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RESEARCH ARTICLE

Development of a Water Bill Arrears Information System Based on Microsoft Access and Visual Basic 6.0 for PDAM Tirta Mon Krueng Baro

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Abstract
This study addresses the development of an automated water bill arrears management system for PDAM Tirta Mon Krueng Baro, aiming to replace the previous manual method that relied on Microsoft Excel. The old system resulted in errors, delays in report generation, and difficulties in tracking overdue payments, which impacted both financial management and customer service. The newly designed system utilizes Microsoft Access and Visual Basic 6.0 to streamline data entry, reduce errors, and enable efficient tracking of overdue bills. With a structured database and normalized tables, the system improves data accuracy, eliminates redundancy, and speeds up reporting processes. The adoption of this system ensures real-time updates and quicker decision-making, which enhances financial management. The user-friendly interface and automated features facilitate smooth implementation and greater user acceptance. By transitioning to a computerized system, PDAM Tirta Mon Krueng Baro can enhance operational efficiency, minimize errors, and improve customer satisfaction. The study demonstrates the positive impact of adopting modern technology to optimize service delivery in public utilities, offering a more effective approach to managing billing processes and overdue payments.

Keywords
Water Bill Arrears; Information System Development; PDAM; Microsoft Access; Visual Basic 6.0; System Automation.

1 | INTRODUCTION

An efficient data management system is crucial for any public service provider, including PDAM (Regional Water Supply Company). In efforts to provide the best service, proper data management, especially regarding water bill arrears, becomes extremely important. Inaccurate recording and monitoring of payments can decrease service quality and affect the company's performance. This issue often arises in PDAMs still using manual methods for data management, which have proven to be ineffective in handling large and complex transaction volumes. The manual approach poses challenges in terms of accuracy and efficiency, making it difficult to track overdue payments and generate reports promptly. As a result, customer complaints may increase, and the overall financial health of the company can be jeopardized. Therefore, adopting an automated system to manage water bill arrears is essential for improving service delivery and operational efficiency. By utilizing technologies such as Microsoft Access and Visual Basic 6.0, PDAM can streamline the management of payment records and arrears. This will allow for real-time updates, error reduction, and better tracking of overdue bills, ensuring timely follow-ups and improved customer satisfaction. Furthermore, the system's implementation can enhance financial management, allowing PDAM to allocate resources effectively and increase overall revenue collection.

In managing water bill arrears data at PDAM Tirta Mon Krueng Baro, there are significant challenges faced by water supply companies operating with manual systems. Prior to the development of this information system, PDAM Tirta Mon Krueng Baro relied entirely on Microsoft Excel to record and manage account data. Although this method seemed practical, the manual system often led to errors in data entry and hindered the smooth generation of reports, which ultimately had a negative impact on managerial decision-making (Humairoh *et al*., 2021). The reliance on Excel for handling a large volume of data was not efficient, as it was prone to human error and lacked real-time updates. This resulted in delays in identifying overdue payments, which, in turn, affected the company's cash flow and customer service. Furthermore, the manual system made it challenging to track payment histories and generate accurate financial reports in a timely manner. These issues not only slowed down operations but also increased the risk of mismanagement. To improve efficiency, PDAM Tirta Mon Krueng Baro recognized the need to transition to a more advanced system that would automate data management and minimize errors, leading to better financial oversight and faster decision-making processes.

Considering technological innovations, implementing a computer-based system has become essential. A study at PDAM Tirta Daroy found that improving the billing system with a technological approach can significantly enhance debt management effectiveness (Rahmaniar, 2023). Likewise, research on receivables control at PDAM Tirta Dharma Purbaya highlighted that digitalizing the system could speed up the billing process and reduce arrears (Aviska, 2022). The development of an information system using Microsoft Access and Visual Basic 6.0 is seen as a key step. This approach is expected to not only replace the old manual system but also improve operational efficiency and customer service (Ayuningbumi & Julianto, 2023). The shift to a digital system provides real-time updates, automates report generation, and offers better tracking of overdue payments. These features minimize human error, improve financial management, and streamline operations. By adopting such a system, PDAM Tirta Mon Krueng Baro can provide better service to customers while ensuring more stable financial health and smoother internal processes.

