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Determination of Profitability: Analysis of Non-Revenue Water, Legal Aspects, Cost of Goods Sold, Chemicals, Custome Behavior, and Government Regulations (Study Literature Review)

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Abstract: The purpose of this literature review is to develop hypotheses for future researchers conducting research related to profitability. The research article on determining profitability: analysis of non-income water, legal aspects, cost of goods sold, chemistry, customer behavior, and government regulations is a scientific literature article in the field of operational management. The approach used in this literature review is descriptive qualitative. The data collection technique used is literature study or reviewing previous relevant articles. The data used in this study is secondary data with a maximum publication of 8 years, sourced from academic online media such as Thomson Reuters Journal, Sage, Springer, Taylor & Francis, Scopus Emerald, Elsevier, Sage, Springer, Web of Science, Sinta Journal, DOAJ, EBSCO, Google Scholar, and digital reference books. Empirical data was used to support the phenomena observed in this study. In this study, one relevant previous study was used for each variable to review the results of the previous study. The results of the literature review are as follows: 1) Non-revenue water affects profitability; 2) Legal aspects affect profitability; 3) Cost of goods sold affects profitability; 4) Chemicals affect profitability; 5) Customer behavior affects profitability; and 6) Government regulations affect profitability.

Keywords: Profitability, Non-Revenue Water, Legal Aspec, Cost of Good Solds, Chemical, Customer Behavior, Government Rules

INTRODUCTION

Water is a basic necessity for all living things, especially for humans to support daily activities such as drinking, bathing, washing, and productive activities in industry and agriculture (Karim et al., 2022). In Indonesia, the systematic provision of clean water is the responsibility of Regional Water Companies (PDAM), which play an important role in ensuring the availability and distribution of clean water to the community (Nanda et al., 2024). However, many PDAMs in Indonesia still face serious challenges in implementing clean water management.

According to a report by PAM Jaya, (2023), only around 67% of customers in Indonesia will have access to safe drinking water/clean water from PDAM by 2023. Issues such as pipeline leaks, high non-revenue water (NRW) rates, limited infrastructure, and high operational costs are the main obstacles to PDAM profitability (Marjaya & Pasaribu, 2019).

Additionally, external factors like changes in government regulations, customer behavior such as non-payment of bills, and inefficient use of chemicals in the water treatment process further exacerbate the operational conditions of the companies.

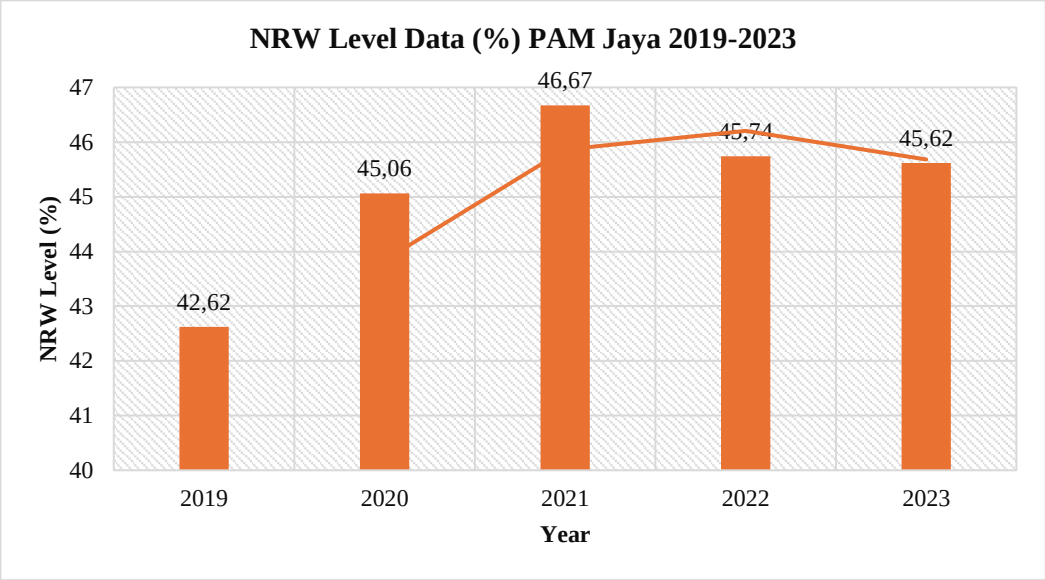

Figure 1. NRW Level Data (%) 2019-2023
Source: PAM Jaya, (2023)

