium	Water Loss	Under Repair
21.	Church Street No. 40 A	PVC, Rucika, 8 m, 6 mm	22-01-2024	Incorrect installation	Medium	Water Loss	Finish
22.	Jl. Nibung II 106	HDPE, Vinilon, 11 m, 10 mm	24-01-2024	High pressure	High	Distribution Disruption	Under Repair
23.	Jl. Sakura III 19/36/40	Cast Iron, Galvanized ,6 m, 8 mm	24-01-2024	Corrosion leakage	Low	Distribution Disruption	Finish
24.	Jl. Mesjid 29/57	PVC, Rucika, 8 m, 6 mm	25-01-2024	Corrosion	Medium	Distribution Disruption	Under Repair
25.	Mistar Street Gg. Buntu 3	HDPE, Supralon, 14 m, 12 mm	26-01-2024	Corrosion	High	Distribution Disruption	Under Repair
26..	Jl. Guru Sinumba No.55	Cast Iron, Galvanized, 9 m, 7 mm	27-01-2024	Corrosion	Medium	Water Loss	Under Repair
27.	Jl. Setia Budi P-VIII	PVC, Wavin, 7 m, 5 mm	28-01-2024	Corrosion	Medium	Distribution Disruption	Finish
28.	Jl. Karya Setuju SEB-84	HDPE, Vinylon, 13 m, 10 mm	28-01-2024	Corrosion	Medium	Distribution Disruption	Under Repair
29.	Jl. Veteran Gg.Manunggal Market VII	PVC, Rucika,	25-01-2024	Corrosion	Medium	Distribution Disruption	Under Repair
30.	Jl. Nibung II 106	Cast iron, Galvanized	17-12-2024	Corrosion	Medium	Water Loss	In Planning
31.	Jl. Setia Budi P-VIII	HDPE, Vinyl	23-11-2024	Corrosion	Very High	Distribution Disruption	Finish

6. Implementation

The Web-Based Pipe Leakage System uses the PHP Laravel 10 programming language and uses My SQL Php My Admin. Web-based pipe leakage system is an information system regarding pipe leaks at PDAM Tirtanadi.

a. User Page

On the User Page there is a pipe leakage information system web page in the "PDAM Tirtanadi Login Page" section which has 2 users, namely Operators and Admins. The operator is tasked with conveying information into the Web-based Pipe Leak Information System while the Admin User is tasked with receiving all information from the operator in the Web-based Pipe Leak Information System.

b. Dasboard Page

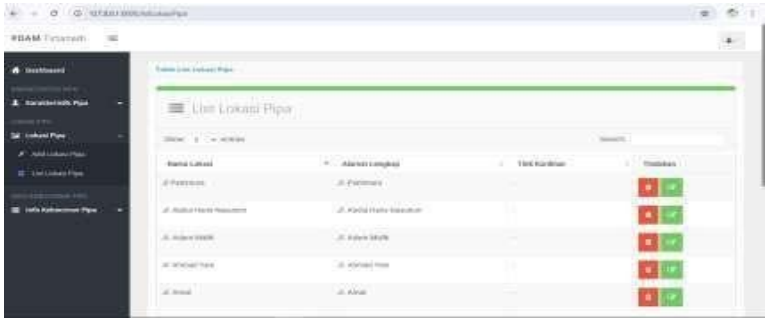
On the Dasboard Page below, is an Operator user Dasboard. Operators can submit information in the form of pipe characteristics, pipe location, and pipe leakage info to the Web-based PDAM Tirtanadi pipe leakage information system.

1. Pipe characteristics

In the pipe characteristics in the Operator User Dashboard section in the Pipe Leakage Information System, there is information about the pipe brand, pipe type, length, and pipe thickness in the Web-Based Pipe Leakage Information System. In the pipe characteristics on the Operator User Dashboard in the PDAM Tirtanadi pipe leakage information system, the operator can delete, edit information if it has an error or correct information data into the Web-based pipe leakage information system. So, if you have information on the Web-based pipe leakage system, adjust it to the needs of the "pipe characteristics". If it does not match the pipe characteristics, the operator can add pipe characteristic data to the Web-based pipe leak information system.

