

Risk-Based Audits to Reduce Water Loss (NRW) in PDAM Companies in Supporting Good Corporate Governance

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ARTICLE INFO	ABSTRACT
<p>Keywords: Risk-Based Audit; Non-Revenue Water; Good Corporate Governance; Risk Management.</p>	<p><i>Risk-Based Audit to Reduce Water Loss (NRW) at PDAM Giri Tirta, Gresik Regency, is an important approach to supporting sustainable Good Corporate Governance (GCG). This study explores the use of risk-based audits at PDAM Giri Tirta in Gresik Regency to reduce Non-Revenue Water (NRW) and support Good Corporate Governance (GCG). The findings show that risk-based audits are effective in identifying water loss, improving operational efficiency, and enhancing the company's financial and governance practices. This research is designed as a case study of qualitative methods to analyze the implementation of risk-based audits in PDAM Giri Tirta, Gresik Regency. Primary data was obtained through interviews with the general director, the director of the Internal Control Department, the meter recording section, and the accounting section. In contrast, the secondary data was composed of financial documentation. The results show that the water leakage rate is still high, but risk-based audits can help identify and reduce water loss and improve the operational efficiency of PDAMs. The theoretical implication of this study is a paradigm shift in auditing towards a risk-based approach, while it can practically help PDAM companies manage risks and improve operational performance.</i></p>

INTRODUCTION

Regulation Number Kep-117/M-MBU/2002, issued on July 31, 2002, establishes Good Corporate Governance (GCG) standards for State-Owned Enterprises (SOEs) in Indonesia, later reinforced by Mandate Number Per-01/MBU/2011. The Board of Commissioners and Supervisory Board oversee GCG adherence, focusing on management standards like visibility, liability, commitment, self-sufficiency, and equity, along with specific assessment parameters.

The regulation aims to improve corporate governance and enhance public trust in the integrity and professionalism of State-Owned Enterprises (SOEs) in Indonesia. It defines risk as the uncertainty linked to decisions or actions that may lead to negative outcomes. According to the Great Dictionary of the Indonesian Language, risk refers to the detrimental consequences of actions. Risks can be managed through strategies, with uncertainty being a significant contributing factor, influenced by environmental, economic, social, and political changes.

Predicting future events is difficult, with human error potentially heightening risks from natural disasters such as earthquakes and floods. External factors like regulatory changes can also influence business risks. While natural disasters are unavoidable, effective anticipation and planning can mitigate their impact. Risks that can be faced:

1. **Financial Risk:** Investors can lose money if the value of the stock falls. Portfolio diversification and a good understanding of the market can reduce these risks.
2. **Health Risks:** Uncertainty about a person's health condition can lead to serious illness or unwanted accidents. The way to reduce this risk is to get health insurance and adopt a healthy lifestyle.
3. **Business Risks:** Organizations encounter various business risks, including operational risks like equipment failures and market risks associated with customer demand fluctuations, price changes, and economic conditions. To ensure stability and sustainability, it is crucial for organizations to implement effective mitigation strategies to manage uncertainty and the potential negative impacts of these risks.
4. **Environmental Risks:** Environmental changes can be triggered by environmental changes. Risks such as pollution or climate change can affect businesses and society as a whole.

An important step to reduce this risk is to raise awareness of environmental impacts and take action to reduce these impacts. Lowering risk in various aspects of our lives is essential, such as business, finance, and health.

How to Reduce Risk:

1. Risk Identification: Risk identification is an essential initial step in risk reduction efforts, focusing on analyzing current conditions to pinpoint threats that could hinder organizational goals. Key risks to identify include operational, market, and financial risks associated with the organization's processes.
2. Risk Assessment: The following stage involves carrying out a risk assessment after identifying the risks. This includes assessing the possible negative impacts and possible risks. In investing, for example, we assess the risks associated with market volatility and possible losses.
3. Risk Management: Risk management involves actions to control and reduce potential risks. This includes contingency planning, preventive measures, and implementing suitable policies. It is an ongoing process that requires regular evaluation and adjustments to effectively manage risks and achieve objectives.

Risk management involves identifying, measuring, and controlling risks, often using insurance for liability mitigation. Risk-based audits enhance operational resilience by pinpointing vulnerabilities and optimizing resources, linking good corporate governance (GCG) to informed decision-making. The Risk-Based Internal Audit (RBIA) combines risk management with auditing to ensure compliance with GCG principles, improving monitoring and assessing risk management effectiveness. Research indicates that effective risk management is essential for achieving organizational objectives and promoting transparency, asset protection, and sustainability. Studies also explore fraud risks and internal audit enhancements to improve risk management capabilities.