The primary goal of implementing the new system at PDAM Tirta Mon Krueng Baro is to accelerate and improve the process of managing water bill arrears. The system is designed to be more structured, making it easier to monitor arrears and speed up report generation (Humairoh *et al*., 2021; Prawira *et al*., 2024). Various stages in system development, including feasibility studies and user-oriented system design, are also crucial to ensure smooth adoption and optimal results within the workplace environment (Prawira *et al*., 2024). By focusing on these aspects, the system aims to streamline the management of overdue accounts, reduce human error, and ensure real-time updates. This will ultimately result in more efficient operations, enabling PDAM to track payments more effectively, generate accurate reports, and make better-informed decisions. Additionally, involving users in the design process helps to tailor the system to meet the specific needs of PDAM, increasing the likelihood of successful implementation and user acceptance. This study aims to address the data management issues faced by PDAM Tirta Mon Krueng Baro. By implementing a more modern information system, the company is expected to improve operational efficiency and support better decision-making processes. Additionally, this system is designed to accelerate billing processes and enhance data accuracy, which will ultimately improve service quality to the community. As a result, the company can provide more optimal, transparent, and responsive services to customers, while strengthening its operational sustainability in the future.

2 | BACKGROUND THEORY

Data management is crucial for public service provider companies to ensure smooth operations and improve service quality. For PDAM (Perusahaan Daerah Air Minum), an efficient system to manage water bill arrears is essential. Manual data management often leads to recording errors and difficulties in generating accurate reports. Without an adequate system, data management becomes ineffective, which can impact timely decision-making. Manual processes frequently hinder the prompt resolution of customer issues and make it challenging to monitor overdue payments (Wali, 2020). Additionally, generating accurate reports for internal or regulatory purposes becomes more complex, affecting the overall performance of the company. A well-designed information system can address these challenges by automating data entry, processing, and reporting, enhancing accuracy, speed, and reliability (Wijayanto *et al*., 2022). Such a system also facilitates better monitoring of overdue accounts and provides a clear view of the company's financial status. Therefore, implementing an automated system for managing arrears can significantly improve operational efficiency, reduce human errors, and ultimately enhance customer satisfaction and service quality (Mahendra *et al*., 2022).

A management information system (MIS) is essential for efficient data management and plays a key role in supporting decision-making within an organization. For PDAM, the system collects and stores customer data, while also managing payments and tracking water bill arrears. By integrating various functions into one platform, the MIS simplifies data processing, ensuring that all information is accessible and maintained with high accuracy (Wali, 2017). The implementation of an integrated MIS brings several benefits. It improves the speed and accuracy of data management, enabling real-time updates and better monitoring of payment statuses. Additionally, such a system reduces the chances of human error that often occur with manual data processing, which can lead to inaccuracies in customer records, billing mistakes, and delayed reporting (Wali, 2018). A well-structured MIS also strengthens data security and enhances the ability to generate reports for both internal and regulatory use. Adopting an effective MIS enables PDAM to optimize operations, deliver timely services, and make informed decisions based on reliable, up-to-date data. As a result, the organization can achieve higher efficiency, improve customer satisfaction, and foster trust with its users, ensuring a more transparent and reliable service.

A database system plays a central role in storing and managing structured information, particularly in the processing of water bill arrears data. With the use of an efficient database system, accessing information, updating data, and generating reports can be done more effectively. For example, the use of Microsoft Access in data management allows for systematic storage and retrieval of information, which significantly supports the handling of more complex data (Kurniawan *et al*., 2018). By utilizing a database system, PDAM can streamline its operations and improve the accuracy of customer records and billing information. The structured nature of databases ensures that data is stored in an organized manner, which facilitates easier and faster access when needed. Furthermore, the system can automate data updates and reporting processes, reducing manual effort and minimizing the risk of human error. The integration of a database system, such as Microsoft Access, offers numerous advantages, including enhanced data integrity, quicker retrieval of important information, and the ability to generate accurate and timely reports. This leads to more efficient decision-making and helps ensure that water bill arrears are managed effectively. Overall, the implementation of a well-designed database system is crucial for improving operational efficiency and supporting the growth and sustainability of PDAM (Wali *et al*., 2023).