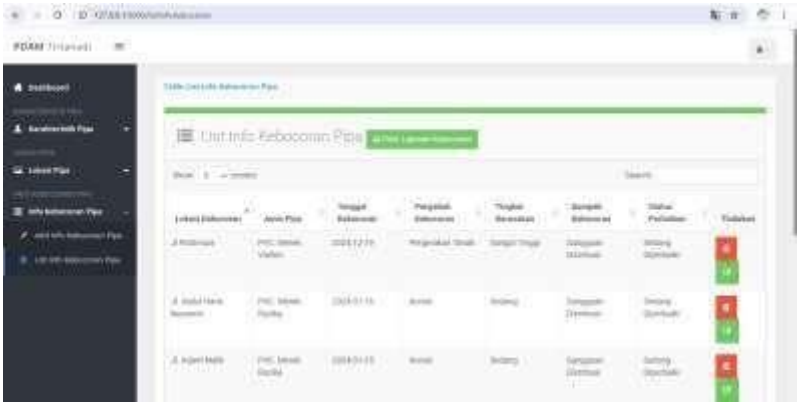
2. Pipe Location

At the Pipe Location on the Dashboard of the Web-Based Pipe Leak Information System there are, Location Name Location Address and Coordinate Points. At the location of the pipe is the same as in "pipe characteristics" User Operators can edit and delete all information data if the data in the pipe location section has errors or improvements in the Web-based pipe leak information system. At the Coordinate point in the Web-Based Pipe Leakage System, there is data that must be emptied because it is confidential (privacy) for PDAM Tirtanadi not to be known by Admin (Customers) so that Information Data is only in the form of Location Names, and Location Addresses according to Information Needs at PDAM Tirtanadi.



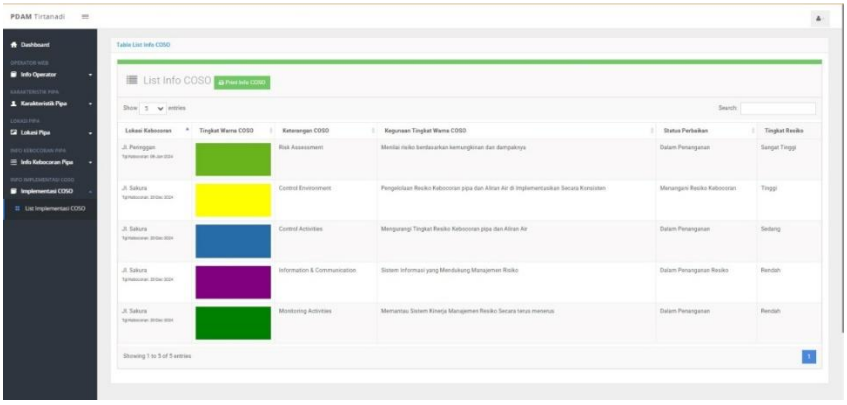
3. Leak Location

On the Opator User Dashboard in the 'Pipe Leak Location' section there are: Leak Location, Pipe Type, Leak Date, Leak Cause, Damage Level. Leakage Impact, and Repair Status. At the Leak Location on the Operator Dasboard User at PDAM Tirtanadi User, the pipe location is the same as in "Pipe characteristics and pipe location" which can edit and delete information data if the information data has errors or improvements to the information data in the PDAM Tirtanadi Web-Based Pipe Leak Information System.



At the pipe leak location there is a "Print Leak Report" which functions as printing all information data reports in the PDAM Tirtanadi pipe leak information system.

