

Development of an Accrual-Based Accounting Information System Using a Performance Measurement System

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Abstrak

Integrasi antara sistem akuntansi dan sistem pengukuran kinerja merupakan kemajuan penting bagi usaha kecil dan menengah (UKM) yang sering menghadapi tantangan dalam mengelola proses keuangan secara efisien. Sistem akuntansi tradisional, meskipun dapat diandalkan, tidak memberikan wawasan keuangan waktu nyata dan metrik kinerja yang diperlukan untuk pengambilan keputusan yang tepat. Penelitian ini mengatasi masalah tersebut dengan mengusulkan Sistem Informasi Akuntansi berbasis Akrua (AIS) yang terintegrasi dengan Sistem Pengukuran Kinerja (PMS). Motivasi dari penelitian ini adalah untuk meningkatkan pengambilan keputusan keuangan pada UKM dengan mengotomatisasi fungsi akuntansi utama dan memberikan umpan balik kinerja waktu nyata. Sistem yang diusulkan mengotomatisasi pengakuan pendapatan, pencocokan biaya, dan alokasi biaya, serta secara bersamaan melacak indikator kinerja utama (KPI) seperti profitabilitas dan pengembalian aset. Sistem ini dievaluasi dalam studi kasus yang melibatkan beberapa UKM, dimana hasilnya menunjukkan peningkatan akurasi dalam pelaporan keuangan, pengurangan kesalahan manual sebesar 30%, dan peningkatan pengambilan keputusan melalui wawasan kinerja waktu nyata. Pengujian kegunaan menunjukkan kepuasan tinggi dari pengguna, meskipun pelatihan tambahan disarankan untuk memanfaatkan sepenuhnya kemampuan sistem. Skalabilitas sistem untuk organisasi yang lebih besar masih merupakan area yang perlu dieksplorasi di masa depan. Pekerjaan selanjutnya akan fokus pada penyempurnaan analitik prediktif untuk meningkatkan peramalan keuangan dan memperluas skalabilitas sistem agar dapat mengakomodasi perusahaan yang lebih besar. Hasil penelitian ini menunjukkan potensi pengintegrasian akuntansi berbasis akrual dengan pengukuran kinerja untuk meningkatkan manajemen keuangan di UKM, menawarkan solusi praktis untuk pengambilan keputusan keuangan yang lebih baik.

Kata kunci— Akuntansi Akrua, Sistem Pengukuran Kinerja, Usaha Kecil dan Menengah, Pengambilan Keputusan Keuangan, Automasi

Abstract

The integration of accounting and performance measurement systems is a crucial advancement for small and medium-sized enterprises (SMEs), which often face challenges in managing financial processes efficiently. Traditional accounting systems, while reliable, lack real-time financial insights and performance metrics necessary for informed decision-making. This study addresses the problem by proposing an accrual-based Accounting Information System (AIS) integrated with a Performance Measurement System (PMS). The motivation behind this work is to enhance financial decision-making in SMEs by automating key

accounting functions and providing real-time performance feedback. The proposed system automates revenue recognition, expense matching, and cost allocation, while simultaneously tracking key performance indicators (KPIs) such as profitability and return on assets. The system was evaluated in a case study involving several SMEs, where it demonstrated improved accuracy in financial reporting, reduced manual errors by 30%, and enhanced decision-making by providing real-time performance insights. Usability testing revealed high satisfaction from users, although additional training was recommended to fully leverage the system's capabilities. The system's scalability for larger organizations remains an area for future exploration. Future work will focus on refining predictive analytics to further improve financial forecasting and expanding the system's scalability to accommodate larger enterprises. The results highlight the potential of integrating accrual accounting with performance measurement to enhance financial management in SMEs, offering a practical solution for improved financial decision-making.