From this data, it can be concluded that PAM Jaya has not been able to significantly reduce the NRW rate over the past five years. Ideally, a healthy NRW rate should be below 20%, while PAM Jaya's has consistently remained above 40%, reaching nearly 47% at its peak (Farouk et al., 2023). This indicates serious inefficiencies in water distribution, which has a direct impact on the company's profitability, as higher NRW rates mean greater potential revenue loss (AbuEltayef et al., 2023).

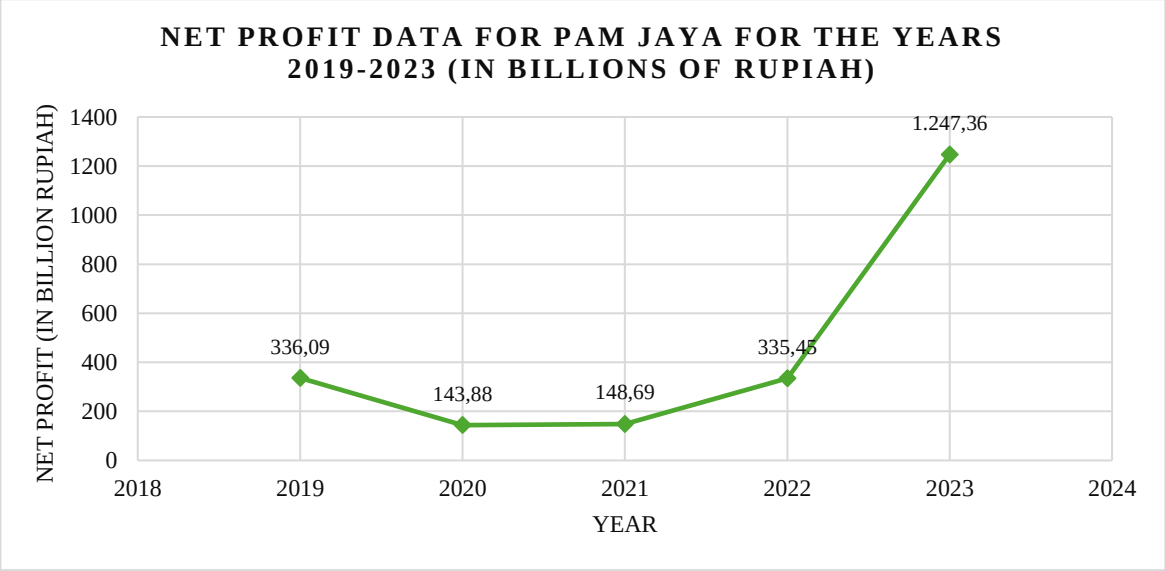

Figure 2. Net profit data for PAM JAYA for the years 2019-2023 (in billions of rupiah)
Source: PAM Jaya, (2023)

The increase in profit in 2023 must be viewed critically. While this indicates positive progress in terms of profitability, it is important to remember that profit growth does not always reflect fundamental improvements, especially when compared to the Non-Revenue Water (NRW) data in Figure 1, which shows high NRW levels (above 40%) over the past five years.