Visual Basic 6.0 is a programming language known for its strengths in developing Windows-based desktop applications with an intuitive user interface. For PDAM's information system development, Visual Basic 6.0 can be applied to design an application that simplifies the management of water bill data, including data entry and report generation. This improves operational efficiency in handling customer data and arrears (Anam *et al*., 2023). The language allows for the creation of user-friendly interfaces that facilitate easy interaction with the system. Its simplicity makes it ideal for developing applications that require basic functionalities, such as entering billing data and generating reports (Wali, 2017). Using Visual Basic 6.0 enables PDAM to streamline several processes, ensuring faster and more accurate completion of tasks like inputting billing information and updating records. Visual Basic 6.0 integrates well with databases such as Microsoft Access, enhancing the system's efficiency by enabling seamless data storage and retrieval (Alfaris *et al*., 2022). This integration ensures more effective management of customer accounts and arrears, ultimately leading to improved service delivery and customer satisfaction. Visual Basic 6.0 plays a significant role in optimizing PDAM's operations. Database normalization is an essential process to ensure that the system stores data without duplication, which directly impacts the quality and performance of the application. Through normalization, the data structure is optimized, reducing the risk of inconsistency and allowing for more efficient data updates and deletions. This process results in an optimal database for applications that support PDAM (Pratama *et al*., 2020). Normalization helps in organizing the data to eliminate redundancy, ensuring that each piece of information is stored in only one place. By doing so, it enhances the integrity of the data and simplifies data management (Wali, 2018). Furthermore, normalization improves query performance, as the system can retrieve and modify data more efficiently. This also reduces the complexity of the database schema, making it easier to maintain and scale as the system grows. An optimized database

structure enables PDAM to handle large volumes of customer and billing data without performance issues. It also ensures that data remains accurate and up-to-date, which is crucial for effective decision-making and timely service delivery. Therefore, the implementation of normalization is a vital step in improving the operational efficiency of the information system used by PDAM (Mahendra *et al*., 2022).

A transaction processing system is an essential tool for handling daily transactions, such as water bill payments and arrears data updates. With this system, each transaction is accurately recorded, facilitating the monitoring of arrears status and reducing the risk of errors in data entry (Anam *et al*., 2023). The use of a transaction processing system ensures that all transactions are logged in real-time, providing an up-to-date record of customer payments and outstanding balances (Wali, 2020). This enhances the accuracy of financial tracking, making it easier to generate reports and monitor payment trends. Additionally, the system automates routine processes, reducing the need for manual data entry and minimizing the potential for human error. By improving the accuracy and efficiency of transaction management, the system allows PDAM to streamline its operations and improve customer service. It ensures that payments are processed promptly, and any discrepancies or overdue accounts are identified quickly. Moreover, the system can generate alerts and reports, helping staff take timely action on overdue payments and prevent further accumulation of arrears (Alfaris *et al*., 2022).

The use of information technology in the public sector, particularly in PDAM operations, seeks to enhance efficiency, transparency, and accountability. Implementing computer-based systems allows PDAM to produce accurate and timely reports, which are vital for management decisions. Additionally, a well-structured information system improves customer service, especially in payment processing and arrears reporting (Baskoro *et al*., 2023). By incorporating technology, PDAM can automate routine tasks, reducing manual efforts and minimizing errors (Wijayanto *et al*., 2022). The system processes data rapidly, providing real-time updates on payments and outstanding balances, which improves the accuracy of financial records. Information technology enables better access for customers to detailed billing data, allowing them to view payment history and track overdue balances. This transparency enhances customer satisfaction and trust in the service. The adoption of information technology leads to more efficient resource management, better service delivery, and increased accountability (Wali *et al*., 2023). These improvements are essential for the long-term success and sustainability of PDAM operations. The implementation of an appropriate information system in PDAM Tirta Mon Krueng Baro can improve the management of water bill arrears data, making the process more efficient and accurate. With the support of a structured database system and user-friendly applications, the company can enhance customer service while simplifying operations (Wali, 2017). This system enables faster data processing, real-time updates, and easy access to crucial information, which supports better decision-making and resource management (Mahendra *et al*., 2022). Moreover, the system minimizes errors related to manual data handling, ensuring higher reliability and accuracy in financial records. Overall, adopting an efficient information system helps optimize management and improves service delivery for PDAM (Wali, 2020).

3 | METHOD

This research adopts a descriptive and qualitative approach to design an information system aimed at managing overdue water bill data at PDAM Tirta Mon Krueng Baro. The qualitative approach was chosen to gain a deeper understanding of the challenges faced by the staff and identify the shortcomings of the existing manual system. The research process involves several stages: conducting a comprehensive literature review, collecting data through interviews and field observations, analyzing the current system's performance, designing a new system based on the findings, and finally, implementing and testing the system to ensure its effectiveness. This systematic approach ensures the development of a user-friendly and efficient system tailored to the needs of PDAM Tirta Mon Krueng Baro.