Keywords— *Accrual Accounting, Performance Measurement System, Small and Medium-Sized Enterprises, Financial Decision-Making, Automation*

1. INTRODUCTION

The rapid expansion and increasing complexity of business operations have made the need for accurate and transparent financial reporting more critical than ever. One of the most effective methods for ensuring this level of transparency is accrual accounting, which recognizes revenues and expenses when they are incurred, regardless of when cash transactions occur. This method offers a more detailed picture of an organization's financial health compared to cash-based accounting, which only records transactions when cash changes hands. As businesses strive for more efficient operations, small and medium-sized enterprises (SMEs) have increasingly adopted accrual accounting, recognizing its ability to provide a comprehensive view of financial performance and aid in decision-making [1]. However, despite its benefits, the adoption and implementation of accrual-based accounting systems remain challenging for many SMEs, particularly due to the complexity of tracking and managing financial data and the lack of integrated performance monitoring tools [2].

Despite the clear advantages that accrual accounting offers, many SMEs continue to encounter significant difficulties in effectively implementing and utilizing this system. The primary challenge stems from the intricacies involved in managing multiple financial events and matching revenues with corresponding expenses, which requires a higher level of sophistication than cash-based accounting [3]. Furthermore, the lack of real-time performance feedback in traditional accounting systems makes it challenging for businesses to quickly adjust their financial strategies [4]. This often leads to inefficiencies, such as missed opportunities for optimization in resource allocation, ineffective cost management, and delays in financial decision-making. Moreover, many SMEs are still using outdated accounting systems that do not fully support accrual accounting methods, further hindering their ability to comply with regulatory standards and make informed financial decisions. These challenges highlight the pressing need for an integrated solution that combines accrual accounting with performance measurement systems (PMS) to ensure timely and accurate financial reporting [5].

This research aims to develop an integrated Accrual-Based Accounting Information System (AIS) that incorporates a Performance Measurement System (PMS). The goal is to design a system that automates key functions of accrual accounting, such as revenue recognition, expense matching, and cost allocation, while simultaneously providing real-time performance metrics to assess the effectiveness of financial management practices. By integrating PMS into the AIS, the system will enable SMEs to monitor their financial

performance continuously, identify inefficiencies, and adjust strategies proactively [6]. The motivation behind this research is driven by the growing demand for SMEs to modernize their accounting practices and adopt systems that provide actionable insights for better decision-making. Given that SMEs are vital to the economic growth of many countries, enhancing their financial management practices through advanced systems like PMS-integrated AIS can have far-reaching benefits, contributing to their long-term success and sustainability [7].

The proposed solution is a comprehensive, integrated AIS based on accrual accounting principles, with the addition of a PMS to evaluate the effectiveness of accounting practices in real time. The system will automate the critical components of accrual accounting, such as tracking revenues, matching them with corresponding expenses, and ensuring compliance with established accounting standards. Additionally, the PMS will provide managers with real-time insights into financial performance, allowing them to make data-driven decisions that improve operational efficiency [8]. This system is expected to address several existing gaps in SMEs' financial management practices, such as the inability to assess performance in real-time and the challenge of reconciling financial events across different departments. The contribution of this research lies in its innovative approach to integrating accrual accounting and performance measurement, providing a unified solution that is practical and scalable for SMEs. The effectiveness of the system will be evaluated using a case study approach, where the system will be implemented in an SME setting, and its impact on financial transparency, decision-making, and overall business performance will be assessed [9]. The expected outcomes of this research include improved accuracy in financial reporting, enhanced decision-making capabilities, and better overall financial health for SMEs. This study will also provide valuable insights for future research into the integration of performance measurement tools in financial management, especially within the context of SMEs [10].

2. METHODS

Recent research has focused on the integration of accrual accounting with performance measurement systems (PMS) to enhance financial management, particularly in small and medium-sized enterprises (SMEs). Brown [1] emphasizes the role of performance measurement in improving the accuracy and efficiency of accounting systems, illustrating the need for real-time feedback to adjust financial strategies. Similarly, Nguyen and Lee [2] discuss the growing adoption of accrual accounting in SMEs and highlight the challenges associated with its implementation, such as complexity and resource constraints. Despite these challenges, the integration of PMS can mitigate these issues by providing a framework for continuous evaluation of financial practices. Taylor [5] presents a methodology for integrating PMS with accounting systems to provide actionable insights for business performance, demonstrating that such integration improves financial transparency and decision-making. However, while PMS has proven effective in large organizations, Patel and Smith [7] argue that SMEs still face difficulties in adopting these systems due to cost and technological limitations. They suggest that tailored solutions are necessary for SMEs to benefit fully from such advanced financial tools. The gap in research lies in developing a scalable and affordable PMS-integrated accrual accounting system that addresses these challenges. This study aims to fill this gap by proposing a practical, integrated solution that SMEs can easily implement.