High NRW levels indicate inefficiencies in the water distribution system, as water produced does not generate revenue (due to leakage, theft, or inaccurate reporting) (Liemberger & Wyatt, 2018). Ideally, if NRW is successfully reduced, profitability should improve based on system efficiency (Ali, 2024). Without effective control of NRW, significant profit gains may be temporary and do not guarantee long-term sustainability (Kavya et al., 2023). Therefore, an integrated strategy between operational efficiency and financial performance improvement is necessary for PAM Jaya to achieve sustainable and reliable profitability.

Faced with these challenges, each PDAM must conduct a comprehensive assessment of the factors that affect its profitability. Factors such as controlling raw material and chemical costs, operational efficiency, understanding customer behavior, and compliance with government regulations are key elements that must be effectively managed (Mwakapola & Joseph, 2024). Improvement efforts are not only technical, but also require a more adaptive and data-driven approach to management and business strategy. Therefore, further research and analysis of the determinants of PDAM profitability is highly relevant and urgent to support future policy formulation and strategic planning.

Problem Formulation

Based on the background of the problem above, the following research questions were formulated to be used as hypotheses for further research: 1) Does non-revenue water affect profitability?; 2) Do legal aspects affect profitability?; 3) Do costs of goods sold affect profitability?; 4) Do chemicals affect profitability?; 5) Does customer behavior affect profitability?; and 6) Do government regulations affect profitability?.

METHOD

This study uses a descriptive qualitative approach. This method was chosen because it allows researchers to investigate and understand the characteristics related to factors that influence profitability comprehensively. Descriptive qualitative data collection and analysis allow researchers to tailor their approach to the needs of the study and the characteristics of the subjects being studied.

The data used in this study were obtained from previous studies related to profitability, non-revenue water, legal aspects, cost of goods sold, chemicals, customer behavior, and government regulations. The data were obtained from electronic sources published within the last eight years. The technique used in this literature review is SALSA (Search, Appraisal, Synthesis, and Analysis). By utilizing previous research, the researcher can develop stronger, evidence-based arguments and contribute to a broader understanding of the factors influencing profitability, (Susanto et al., 2024).

This study utilizes data from various leading academic journals, including Thomson Reuters Journal, Springer, Taylor & Francis, Scopus, Emerald, Sage, WoS, Sinta Journal, DOAJ, and EBSCO, as well as platforms such as Publish or Perish and Google Scholar. By using these sources, researchers can ensure that the data they collect is valid and accountable. The use of multiple sources also allows researchers to gain a more comprehensive understanding of profitability from various perspectives.

RESULTS AND DISCUSSIONS

Results

The following are the findings of the study, taking into account the context and problem formulation:

Profitability

Profitability is the ability of a company or organization to earn a profit from its operations within a given time. Profitability reflects a company's efficiency in managing its resources and

revenues relative to its costs and expenses. Common measures of profitability include net profit margin, return on assets (ROA), and return on equity (ROE) (Feizal et al., 2021).

Indicators or dimensions found in profitable variables include: 1) Net profit margin: Measures net profit as a percentage of total revenue. The higher the margin, the higher the profitability; 2) Return on assets (ROA): Indicates the company's ability to generate profit from its total assets; 3) Return on equity (ROE): Measures how much profit is earned on the investment of shareholders; and 4) Gross Profit Margin: The percentage of gross profit to sales, reflecting production efficiency and COGS control (M. W. Darmawan et al., 2023).

The profitable variable is relevant to previous research conducted by: (Anggari & Dana, 2020), (Kharlamov & Parry, 2021), (Ekadjaja et al., 2020), (Sudrajat & Setiyawati, 2021).

Non-Revenue Water

Non-revenue water is the amount of water produced by a water utility that does not generate revenue due to technical losses (leaks), theft, inaccurate meter readings, or free water distribution. NRW is an indicator of the operational efficiency and management of the water distribution system. The higher the NRW, the greater the potential revenue loss to the company (Farouk et al., 2023).