Water management remains one of the most challenging aspects of public sector governance, particularly in countries where infrastructure and financial constraints hinder effective service delivery. According to (Chua et al., 2024), proper water management not only ensures the sustainability of water resources but also contributes to the socio-economic development of communities. Efficient water management can increase access to clean water, reduce public health risks, and improve the overall quality of life for residents. However, many water utilities, particularly in developing countries like Indonesia, face significant operational challenges, including high rates of Non-Revenue Water (NRW), which significantly impacts their financial sustainability.

Digital technologies have proven to be transformative in improving water management systems by enabling real-time monitoring, data collection, and predictive analytics. According to (Fan, 2023), the integration of Internet of Things (IoT) sensors, Geographic Information Systems (GIS), and data analytics has significantly improved the ability of water utilities to track system performance, detect leaks, and optimize resource distribution. These technologies not only support operational efficiency but also help in making informed decisions that reduce Non-Revenue Water (NRW) and enhance the sustainability of water resources. By incorporating such digital solutions, water management systems can be more adaptive to emerging challenges, ensuring a reliable water supply and better service for consumers.

Non-Revenue Water (NRW) refers to water that has been produced but is not billed to customers. This loss, which includes both physical and commercial losses, can occur due to leaks in aging infrastructure, illegal water connections, and inaccurate meter readings (Pazarskis et al., 2023). According to (Gunarsah, 2019), NRW is a critical issue for water utilities globally, with some countries facing losses as high as 40-50% of their total water production. The high levels of NRW in Indonesia's regional drinking water companies (PDAMs) exacerbate the financial challenges these utilities face, hindering their ability to invest in infrastructure upgrades and improve service delivery.

A significant factor contributing to NRW is inadequate risk management practices within water utilities. As noted by (Xu et al., 2020), effective risk management is essential in mitigating potential operational disruptions and reducing losses. Risk-based audits, which focus on identifying and assessing the most significant risks to operational efficiency and financial stability, can help utilities like PDAM Giri Tirta prioritize actions that address key areas of water loss. Risk-based auditing offers a proactive approach to identifying vulnerabilities and optimizing resource allocation, thereby improving operational performance and reducing NRW (Al-Taee & Flayyih, 2023)

The concept of Risk-Based Internal Audit (RBIA) has gained significant traction in recent years as a strategic tool for improving corporate governance and enhancing organizational performance. As explained by (Bhaskar, 2020), RBIA combines traditional auditing with risk management to ensure that audits are focused on areas with the greatest potential impact on the organization's objectives. This approach is particularly relevant for public utilities, where financial and operational efficiency are crucial to ensuring the sustainability of services. By focusing on high-risk areas such as NRW, PDAM companies can improve their risk management capabilities and contribute to the achievement of Good Corporate Governance (GCG) principles.

In Indonesia, the implementation of GCG principles is critical for improving the transparency and

accountability of state-owned enterprises (SOEs), including PDAM companies. According to the National Committee for Governance Policy (Anyufa et al., 2024), GCG provides a framework for enhancing corporate transparency, accountability, responsibility, and fairness. These principles are essential for ensuring that public service providers such as PDAMs operate efficiently and in the best interests of the public. However, the implementation of GCG remains a challenge, particularly in regions with limited resources and political constraints on tariff adjustments (Harymawan et al., 2017).

The application of GCG principles through risk-based audits can help address these challenges by providing a structured approach to managing water loss and improving financial performance. As noted by (Andersen & Sax, 2019), risk-based audits not only help identify operational inefficiencies but also promote a culture of transparency and accountability. By using risk-based audits, PDAM companies can better manage their resources, ensure compliance with regulatory requirements, and enhance public trust in their operations.

Additionally, the role of auditors in managing risks associated with NRW is critical. According to (O'Regan, 2003), auditors play a crucial role in identifying risks, assessing their potential impact, and recommending appropriate measures to mitigate these risks. By incorporating risk-based audit methodologies, auditors can help PDAM companies pinpoint areas of water loss, such as leaks or illegal connections, and suggest targeted solutions. Furthermore, the involvement of auditors in promoting GCG can lead to better decision-making, which is essential for improving the long-term sustainability of PDAMs.

The shift from traditional auditing methods to risk-based auditing represents a paradigm change in how organizations approach risk management. As noted by (Kalina et al., 2022), risk-based auditing allows organizations to focus on areas of highest vulnerability and impact, ensuring that audit resources are used efficiently. This shift has been particularly beneficial for industries like water management, where operational inefficiencies and financial losses can have far-reaching consequences. The adoption of risk-based auditing practices in PDAM Giri Tirta could help identify critical issues that contribute to high levels of NRW and enable the utility to take appropriate action.