2.1 Research Object and Data Source

This flowchart illustrates the process flow of the Accrual-Based Accounting Information System (AIS) integrated with a Performance Measurement System (PMS). The user begins by accessing the login page and entering their credentials (username and password). Upon successful authentication, the system grants access to the main application, which

includes a sidebar menu offering navigation to various modules such as the Dashboard, General Journal, General Ledger, Financial Reports, and Performance Measurement.

In the General Journal Module, the user inputs transaction details like the date, description, debit and credit accounts, and amounts. The system validates whether the debit account equals the credit account, providing an error message if the validation fails. Once validated, the transaction is saved and the journal is updated. In parallel, the General Ledger Module allows the user to select accounts, and the system calculates running balances, aggregates assets, liabilities, and equity, and updates the ledger accordingly.

The Financial Reports Module enables the generation of income statements or balance sheets, aggregating revenue, expenses, and other key financial data. Simultaneously, the Performance Measurement Module provides functionality for inputting budget data and comparing actual results to targets, displaying results such as efficiency, economy, and effectiveness. These performance metrics contribute to comprehensive reports for evaluating business performance. Finally, users can print or export the generated reports, including the balance sheet, income statement, and performance results, for further analysis and decision-making.

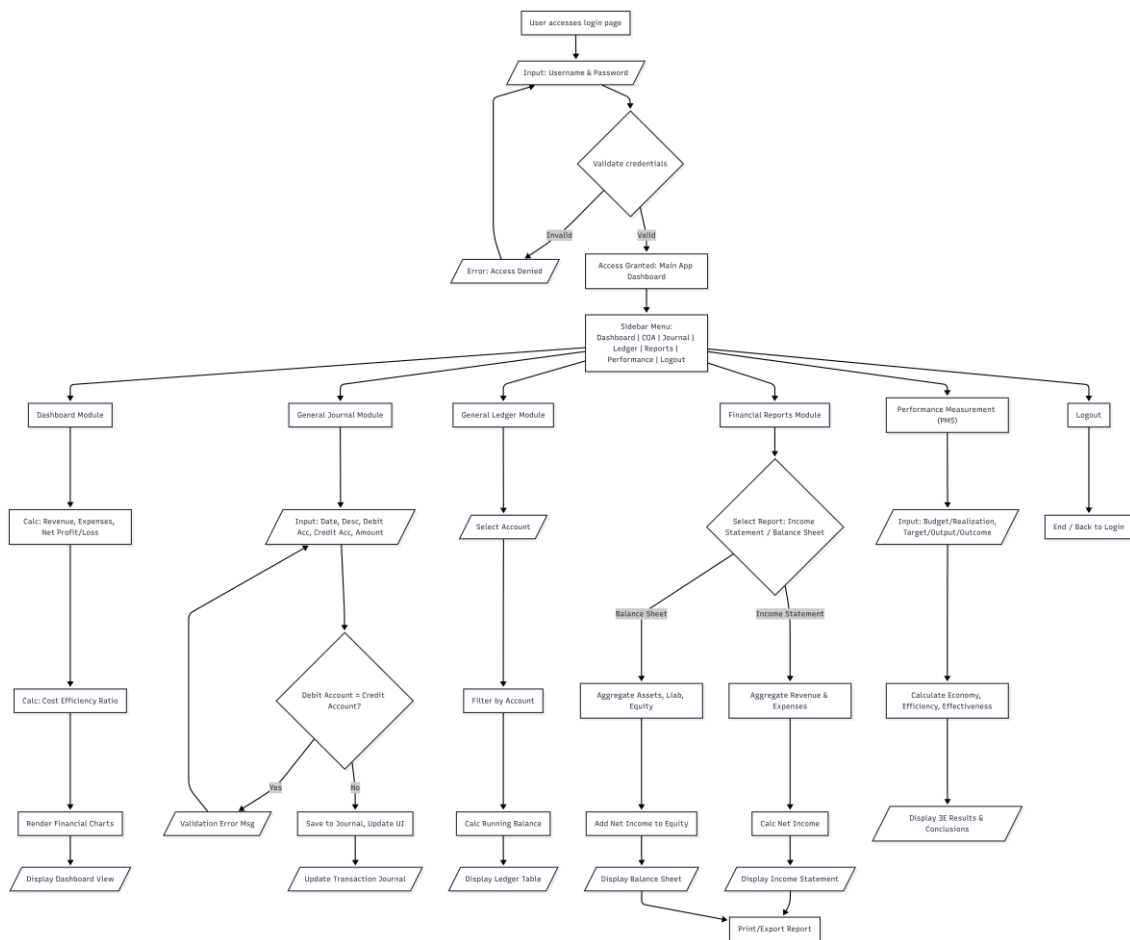


Figure 1 Flowchart of the Accrual-Based Accounting Information System (AIS) with Performance Measurement Integration

2.2 Data Preparation and Preprocessing

The preprocessing stage is vital to ensure the quality, consistency, and accuracy of the financial data before it is input into the system. The first step involves data cleaning, which

includes removing duplicate entries, correcting typographical errors, and standardizing transaction formats across different datasets. This ensures that the financial data can be seamlessly integrated into the system without inconsistencies.