Indicators or dimensions found in non-revenue water variables include: 1) Physical Loss: Water lost due to pipe leaks, damaged connections; 2) Commercial Loss: Losses due to theft, incorrect meter readings, or damaged meters; 3) Production Volume and Billed Volume: The difference between water produced and water billed; and 4) Percentage of NRW to Total Production: Measures the amount of water that does not generate revenue (Liemberger & Wyatt, 2019).

Non-revenue water variables are relevant to previous research conducted by: (AbuEltayef et al., 2023), (Güngör-Demirci et al., 2018), (Cassidy et al., 2021).

Legal Aspects

Regulatory refers to the rules, regulations, and laws with which a company must comply in the conduct of its business. These include business licenses, industry regulations, environmental laws, contracts, and tax regulations. Strong legal aspects provide legal certainty in conducting business and avoid legal risks that could affect profitability (Polontoh et al., 2025).

Indicators or dimensions found in legal aspects include: 1) Industry Compliance: The extent to which the company complies with specific industry regulations; 2) Legal risks and litigation: The number of lawsuits or potential lawsuits facing the company; 3) Contract Security and Business Legality: The completeness of legal documents supporting business continuity; and 4) Regulatory change: The impact of new regulations or legislative changes on operations and profits (Cejka, 2020).

Legal variables are relevant to previous studies conducted by: (Shereshashvili & Sabauri, 2021), (Hakim et al., 2020), (Al-Ibbini & Shaban, 2023).

Cost of Good Solds

Cost of Goods Sold (COGS) is the total direct cost incurred by a company to produce goods or services sold during a given period. COGS includes the cost of raw materials, direct labor, and other production costs. The lower the COGS for the same amount of revenue, the higher the company's profit (Ledley et al., 2020).

Indicators or dimensions found in the cost of goods sold variable include: 1) Raw Material Costs: The total cost of production materials; 2) Direct Labor Costs: Wages paid to workers directly involved in the production process; 3) Production Overhead: Indirect costs such as electricity and machine rental; and 4) Production Cost Efficiency: The ratio of actual costs to standard production costs (Dennis et al., 2020).

The variable cost of goods sold is relevant to previous research conducted by: (Rashid, 2021), (Basyith et al., 2021), (Karim et al., 2023).

Chemical

Chemicals are substances used in processing or manufacturing, such as chlorine, alum, or water purification chemicals. The purchase and use of these chemicals are part of the operating costs that affect a company's efficiency and profit (Kumar et al., 2023).

Indicators or dimensions found in chemical variables include: 1) Types of chemicals used: The variety of chemicals used, such as alum, chlorine, or water purifiers; 2) Quantity and Dosage Used: How much chemical is used per volume of production; 3) Processing Effectiveness: How well the chemicals work to achieve product quality standards; and 4) Chemical Purchase Cost: The total budget allocated to purchasing chemicals (Baena-Moreno et al., 2020).

The chemical variables are relevant to previous studies conducted by: (Nasfi, 2022), (Sánchez et al., 2022), (Amri, 2021).

Customer Behavior

Customer behavior is the study of how individuals or groups make decisions to purchase, use, and evaluate products or services. In the context of profitability, customer behavior influences consumption levels, loyalty, timely payments, and complaints. Positive behavior supports revenue and business continuity (Subaebasni et al., 2019).

Indicators or dimensions found in customer behavior variables include: 1) Consumption or Usage Level: How much or how often customers use the product/service; 2) Payment Compliance: Discipline of customers in paying bills; 3) Complaints and Feedback: Number of complaints and feedback from customers; and 4) Customer Loyalty and Retention: How loyal customers are and how likely they are to switch to competitors (Rane et al., 2023).

Variable customer behavior is relevant to previous research conducted by: (Farahdiba, 2020), (Valdez-Juárez et al., 2021), (Kim et al., 2020).

Government Rules

Government regulations are policies, rules, or laws established by the government with which companies must comply. These can include tariffs, environmental regulations, taxation, safety standards, and others. Changes or implementation of certain regulations can have a direct impact on a company's costs, revenues, and profitability (Eprianto et al., 2021).