1) Literature Review
   The literature review was conducted to gather information on relevant theories in information systems, databases, and application programming specific to water bill arrears management. Sources included books, academic journals, and articles that examine the use of information technology in public sector utilities. The review helped identify existing solutions, best practices, and technological tools that could be applied to improve the billing and arrears management system at PDAM Tirta Mon Krueng Baro.
2) Data Collection
   Data for this study was collected through interviews with PDAM staff and direct observation of the existing system in operation. The interviews aimed to identify the problems the staff encountered when using the manual system, while the observations focused on how the current system was being used in daily operations. This combination of methods provided a comprehensive understanding of the issues with the old system, such as inaccuracies in data entry and slow report generation.

3) Analysis of the Existing System
The existing manual system at PDAM was analyzed to pinpoint its weaknesses and areas for improvement. The manual process was primarily based on Microsoft Excel, which was prone to errors and delays. The analysis revealed that the system lacked real-time updates, which made tracking overdue payments and generating accurate reports difficult. Based on this assessment, the design of a new, automated system was initiated, with the goal of resolving these issues by improving data accuracy, automating report generation, and streamlining overdue payment management.
4) System Design
The system design was based on the findings from the analysis phase. The tools chosen for the new system were Microsoft Access 2007 for database management and Visual Basic 6.0 for application development. The design process involved creating flowcharts to map the system's processes, defining the database structure, and designing a user interface that simplifies the management of overdue water bills. Special attention was given to ensuring that the database structure minimized redundancy through normalization, which enhances data consistency and reduces errors.
5) Implementation and Testing
The implementation phase included the installation of the system and testing to ensure it met the desired functionality and performance criteria. Testing focused on ensuring that data was entered quickly and accurately, reports were generated without delays, and overdue payments could be tracked effectively. The results of the testing showed that the system significantly improved the efficiency and accuracy of data management. Real-time updates made it easier for staff to monitor overdue payments and generate reports in a timely manner.
6) Evaluation and Feedback
After the system was implemented, feedback was collected from the staff who interacted with the system daily. This feedback confirmed that the new system had reduced the time required for data entry, improved the accuracy of reports, and simplified the management of overdue payments. The staff reported a noticeable reduction in manual errors, and the ability to generate reports instantly improved their workflow and decision-making.
7) Future Work
Future work on this system will focus on improving its scalability and expanding its features. As the volume of data grows, it will be necessary to optimize the system to handle larger datasets more efficiently. Additionally, integrating the system with an online payment gateway will streamline the billing process and make it easier for customers to pay their bills. Another area for development is the addition of mobile access, which would allow customers to view and pay their bills using smartphones. Future versions of the system could also incorporate predictive analytics, helping PDAM proactively manage overdue accounts before they accumulate.

The research successfully developed an automated system for managing overdue water bills at PDAM Tirta Mon Krueng Baro. The transition from a manual to a computerized system has improved operational efficiency, financial management, and customer service. The implementation of the system has already led to better data accuracy, faster report generation, and more efficient overdue payment tracking. The planned future enhancements will further strengthen the system’s ability to meet the needs of the organization and its customers.

4 | RESULTS AND DISCUSSION

4.1 Reults

4.1.1 System Development

System development refers to the process of modifying, replacing, or reorganizing an existing system to improve its performance, either partially or entirely. This process aims to enhance the operational mechanisms and systems within a company, ensuring they function more efficiently. In dynamic companies, system development plays a critical role in optimizing business processes. Its primary goal is to improve the integration of various aspects of the company through a more effective and cohesive system. The focus of system development lies in transforming outdated, conventional systems into more modern, computerized systems that facilitate better data processing. The new system allows for the generation of high-quality information, which is vital for decision-making at the managerial level. Once data is collected and documented, the system analysis phase begins, which aims to gain a thorough understanding of the existing system's operations. Following this, a feasibility study is conducted to assess whether the organization can proceed to the next stage in the system development process. This study evaluates key factors that may impact the system's ability to achieve its intended goals. The first step in system analysis is the preliminary study, which focuses on understanding the

type, scope, and initial overview of the information technology system project. This phase results in an early outline of the system to be developed, including cost estimates and the time required for its implementation.