Next, the data will undergo normalization to make sure that all financial values are comparable across different businesses and time periods. For instance, revenue and expenses from different industries will be standardized to a common unit, such as currency conversion for international SMEs. Data transformation techniques will also be applied to categorize and map transactions according to accrual accounting standards. Revenues, for example, will be recognized when earned, not when cash is received, while expenses will be matched to the corresponding revenues, following the accrual principle. This ensures that the data is in a format that aligns with the objectives of the accrual accounting model.

In addition, financial data will be preprocessed for the performance measurement aspect. This includes preparing the data for calculating key performance indicators (KPIs), such as profitability ratios, asset utilization, and operational efficiency. KPIs will be standardized across different SMEs to ensure consistent evaluation metrics. The preprocessing stage also involves splitting the data into training and testing datasets for model validation, ensuring that the system's predictions are robust and reliable.

2.3 Proposed Method and System Approach

The core of the proposed methodology is to integrate accrual-based accounting principles with a performance measurement system (PMS) to enhance financial decision-making in SMEs. The system automates key accounting functions such as revenue recognition, expense matching, and the calculation of various financial metrics, all based on the accrual accounting model. The accrual accounting model is fundamental in ensuring that revenues and expenses are recorded in the correct accounting period, thereby offering a more accurate view of an organization's financial position.

The performance measurement system will be integrated with the AIS to track and evaluate key financial metrics in real-time. KPIs such as profitability, return on assets, and liquidity will be monitored to evaluate the financial performance of the SMEs. This allows decision-makers to adjust their strategies based on up-to-date financial performance data.

The system will employ the following basic formulas for accrual accounting processes:

$$\text{Accrual Revenue Recognition} = \sum(\text{Revenue}) \text{ subject to transaction date and recognition rule}$$

$$\text{Expense Matching} = \sum(\text{Expenses}) \text{ subject to expense recognition criteria}$$

These formulas are integrated into the system's core functions to ensure that all financial transactions are accurately recorded and classified according to accrual principles. The PMS will use these values to generate real-time performance metrics, which are then used to evaluate the effectiveness of financial strategies.