Furthermore, implementing RBIA within PDAM Giri Tirta can lead to improvements not only in water management but also in the financial and operational stability of the utility. According to (Wang et al., 2021), the use of RBIA can enhance decision-making processes by providing a more accurate understanding of an organization's risk profile. For PDAMs, this means that the utility's leadership will be better equipped to make informed decisions about infrastructure investments, operational improvements, and water pricing, ultimately improving service delivery and financial sustainability.

Finally, risk-based audits can also foster a culture of continuous improvement within PDAMs. By regularly assessing and managing risks, water utilities can adapt to changing circumstances, such as new regulatory requirements or shifts in public demand. This adaptability is critical in maintaining the quality and reliability of water services, particularly in regions with rapid population growth or limited resources (Chua et al., 2024). The ability to address emerging risks proactively ensures that PDAMs can continue to meet the needs of their customers and contribute to the broader goals of sustainable water management.

Risk-based audits have been explored in various industries to improve organizational performance and governance, particularly in sectors with significant risk factors like water management. Previous studies such as those by (Tristyanto & Suroto, 2020) and (Kzykeyeva, 2022) have examined the effectiveness of risk-based auditing in mitigating risks, enhancing internal controls, and supporting Good Corporate Governance (GCG). In water management, research by (Chua et al., 2024) demonstrated the importance of auditing in reducing operational inefficiencies and water losses in municipal systems. However, there is a gap in specific studies that focus on the implementation of risk-based audits in Indonesian water utilities, especially in terms of reducing Non-Revenue Water (NRW).

While the implementation of risk-based audits has been studied in various industries, there remains a gap in research focusing on their application in water utilities, specifically to reduce Non-Revenue Water (NRW). Prior studies have not adequately addressed the unique challenges faced by PDAM companies in Indonesia, such as outdated infrastructure and political constraints on tariff adjustments. This research aims to fill this gap by analyzing how risk-based audits can be tailored to address the specific needs of PDAM Giri Tirta in Gresik Regency, ultimately supporting improved water management and enhanced corporate governance.

The novelty of this research lies in its focus on the use of risk-based audits to address the specific challenges of Non-Revenue Water (NRW) in the context of PDAM companies in Indonesia. While risk-based audits have been implemented in various sectors, this study provides a unique perspective by applying these audits to water loss management, a critical issue for water utilities in developing countries. By incorporating a case study of PDAM Giri Tirta in Gresik Regency, this research offers practical insights into how risk-based audits can support sustainable Good Corporate Governance (GCG) and enhance operational efficiency in the water management sector.

The research explores the impact of risk management on internal auditors' actions at BPJS Ketenagakerjaan and employs machine learning to predict cybersecurity risks based on company

characteristics. It references prior studies on risk-based auditing and suggests a three-step prioritization method, emphasizing the necessity of unique risk management and internal audit functions for high-risk clients to improve organizational efficiency. Additionally, the study evaluates the implementation of Risk-Based Audit (RBIA) in addressing Non-Revenue Water (NRW) issues in Indonesia's PDAM Giri Tirta, highlighting the country's significant water loss rates. It underscores the need for adherence to corporate governance principles and cites successful strategies from Phnom Penh's water authority for managing unaccounted water loss to enhance service quality and efficiency.

This research examines the use of Risk-Based Audits to minimize Non-Revenue Water (NRW) in Regional Drinking Water Companies (PDAM). It aims to demonstrate how these audits can support sustainable Good Corporate Governance (GCG) by addressing issues such as leaks and resource wastage, thus promoting effective water management.

This study aims to evaluate the implementation of Risk-Based Auditing at PDAM to reduce Non-Revenue Water (NRW). It examines the methods used by companies to identify and assess risks related to water loss, highlighting how these audit principles can improve water resource management and enhance Good Corporate Governance (GCG) policies.

This research aims to improve audit practices in the water management sector by adopting a risk-based approach, shifting from a general to a more adaptive framework. It provides guidance for practitioners to identify and mitigate water loss, allowing PDAMs to reduce operational costs. For communities, decreased non-revenue water enhances water availability, pressure, and quality, ultimately increasing customer satisfaction and trust in PDAM as a reliable service provider.