Indicators or dimensions found in government rules variables include: 1) Tariff or subsidy policies: Government regulations regarding selling prices and subsidies; 2) Licensing and operating standards: Compliance with legal and technical requirements from government agencies; 3) Environmental regulations: Regulations related to waste, emissions and environmental impact; and 4) Changes in public policy: The impact of policy changes on the company's strategy and profits (Wang et al., 2020).

The variable of government rules is relevant to previous research conducted by: (Iqbal Hussain et al., 2021), (Zaleski & Chawla, 2020), (Athari, 2021).

Previous Research

Based on the above findings and previous studies, the research discussion is formulated as follows:

Table 1. Results of Previous Relevant Research

No	Author (Year)	Research Results	Similarities With This Article	Differences With This Article
1	(Nanda et al., 2024)	-Non-revenue water variables affect the	This article has similarities in examining	-The difference from previous studies is that

		profitability of the Palangka Raya Central Water Company (SPAM Pusat Perumda Air Minum Palangka Raya). -Distribution channel variables affect the profitability of the Palangka Raya Central Water Company (SPAM Pusat Perumda Air Minum Palangka Raya)	Non-Revenue Water as an independent variable and Profitability as a dependent variable.	Distribution Channel is included as another independent variable. -Another difference is that the research was conducted at the Palangka Raya Public Water Company (SPAM Pusat Perumda Air Minum Palangka Raya).
2	(Polontoh et al., 2025)	-Legal Aspects variable affects Profitability -Business Contracts variable affects Profitability	This article has similarities in examining the Legal Aspects variable in the independent variable and examining the Profitability variable in the dependent variable.	The difference with previous studies lies in the variable Business Contracts as another independent variable.
3	(Ledley et al., 2020)	-Variable Cost of Goods Sold affects Profitability -Variable EBITDA affects Profitability	This article has similarities in examining the Cost of Goods Sold variable as the independent variable and examining the Profitability variable as the dependent variable.	The difference with previous studies lies in the use of EBITDA as another independent variable.
4	(Lim & Rokhim, 2021)	-The variable Use Chemical affects Profitability -The variable Sustainable Growth affects Profitability	This article has similarities in examining the Chemical variable as the independent variable and examining the Profitability variable as the dependent variable.	The difference with previous studies lies in the variable of Sustainable Growth as another independent variable.
5	(Abbasimehr & Shabani, 2021)	-Customer Behavior variables affect Profitability in Banking -Growing Customers variables affect Profitability in Banking	This article has similarities in examining the variable of Customer Behavior as the independent variable and examining the variable of Profitability as the dependent variable.	The difference with previous studies lies in the variable Growing Customers as another independent variable.
6	(Phi et al., 2021)	-Political Stability variable affects Profitability -Regulatory Quality variable affects Profitability -Government Rules variable affects Profitability	This article has similarities in examining the Government Rules variable in the independent variable and examining the Profitability variable in the dependent variable.	The difference with previous studies lies in the inclusion of Political Stability and Regulatory Quality as additional independent variables.

Discussion

This literature review will be discussed based on the history of the topic, research objectives, problem formulation, indicators or dimensions, and previous related research:

1. The Influence of Non-Revenue Water on Profitability

Based on a literature review and relevant previous research, it can be stated that non-revenue water affects profitability.

To increase profitability through non-revenue water, companies or organizations must do the following: 1) Physical losses: These losses are caused by leaking pipes, damaged connections, and aging infrastructure; 2) Commercial loss: Revenue is lost due to water theft, inaccurate meter readings, or illegal customers; 3) Production volume and volume charged: A large discrepancy between production and billed water volume indicates inefficiency; and 4) Percentage of non-revenue water to total production: The higher the percentage, the greater the company's losses.