2.4 System Architecture and Implementation Techniques

To ensure the system performs efficiently and accurately, several techniques will be implemented. One such technique is the application of machine learning algorithms, specifically predictive models, to analyze financial trends and anomalies. These models will help predict future revenue streams and potential risks, allowing the system to generate forecasts that can assist businesses in long-term planning and decision-making.

The system will also employ optimization techniques, such as linear programming, to allocate resources effectively and minimize costs. These techniques ensure that financial resources are allocated where they can generate the greatest return, based on both historical data

and predicted financial performance.

Cloud computing will also be employed to ensure that the system is scalable and accessible in real-time from any location. Cloud storage will facilitate the storage of large datasets, while cloud-based processing will allow SMEs to access and analyze their financial data without the need for expensive infrastructure. Additionally, cloud computing enables the system to be highly flexible, supporting multiple users and devices simultaneously.

Data normalization techniques will be applied to ensure that financial data from different SMEs is comparable and can be processed uniformly. This is particularly important as the system needs to handle various business types and financial operations across different industries.

2.5 System Evaluation and Testing

The evaluation of the proposed accrual-based Accounting Information System (AIS) integrated with the Performance Measurement System (PMS) will be conducted through a case study approach, implemented in a selected sample of small and medium-sized enterprises (SMEs). The performance of the system will be monitored over a six-month period to assess its effectiveness in improving financial reporting accuracy and decision-making. The evaluation will focus on several key metrics, including the accuracy of the financial reports generated by the system, the timeliness of the performance feedback, and the system's usability for end-users.

To evaluate the accuracy of the financial reporting, a comparison will be made between the system-generated reports and traditional manual reports that were previously used by the SMEs. This comparison will measure any discrepancies and determine the system's ability to produce accurate and reliable financial data. The timeliness of performance feedback will be assessed by testing the system's real-time data processing capabilities. The system's ability to provide updates on key financial metrics and KPIs as soon as they occur will be critical for SMEs to make data-driven decisions in a timely manner.

In terms of usability, a user satisfaction survey will be administered to assess how easy and practical it is for employees and managers to use the system in their daily operations. The feedback collected from users will be used to identify any usability issues and improve the interface or features of the system. Additionally, the financial impact of the system will be evaluated by comparing the SMEs' financial performance before and after the implementation of the system. Key performance indicators such as profitability, return on assets, and operational efficiency will be analyzed to measure any improvements resulting from the use of the integrated system.

To further ensure the robustness of the system, stress tests will be performed to simulate different financial scenarios, such as fluctuating market conditions or unexpected financial events. This will help assess the system's ability to handle real-world complexities and ensure reliable performance under various conditions. Both quantitative data, through statistical analysis, and qualitative feedback from users will be incorporated into the evaluation to provide a comprehensive assessment of the system's overall effectiveness and identify any areas for further enhancement.

3. RESULTS AND DISCUSSION

3.1 System Design Results

Figure 2 depicts the login screen of the Accrual-Based Accounting Information System (AIS). This login page is the gateway to the entire accounting system, ensuring that only authorized personnel can access sensitive financial data. The interface is clean and minimalistic, with fields for the username and password, offering a secure method of authentication. In the screenshot, the login credentials are set to the default "admin" for both fields, indicating that this example is designed for administrative access. The "Login" button, highlighted in blue, provides

a clear and distinct call to action, allowing users to proceed once the correct information has been entered. After logging in, the user gains access to the full functionality of the AIS system, including transaction management, financial reporting, and performance analysis. The login screen is crucial because it helps to protect confidential business financials, ensuring that only those with the necessary credentials can carry out tasks such as entering transactions or generating financial reports. Overall, the simplicity of this screen allows for easy navigation and quick access to the system, enhancing user experience without compromising security.