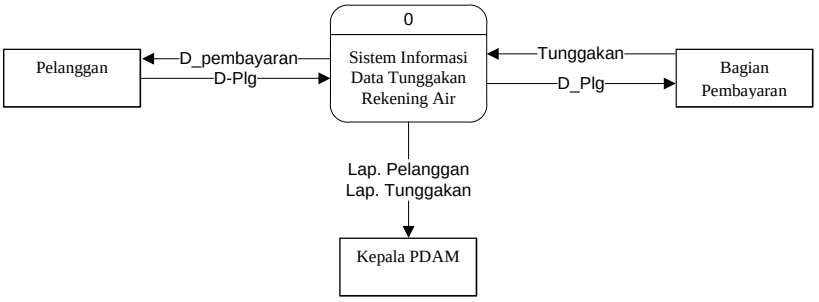

Figure 1. Context diagram of the proposed system

The process begins with the customer providing their personal data. Subsequently, the payment section verifies the outstanding water bill data and proceeds to settle the arrears, which is then used for evaluating the overdue payment records. The data collection process for the overdue water bills can be further understood in the following explanation. The analysis phase involves four main processes in the data collection of overdue water bills. These steps include entering customer data, entering overdue data, recording payments, and generating reports. The relationships between these processes can be understood by examining the flow from one step to the next in the subsequent section. The process of recording overdue water bill data starts with customer data entry, followed by the system registration of this data. The final step involves generating a report, which is forwarded to the head of the water utility company (PDAM). The second level of the data flow diagram further illustrates how the data is organized into tables from the existing data. Each data archive supplies information to the relevant data input process. For instance, data regarding overdue water bills is provided to the input process for overdue records. After input, the data is stored in respective data files for further processing. The structure of the information system for tracking overdue water bills consists of several components, each playing an integral role in efficiently processing and managing the data. This phase involves the placement of the system to ensure it is ready for operation. System implementation also entails replacing or discontinuing the use of the old system with a new one. To successfully transition from the old system to the new system, an appropriate approach or strategy is required.

4.1.2 System Design

The designed information system provides facilities for fast data collection, thereby simplifying the workflow at PDAM Tirta Mon Krueng Baro. The system design is carried out with the objective of improving the information system in the procedures involved in data processing. Additionally, the design of the overdue water bill information system utilizes computer tools such as Microsoft Access 2007 and Microsoft Visual Basic 6.0, which previously relied on Microsoft Excel 2007. The first step in building a database is creating tables correctly and efficiently. A well-designed table not only enhances application complexity but also increases flexibility. A proper data structure is critical to the success of the application. To ensure the raw data is suitable for a relational database model, a process called normalization is necessary. Normalization is a technique used to create relations or tables that minimize data duplication and prevent inconsistencies, especially when adding or deleting data. The stages of normalization include the unnormalized form (UNF), where data is inserted as-is without modification and may contain repeated fields or attributes. For instance, the overdue water bill data in its unnormalized form may look like this: the table contains multiple entries for the same customer data, with no differentiation between fields. In the normalized form (1NF), each combination of columns and rows contains only a single value. This form eliminates data repetition and ensures each data element is atomic. For example, in the normalized table for overdue water bills, customer records are uniquely identified with separate rows and fields, ensuring that there is no redundancy. The system development process includes several essential steps. The first step is creating a program folder, which involves navigating through the file explorer, creating a new folder, and naming it “Aplikasi Tunggakan Air.” The second step involves creating the project in Microsoft Visual Basic 6.0 by selecting the "Standard Exe" option in the New Project dialog. Following this, the database creation process begins by adding the Visual Data Manager in Microsoft Visual Basic, creating a new Microsoft Access 7.0 MDB file, and saving it as “DBAIR.mdb.” After the database is created, new tables are added, and field names are defined. The database structure consists of three tables and five form objects, which are used to manage the overdue water bill data. The database structure includes three main tables: the admin data table, the customer data table, and the overdue data table. The admin table contains fields such as Kode_Admin (Primary Key), Username, and Password. The

customer table includes fields like ID Pelanggan (Primary Key), Gol. Tarif, Loket, Rute, Nama, Alamat, and Kecamatan. The overdue data table consists of fields like No (Primary Key), ID Pelanggan (Foreign Key), Bulan, and Jumlah. The design of the system also involves creating forms, with one of the key forms being the login form. This form serves as a security measure for the program, ensuring that users must input a valid username and password before accessing the main menu. If the login credentials are correct, the main menu will be accessible, allowing users to view and operate all available features.