If companies or organizations can pay attention to physical losses, commercial losses, production volume and volume charged, and the percentage of non-revenue water to total production, this will have an impact on profitability, including: 1) Net profit margin: Reducing NRW reduces wasteful costs and increases net revenue, thereby improving profit margins; 2) Return on assets: Efficient water distribution without waste increases revenue without adding assets, thereby improving the profit-to-asset ratio; 3) Return on equity: Increased revenue and cost efficiency will increase net income, positively impacting shareholders' return on investment; and 4) Gross profit margin: By reducing waste (cost of goods sold from unaccounted for water), gross profit increases significantly.

The results of this study are in line with previous research conducted by (Nanda et al., 2024), (Daneshgar & Zahedi, 2022), (Tran et al., 2020), which states that there is a relationship between non-revenue water and profitability.

2. The Influence of Legal Aspects on Profitability

Based on a literature review and relevant previous research, it can be stated that legal aspects have an influence on profitability.

To increase profitability through legal aspects, companies or organizations must do the following: 1) Industry compliance: Companies that comply with legal standards and industry regulations avoid fines, penalties, or shutdowns; 2) Legal risks and lawsuits: Legal actions can result in significant losses in the form of fines, legal fees, and damage to reputation; 3) Contract security and business legality: Legally valid and strong contracts protect companies from conflicts, fraud, and losses in business partnerships; and 4) Regulatory changes: A company's ability to adapt to new regulations is key to rapid adaptation.

If companies or organizations can pay attention to industry compliance, legal risks and lawsuits, contract security and business legality, regulatory changes, this will have an impact on profitability, including: 1) Net profit margin: Legal compliance avoids fines and litigation losses, thereby increasing net income; 2) Return on assets: When legal risks are minimized, asset efficiency increases because assets are not legally encumbered; 3) Return on equity: When legal risk is reduced, profits available to shareholders increase, resulting in higher ROE; and 4) Net profit margin: Legal compliance avoids operational disruptions and unexpected costs, keeping gross margins optimal.

The results of this study are in line with previous research conducted by (Polontoh et al., 2025), (Wang et al., 2020), (Yu et al., 2022), which states that there is an influence between legal aspects and profitability.

3. The Influence of Cost of Good Solds on Profitability

Based on a literature review and relevant previous studies, it can be stated that the cost of goods sold affects profitability.

To increase profitability through the cost of goods sold, companies or organizations must do the following: 1) Raw material costs: Companies must procure raw materials efficiently, either through price negotiations with suppliers, optimal inventory management, or selection of less expensive alternative raw materials without compromising quality; 2) Direct labor costs: Increased employee productivity, appropriate training, and the use of technology can help reduce production costs per unit; 3) Production overhead costs: Indirect costs such as electricity, water, rent, and depreciation of production equipment must be controlled through efficient management and optimal use of resources; and 4) Production cost efficiency: Overall production efficiency can be achieved through the implementation of quality management systems, automation, and elimination of waste at each stage of production.

If companies or organizations can pay attention to raw material costs, direct labor costs, production overhead costs, and production cost efficiency, this will have an impact on profitability, including: 1) Net profit margin: Increased because the difference between revenues and costs becomes larger after the reduction in COGS; 2) Return on assets: Increased because of higher net income, reflecting more efficient use of assets in generating profits; 3) Return on equity: Indicates a higher return to shareholders due to increased net income; and 4) Net Profit Margin: Will increase due to efficiency in production costs, resulting in a larger difference between revenues and COGS.

The results of this study are in line with previous research conducted by (Ledley et al., 2020), (Rashid, 2021), (Gołaś, 2020), which states that there is an influence between the cost of goods sold and profitability.

4. The Influence of Chemical on Profitability

Based on a literature review and relevant previous research, it can be stated that chemicals have an effect on profitability.