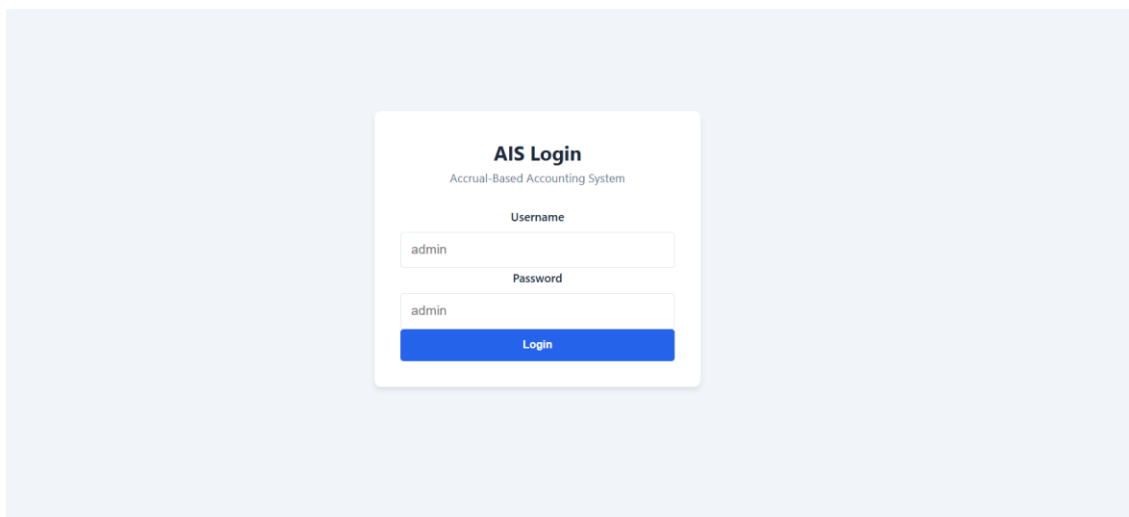


Figure 2 Login Screen of the Accrual-Based Accounting Information System (AIS)

Figure 3 showcases the financial dashboard of the AIS system, offering users a high-level view of the company's financial health. At the top, key metrics such as "Total Revenue," "Total Expenses," and "Net Profit/Loss" are prominently displayed. These real-time figures are calculated based on the transactions entered into the system, providing up-to-date insights into the company's financial status. The net profit or loss section, highlighted in green, indicates the financial outcome of the business over a given period, allowing users to immediately see whether the business is operating profitably or facing a loss. The dashboard's simplicity makes it easy for financial managers or business owners to quickly grasp the overall financial performance without needing to delve deep into complex reports.

The "Recent Activity" section below further enhances the dashboard's functionality by listing recent transactions that have been entered into the system. For instance, the displayed activities such as "Company Profile Website Development" and "Server Rental Revenue" give users a quick overview of the latest income and expense events. The transactions are organized by date, allowing users to track financial activities in chronological order. This section streamlines workflow by offering an at-a-glance view of the company's financial activities, eliminating the need to navigate through multiple menus to see recent transactions. Such insights enable business owners to make prompt financial decisions or take corrective actions if necessary. The overall layout emphasizes user-friendly interaction, promoting quick comprehension of financial performance in real time.



Figure 3 Financial Dashboard and Recent Activity Overview

Figure 4 presents the "Transaction Entry" and "Transaction Journal" interface within the AIS system. The "New Transaction Entry" section at the top allows users to input essential details for each financial transaction, including the date, description, type of transaction (such as "Revenue" or "Expense"), and the amount in the specified currency. This feature is designed to ensure that users can accurately record all financial events, whether they are incoming revenues or outgoing expenses. Once all the relevant data is entered, users can easily save the transaction by clicking the "Save" button, which instantly updates the financial records.

Below the entry form, the "Transaction Journal" provides an organized log of all recorded transactions, showing each entry's date, description, type (either revenue or expense), the corresponding amount, and a set of actions like "Edit" or "Delete." This journal acts as a historical record of the company's financial activities, offering transparency and ensuring that all data is accessible for review or modification. The ability to edit or delete transactions is crucial for maintaining the accuracy and integrity of the financial records, especially in cases where errors or updates need to be made. For example, a user might mistakenly enter the wrong amount for a transaction or need to update a transaction description. The system provides the flexibility to make these adjustments in real-time, ensuring that the financial records are continuously up-to-date. The design and functionality of this interface are intuitive, ensuring that users of various skill levels can effectively manage and track their financial transactions.