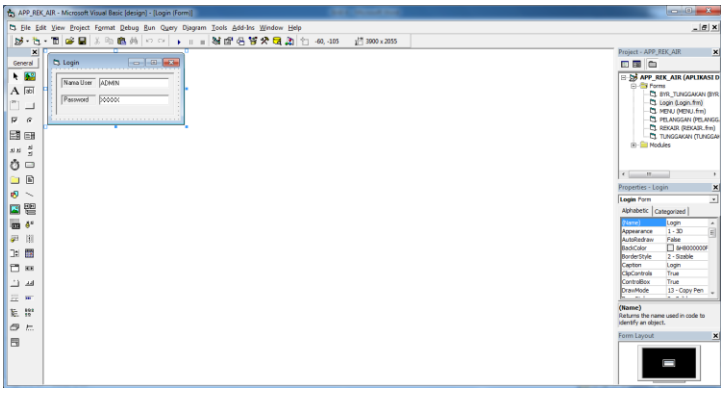

Figure 2. Login Form

The main menu form is essential for accessing and utilizing all the submenus within the program. This form provides several menu options, each corresponding to specific functionalities, allowing users to efficiently navigate the system. By using this menu, users can perform various tasks such as data entry, viewing reports, or modifying settings, making it a central hub for all activities in the program. The design of the main menu form includes key components like the MDI (Multiple Document Interface) form, which serves as the main window for the application. Additionally, the form incorporates an image list, which is used to display icons or images associated with different menu items for better visual representation. A toolbar is also included for quick access to frequently used features, providing an intuitive user experience. Lastly, the status bar displays relevant information, such as the current operation or status of the system, keeping the user informed as they interact with the program. These elements work together to create a user-friendly interface, making it easier to navigate through the program. The clean and organized layout ensures that users can easily access and manage the various functionalities offered by the system, improving overall efficiency and usability.

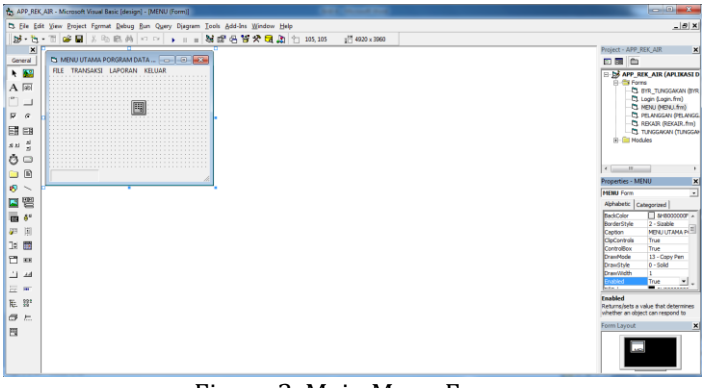

Figure 3. Main Menu Form

The Customer Form is designed for entering customer data into the system. This form consists of several fields where users can input specific information about each customer. These fields include customer ID, tariff group, counter, route, name, address, and sub-district, each corresponding to a textbox where the relevant data can be entered. Additionally, the form contains buttons for actions such as inputting data, editing records, deleting entries, and closing the form. These features make the form functional and user-friendly, allowing users to efficiently manage customer data. The design of the form ensures that it is easy to navigate, with clearly labeled fields that guide users in completing the necessary information. The Overdue Form is used for entering data related to overdue bills. Similar to the Customer Form, it contains fields for the current date, the month and year of the overdue bill, and the end date for the overdue period. The form also includes options for displaying overdue data and saving records. A data grid is incorporated into the design to present the overdue information in a clear,

structured format. This design helps users easily view and manage overdue bill records, improving the efficiency of the data entry process. The Payment Form is used for recording payments made toward overdue bills. This form includes fields for entering payment details such as the payment number, customer name, tariff group, counter, total amount, payment status, and any change. The form also features textboxes for entering the necessary payment information, as well as a data grid to display the payment records. Additionally, the form includes buttons for inputting, editing, and closing the form, offering a comprehensive solution for managing payment transactions efficiently. The design of the customer report utilizes 12 text objects to display the relevant customer information. The layout is structured to ensure that the report is well-organized and easy to interpret. By focusing on clear presentation and organization, the report design allows users to generate and review customer data efficiently, ensuring that the necessary information is accessible and easy to understand.