To increase profitability through chemicals, companies or organizations must do the following: 1) Types of chemicals used: Companies must select chemicals that are suitable for their production processes, are of good quality, are environmentally friendly, and support optimal production results; 2) Amount and dosage used: The use of chemicals must be adjusted to the appropriate dosage to avoid waste or negative impact on product quality, as well as to avoid additional costs due to overdosage; 3) Effectiveness of processing: The chemicals used must be able to improve process efficiency, such as reducing production time, reducing waste, and improving the quality of the final product; and 4) Cost of purchasing chemicals: Companies must regularly evaluate chemical prices, select reliable suppliers, and consider bulk purchasing to obtain more favorable prices.

If companies or organizations can pay attention to the types of chemicals used, the amount and dosage used, the effectiveness of processing, and the cost of purchasing chemicals, this will have an impact on profitability, including: 1) Net profit margin: Increased because chemical efficiency reduces production costs, resulting in higher net profits; 2) Return on assets: Increased because asset utilization becomes more optimal due to improved production efficiency resulting from the use of appropriate chemicals; 3) Return on equity: Also increased because higher net profits provide a higher return on investment to shareholders; and 4) Margin laba kotor: Improved because chemical control reduces the direct cost of production (COGS), thereby increasing the difference between sales revenue and production costs.

The results of this study are in line with previous research conducted by (Baributsa et al., 2019), (Nasfi, 2022), (Queiroz et al., 2022), (Lim & Rokhim, 2021), which states that there is an influence between chemicals and profitability.

5. The Influence of Customer Behavior on Profitability

Based on a literature review and relevant previous research, it can be stated that customer behavior affects profitability.

To increase profitability through customer behavior, companies or organizations must do the following: 1) Increase consumption and usage: Understanding customer consumption patterns enables companies to tailor their product or service offerings, thereby increasing sales volume; 2) Payment compliance: Customers who pay on time support healthy cash flow, reduce the risk of bad debts, and strengthen financial stability; 3) Complaints and feedback: Proactively responding to customer complaints and feedback can improve service quality, build long-term relationships, and prevent customer loss; and 4) Customer loyalty and retention: Loyal customers who continue to use the company's products or services over the long term reduce the cost of acquiring new customers and increase recurring revenue.

If companies or organizations can pay attention to consumption and usage levels, payment compliance, complaints and feedback, customer loyalty and retention, this will have an impact on profitability, including: 1) Net profit margin: Increases due to stable revenue from loyal customers and reduced costs due to more efficient service; 2) Return on assets: Increases due to more productive use of assets in serving high-value customers; 3) Return on equity: Increases due to high net profits that provide greater returns to shareholders; and 4) Gross profit margin: Increases due to increased sales volume with controlled variable costs as a result of positive customer behavior.

The results of this study are in line with previous research conducted by (Abbasimehr & Shabani, 2021) and (Yarahmadi et al., 2022), which states that there is an influence between customer behavior and profitability.

6. The Influence of Government Rules on Profitability

Based on a literature review and relevant previous research, it can be stated that government rules have an effect on profitability.

To increase profitability through government regulations, companies or organizations must do the following: 1) Tariff or subsidy policies: Government policies such as import tariffs, taxes, or subsidies have a significant impact on production costs and product price competitiveness. Companies that receive subsidies or tax incentives can reduce costs and increase profit margins; 2) Licensing and operational standards: Compliance with business licenses and operating standards set by the government can protect companies from legal sanctions, streamline production processes, and enhance their reputation with consumers and business partners; 3) Environmental regulations: Regulations related to waste management, emissions, and resource conservation must be complied with to maintain business sustainability; and 4) Public policy changes: New government policies, such as tax reforms, industry deregulation, or changes in bureaucratic structure, must be responded to quickly by companies to remain competitive and adaptable in a changing environment.