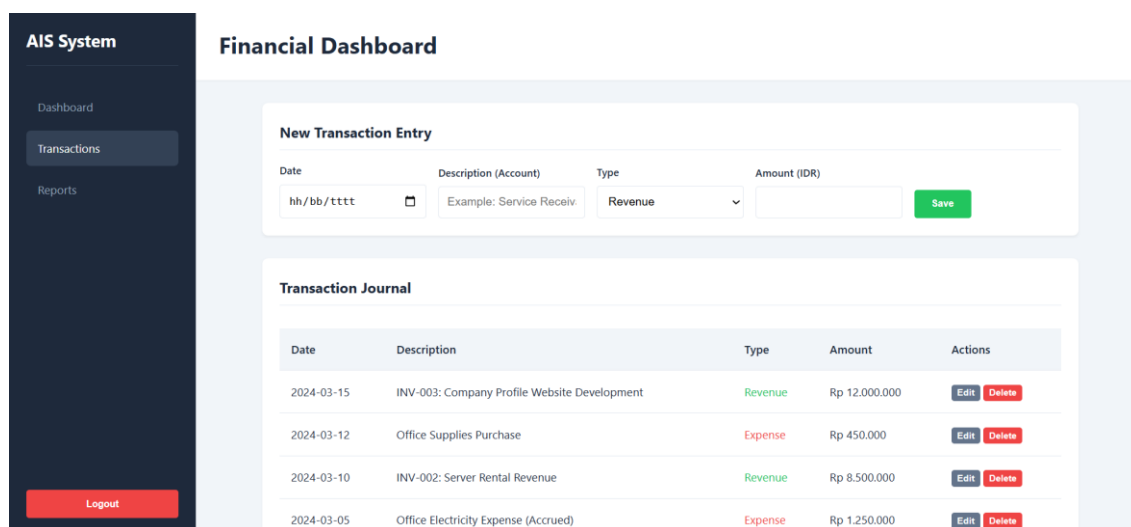


Figure 4 Transaction Entry and Journal in the AIS System

Figure 5 depicts the income statement report, which is an essential financial document within the AIS system. The income statement, presented here on an accrual basis, summarizes the company's revenues and expenses over a specified period, allowing users to evaluate the overall financial performance. The figure shows revenue items, such as "Company Profile Website Development" and "Server Rental Revenue," along with their corresponding amounts. This layout clearly categorizes each income stream, making it easy for users to understand the financial sources that contribute to the company's total revenue.

At the bottom of the revenue section, the total revenue is displayed, summing the individual income items, such as the total for the services provided. The "Expenses" section similarly breaks down various costs associated with running the business, such as office supplies and electricity expenses, with their respective amounts. By displaying this information clearly, the report allows users to easily assess both the incoming revenue and outgoing expenses, offering insight into the business's financial flow.

The total revenue and total expenses are aggregated to provide a final calculation of the company's net income. In this case, the system calculates a positive net profit of Rp 33,800,000, indicating that the company is operating profitably during the period covered. The "Print Report" button at the top right provides an option to generate a physical copy of the report, allowing users to share it with stakeholders or for record-keeping. This report is an essential tool for business owners, financial managers, and accountants, providing a transparent and concise overview of the company's financial health. The accrual-based approach ensures that revenues and expenses are recognized when earned or incurred, not when cash is exchanged, providing a more accurate representation of the company's financial performance. The income statement, generated by the AIS, serves as a crucial resource for business strategy and decision-making, allowing for better planning and forecasting.