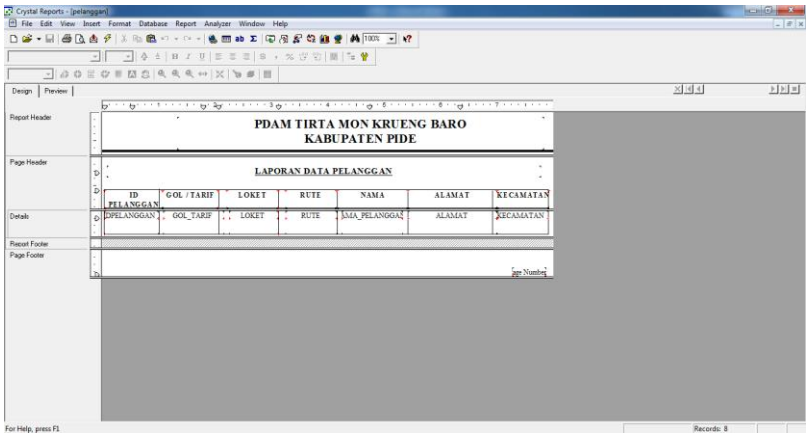

Figure 4. Customer Data Report

The Customer Data Report layout in the image reflects a well-organized design created in Crystal Reports for PDAM Tirta Mon Krueng Baro, Kabupaten Pide. At the top of the page, the header displays the organization's name and the title Laporan Data Pelanggan (Customer Data Report), giving a clear and professional introduction. Below, a table is set up to list customer information with fields for ID Pelanggan (Customer ID), Gol. Tarif (Tariff Group), Loket (Counter), Rute (Route), Nama (Name), Alamat (Address), and Kecamatan (Sub-district). Each column is labeled to ensure that data is neatly organized, making it easy for anyone reviewing the report to locate specific information. The footer section shows pagination details or the number of records currently displayed, helping users keep track of the entries. The overall structure prioritizes readability, with careful alignment of data fields and a clear presentation of information, ensuring that it is both efficient and user-friendly for those accessing the report.

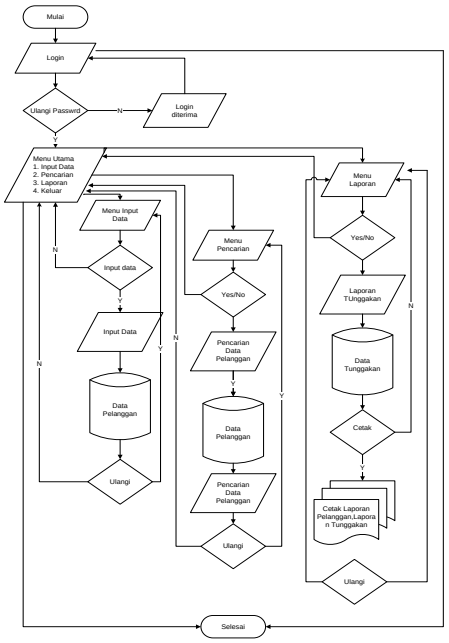

Figure 5. Flowchart

The flowchart illustrates the login process and subsequent navigation through the system's menus. The process starts with the user being prompted to log in by entering a password. If the password is incorrect, the system asks the user to try again. Once the login is successful, the main menu appears with four options: Input Data, Search, Reports, and Exit. Selecting Input Data leads the user to a form where they can enter customer data. After completing the data entry, the system loops back to the main menu for further actions. If the Search option is chosen, the system prompts the user to decide whether to search for customer data or overdue data. If the user opts for customer data, the system fetches the relevant records. If no results are found, the user can choose to search again or exit. For generating reports, the Report Menu offers the choice between a customer report or an overdue report. After selecting the desired report, the system asks whether the user wants to print the report or return to the previous menu. The flowchart follows a looping structure, enabling users to repeatedly perform tasks or exit the system when finished. This continuous cycle ensures users can input, search, and generate reports as needed until they choose to exit.

4.2 Discussion

The results of the system development process, particularly in the context of managing overdue water bill payments, align closely with several studies on optimizing billing systems in water utility companies. Rahmaniar (2023) emphasizes the significance of system optimization in managing overdue accounts, pointing out that efficient data collection and analysis are essential in reducing overdue payments. Similarly, the study by Humairoh *et al*. (2021) discusses the importance of integrating automated systems into billing operations, which is a core component of the system designed for PDAM Tirta Mon Krueng Baro. The transition from manual methods to a computerized system as discussed in the results follows the same principles outlined by these authors, where the system is designed to enhance data collection, tracking, and reporting efficiency. The implementation of a modern system to handle overdue water bills at PDAM Tirta Mon Krueng Baro incorporates several key components discussed by Ayuningbumi and Julianto (2023), who highlight the role of information systems in accounting procedures for water utility payments. The structured design of the database, including normalization techniques, ensures that data is organized in a way that minimizes redundancy and maximizes accuracy. This is consistent with Aviska's (2022) analysis of managing and controlling receivables, where organizing data efficiently is crucial for effective financial management and minimizing overdue payments.