If companies or organizations can pay attention to tariff or subsidy policies, licensing and operational standards, environmental regulations, and changes in public policy, this will have an impact on profitability, including: 1) Net profit margin: Increase through cost efficiencies from government incentives or avoidance of legal penalties; 2) Return on assets: Improve through more optimal use of assets in a compliant system; 3) Return on equity: Increase through increased net profits and operational efficiencies that benefit shareholders; and 4) Gross profit margin: Remain stable because production and distribution costs can be controlled through favorable subsidy or tariff policies.

The results of this study are in line with previous research conducted by (Phi et al., 2021), which states that there is an influence between government rules and profitability.

Conceptual Framework

The conceptual framework is determined based on the problem statement, research objectives, and previous studies relevant to the literature review in this study:

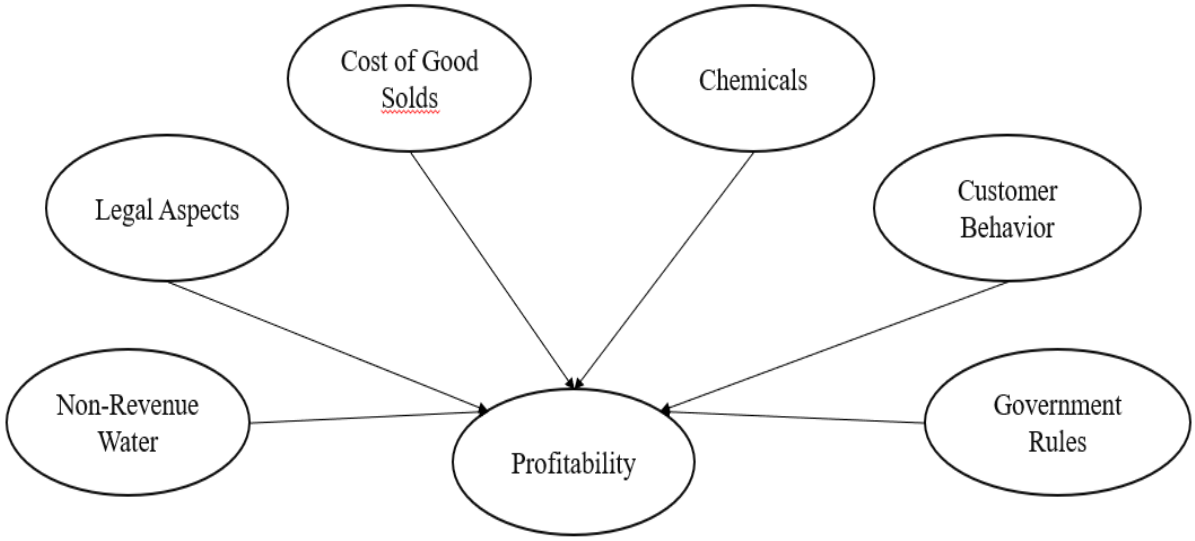

Figure 3. Conceptual Framework

Based on Figure 3 above, non-revenue water, legal aspects, cost of goods sold, chemicals, customer behavior, and government regulations affect profit. However, in addition to non-revenue water, legal aspects, cost of goods sold, chemicals, customer behavior, and government regulations that affect profit, other variables also affect profit, including:

1) Service Quality: (Abdurochman & Tantra, 2023), (Septiana et al., 2021), (Athar et al., 2020), (Saputra & Ardani, 2020).
2) Market Competition: (Rambe & Aslami, 2022), (He et al., 2023), (Liu et al., 2022), (Long et al., 2020), (Tsendsuren et al., 2021).
3) Quality of Human Resources: (D. Darmawan et al., 2020), (Rahardja, 2022), (Putri et al., 2022), (Candra Susanto et al., 2023).

CONCLUSION

Based on the problem formulation, results, and discussion above, the conclusions of this study are as follows:

1. Non-revenue water affects profitability.
2. Legal aspects affect profitability.
3. Cost of goods sold affects profitability.
4. Chemicals affect profitability.
5. Customer behavior affects profitability.
6. Government regulations affect profitability.

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