4. Implementation of COSO (Committee of Sponsoring Organization of the Treadway Commission) Colors on PDAM Tirtanadi Pipe Leak Information System



The PDAM Tirtanadi Pipe Leak Information System has a feature "Implementation of the COSO (Committee of Sponsoring Organization of the Treadway Commission) Level Color" which has a table: Leak Location, COSO Color Level, COSO Description, Usefulness of COSO Color Level, Repair Status, and Risk Level. Implementation of COSO Color has a risk level according to the risk level in the PDAM Tirtanadi Pipe Leak Information System.

CONCLUSION

The implementation of the Risk Management Information System (SIMR) at PDAM Tirtanadi with an Enterprise Risk Management (ERM) approach has proven essential in identifying and managing the various risks faced by the company, particularly related to pipeline leakage. This information system allows PDAM Tirtanadi to conduct real-time monitoring, forecast potential leaks, and respond quickly to minimize the impact on operations and customer service.

By applying COSO (Committee of Sponsoring Organizations of the Treadway Commission) level colors for risk levels, PDAM Tirtanadi can clearly visualize risk categories based on severity and probability of occurrence. This supports more effective decision-making in planning risk mitigation measures and ensuring more efficient operational performance.

Technology Infrastructure Upgrade: To improve the effectiveness of SIMR, PDAM Tirtanadi needs to update and upgrade its technology infrastructure, such as automated leak detection systems and more sophisticated remote monitoring. Improved Decision Making - With an ERM-based information system in place, decision making related to risk improvement and mitigation becomes faster and data-driven. Continuous Evaluation and Improvement - The system must be evaluated regularly to keep it in line with technological developments and PDAM Tirtanadi's operational needs.

REFERENCES

Atikah, B., & Corralynn, S. (2023). Risk Management on the Production Floor Using Method Enterprise Risk Management Method at PT. XYZ. Talenta Conference Series. https://talentaconfseries.usu.ac.id/ee/article/view/1930

Beasley, M. S., Clune, R., & Hermanson, D. R. (2015). Enterprise Risk Management: A Process for Enhanced Management and Improved Performance. Journal of Accounting and Public Policy, 24(6), 521- 531.

Boehm, B.W. (1998) Spiral Model of software development and enhancement. Addison- Wesley

Irobi, A. E., & Amanze, K. O. (2018). Enterprise Risk Management and Business Continuity: A Study of Financial Institutions in Nigeria. Journal of Research in Business Studies and Management, 5(11), 1-13.

Ishak, A., & Abdillah, F. (2021). Risk Analysis of Fly Ash Silo Machine Parts with the Enterprise Risk Management (ERM) Method. Talenta Conference Series: Energy https://talentaconfseries.usu.ac.id/ee/article/view/1252

Laisasikorn, K., & Ussahawanitchakit, P. (2022). Enterprise Risk Management and Firm Performance: A Contingency Perspective. Journal of International Business and Economics, 12(3), 51-71.

Miftah, H., Yoesdiarti, A., Afandi, S., Zuher, V. M., & ... (2022). RISK MITIGATION OF HORTICULTURAL PRODUCT DISTRIBUTION BASED ON ENTERPRISE RISK MANAGEMENT (ERM) METHOD. In Journal Socialacademia.edu. https://www.academia.edu/download/87282750/3006.pdf

Mosconi E., & Pépin, M. (2017). Developing an Integrated Risk Management Information System: A Case Study in the Oil and Gas Industry. International Journal of Information Systems and Project Management, 1(3), 5-16.

Sefty, I. D. (2022). Dissemination of Operational Risk Analysis in the Production Area of PT. XYZ with the Enterprise Risk Management (ERM) Method. ... PT. XYZ with the Enterprise Risk Management Method http://eprints.umg.ac.id/6538/

Susilo, D. E., & Mahrozi, M. (2020). Operational Risk Analysis at Mulya Lestari Printing Using Enterprise Method Risk Management.repository.stiedewantara.ac.id. http://repository.stiedewantara.ac.id/1102/