The focus on improving integration across various aspects of the company is also supported by Prawira *et al*. (2024), who discuss how internal control mechanisms in water utility systems can significantly reduce overdue payments. In the results, the system's design allows for better tracking of overdue accounts, which is essential for timely decision-making and effective payment management. By allowing for easy access to customer and payment data, the system ensures that overdue bills can be tracked and acted upon swiftly, which in turn supports financial stability for the utility company. Mirza *et al*. (2023) also emphasize the role of technology in enhancing bureaucratic efficiency, which is particularly relevant to the system designed for PDAM Tirta Mon Krueng Baro. By incorporating automated systems, the new system enhances the speed and accuracy of data processing, making administrative processes more efficient. This reduction in administrative workload aligns with the findings of Baskoro *et al*. (2023), who highlight how digitalization can transform administrative functions in various sectors.

The successful integration of various forms such as customer data entry forms, overdue data management, and payment recording aligns with the best practices for system design discussed by Kurniawan *et al*. (2018) and Humairoh *et al*. (2021). These systems ensure that users can input and access data efficiently while also generating the necessary reports for analysis and decision-making. The focus on a modular and user-friendly interface, as outlined in the results, also supports the principles discussed by Karyaningsih *et al*. (2020) in their design of user-friendly systems for managing billing records. The flowchart presented in the results highlights the sequential navigation through the system, from login to data input and report generation. This structured approach is consistent with the findings of Tarmon and Inggi (2021), who emphasize the importance of clear, step-by-step processes in system designs, particularly for online billing systems. The design of the PDAM system follows this principle, ensuring that each task is clearly defined and easy to follow for users.

The results show that the system developed for PDAM Tirta Mon Krueng Baro not only aligns with the findings of previous studies but also introduces key features that optimize the billing and payment process. By incorporating modern technology, such as Microsoft Access and Visual Basic, the system significantly improves data management and report generation. The integration of normalized databases, user-friendly forms, and efficient reporting tools ensures that the system is both effective and adaptable, providing the utility company with the tools necessary for managing overdue accounts and improving financial stability. These improvements in system design and implementation echo the conclusions of several studies, such as those by Ayuningbumi and Julianto (2023) and Humairoh *et al*. (2021), that highlight the need for efficient systems to streamline the management of overdue payments in water utilities. The successful implementation of these components, backed

by the analysis of related research, demonstrates the positive impact of modern information systems in enhancing the performance of utility companies like PDAM Tirta Mon Krueng Baro.

5 | CONCLUSIONS AND FUTURE WORK

The development of the water bill arrears management system at PDAM Tirta Mon Krueng Baro represents a significant improvement over the previous manual approach. The shift from using Microsoft Excel to an automated system based on Microsoft Access and Visual Basic 6.0 has resulted in more accurate data management, reduced human errors, and increased efficiency in tracking overdue payments. By automating key processes, the new system has streamlined report generation, allowing for real-time updates that enhance decision-making and financial management. These improvements have not only supported better operational control but also contributed to enhanced customer satisfaction by providing more timely and accurate billing information. The use of a structured database with normalized tables has played a critical role in reducing data redundancy and ensuring consistency, which is vital for long-term system reliability. The user-friendly interface of the system has made it easier for employees to interact with and manage customer data, ensuring a smoother transition to the new technology and higher user acceptance. As a result, PDAM Tirta Mon Krueng Baro is now better equipped to manage overdue bills, improve its cash flow, and maintain stable financial health.

Future Work includes expanding the system's capabilities to accommodate larger data volumes and further optimizing its performance. The integration of cloud-based solutions could enhance data accessibility and support remote access for both employees and customers. Additionally, incorporating mobile applications for customer interactions, such as online payment and balance inquiries, could improve service convenience. The inclusion of predictive analytics using artificial intelligence could help identify potential overdue accounts before they accumulate, allowing PDAM to take proactive measures. These future enhancements would ensure that the system remains scalable and adaptable to the evolving needs of the company, ultimately improving the quality of service and operational efficiency.

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