METHOD

This research uses a qualitative case study approach to analyze the implementation of Risk-Based Audits (RBIA) at PDAM Giri Tirta in Gresik Regency, focusing on its effectiveness in reducing Non-Revenue Water (NRW) and supporting Good Corporate Governance (GCG). Primary data were collected through interviews with key stakeholders, including the general director, the internal control department, and relevant sections involved in water management and accounting. Secondary data, such as financial and audit reports, were also reviewed. Thematic analysis was used to identify key themes related to risk management, NRW reduction, and governance improvements. This case study approach allows for an in-depth exploration of the specific challenges and successes in applying RBIA within a regional water utility.

RESULTS AND DISCUSSION

The main issue of Non-Revenue Water (NRW) for PDAM Giri Tirta Gresik stems from three factors: discrepancies between supplied and sold water, leaks from aging pipes from the Dutch colonial era, and meter recorders' water theft. Political constraints impede tariff increases, complicating loss recovery. To tackle the NRW challenge and promote sustainable Good Corporate Governance (GCG), implementing GCG principles clarity, accountability, responsibility, independence, and equity is essential. The article highlights how risk-based audits can enhance water management and operational efficiency.

- 1. Transparency:** Transparency is crucial in managing water leaks, as accurate financial reports and operational data enhance public trust. Regular internal audits ensure relevant information is accessible to stakeholders, promoting data-driven decision-making.
- 2. Accountability:** The principle of accountability mandates clear responsibilities for water management within each PDAM department. Risk-based audits can assess performance in reducing NRW, while an effective reporting system enables evaluation of policies and ensures accountability in decision-making.
- 3. Responsibility:** Water companies are responsible for maintaining infrastructure and managing water resources. Implementing risk-based audits can help PDAM identify potential leak risks. Additionally, collaborating with the community and training employees to detect leaks are essential for enhancing management efficiency.
- 4. Independence:** Independent decision-making and audit committees enhance managerial integrity, provide objective evaluation of water management systems, and promote transparency in reporting to stakeholders.
- 5. Fairness:** Fairness in water management is crucial, requiring public education, cross-subsidy policies, and risk-based audits to balance company interests and community interests.

The application of GCG principles via risk-based audits offers a robust framework for PDAM Giri Tirta Gresik to lower non-revenue water (NRW). This approach aims to enhance operational efficiency, minimize financial losses, and secure sustainable water supply for the community, aligning with improved Good Corporate Governance objectives.

Implementing Good Corporate Governance principles in managing water leakage offers a framework for drinking water companies to tackle Non-Revenue Water (NRW) challenges. Emphasizing clarity, accountability, responsibility, independence, and equity helps reduce leakage, enhance operational efficiency, and ensure sustainable water availability for communities.

This study demonstrates the significance of the Risk-Based Audit approach in minimizing Non-Revenue Water (NRW) at PDAM Giri Tirta Gresik, thereby enhancing sustainable Good Corporate Governance (GCG). Employing the Exponential Non-Discriminatory Snowball Sampling method, the research identifies major risks such as pipe leaks, water theft, and meter errors that contribute to high NRW. The findings suggest that risk-based audits effectively identify and mitigate these risks, ultimately supporting better corporate governance. Data triangulation further bolsters the credibility of the results and provides valuable insights into risk management strategies.

Risk-based audits have effectively reduced Non-Revenue Water (NRW) at PDAM Giri Tirta Gresik, contributing to sustainable Good Corporate Governance (GCG). The study offers practical recommendations for enhancing the use of risk-focused audits to improve operational efficiency and sustain community services.

CONCLUSION

The study suggests strategic steps to support sustainable Good Corporate Governance (GCG) in PDAM Giri Tirta Gresik to minimize water loss and reduce the non-revenue water (NRW) grade. These steps include reviewing and adjusting contracts with water suppliers to align with the company's evolving needs, particularly in industrial areas like JIPE and PT Freeport, to prevent water wastage due to marketing challenges. Infrastructure modernization is also essential, requiring management to update aging pipes and metering devices with an economic life of 5-10 years, aligning investments with cash flow conditions and securing funding from the Gresik Regency Government. Additionally, employee coaching and supervision should be reinforced through strict oversight, rewards for outstanding performance, and sanctions for negligence. The research highlights the effectiveness of a Risk-Based Internal Audit (RBIA) in promoting sustainable GCG by identifying key issues, particularly the significant political influence in setting water tariffs. PDAM Giri Tirta Gresik currently has the lowest basic water tariff in East Java, but a tariff adjustment scheduled for April 2024 aims to strengthen the company's financial health. The findings emphasize the necessity of risk-based audits for efficient management and sustainable operations, ensuring continuous improvement in service quality for the community.

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