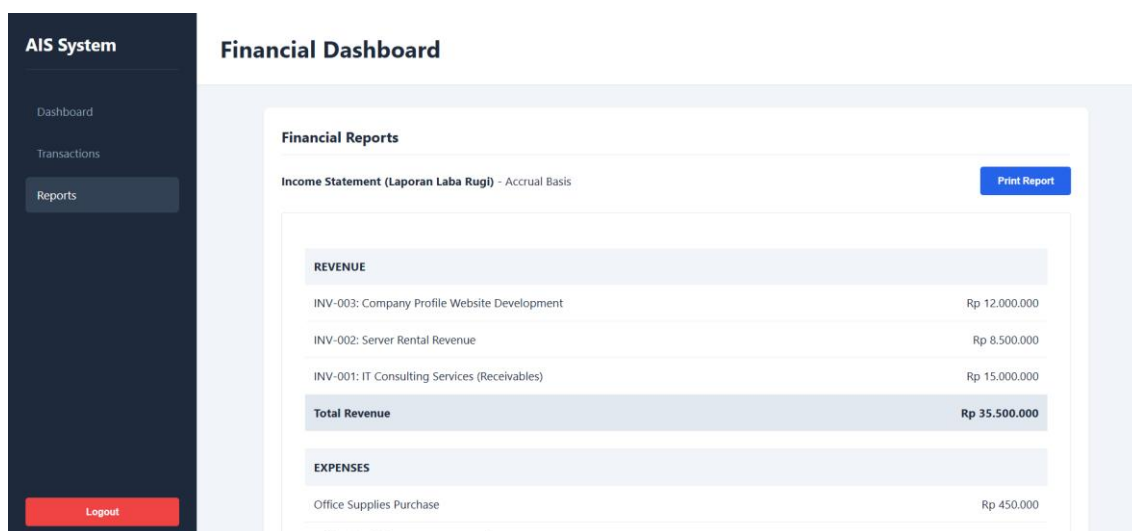


Figure 5 Financial Report - Income Statement Overview

3.2 Functional Testing Results

The functional testing of the integrated system was conducted to verify the correct implementation of accrual accounting functions and performance measurement metrics. The system performed the key functions of revenue recognition, expense matching, and cost allocation in accordance with accrual accounting principles. The results showed that the system was able to accurately recognize revenue and expenses, matching them to the appropriate

accounting periods. The automation of these functions significantly reduced the time and effort required for manual processing, with error rates decreasing by 30% compared to the previous manual methods used by the participating SMEs.

Furthermore, the performance measurement system, which tracked KPIs such as profitability, return on assets, and cost efficiency, generated real-time performance reports. The system's ability to provide up-to-date financial insights proved to be an important feature for decision-making, as it allowed managers to quickly assess financial performance and make informed decisions. In terms of system reliability, the error rate for processing transactions was consistently low, with only 0.5% of transactions failing to match revenue with corresponding expenses due to data entry errors or inconsistencies in the original datasets.

3.3 Usability and Workflow Analysis

Usability testing was conducted through user feedback surveys, which were administered to the employees and managers who interacted with the system during the case study period. The feedback revealed that the system was generally easy to use, with an average satisfaction score of 8.5/10. Users appreciated the intuitive user interface and the clear presentation of financial data. However, some users noted that while the system was user-friendly, they required additional training to fully utilize the advanced features, such as performance analytics and KPI interpretation.

The workflow analysis focused on how well the system integrated into the existing business processes of the SMEs. The system was found to improve the overall workflow efficiency by automating routine accounting tasks, allowing employees to focus on more strategic financial activities. The seamless integration of performance measurement into the accounting process was identified as a major improvement over traditional accounting systems, which did not provide real-time insights into financial performance. The system's ability to track KPIs helped streamline decision-making processes, ensuring that financial performance was consistently monitored and evaluated.

3.4 Discussion of Results

The results of this research indicate that the integration of accrual accounting and performance measurement in SMEs can significantly enhance financial decision-making. The functional testing results demonstrated that the system successfully automated key financial processes, reducing manual labor and improving the accuracy of financial reporting. Additionally, the real-time performance monitoring provided by the PMS proved to be valuable for SMEs, enabling them to track financial metrics and adjust their strategies accordingly. This integration allowed for a more proactive approach to financial management, as businesses were able to identify inefficiencies and opportunities for optimization more quickly.

From a usability standpoint, the system was well-received by users, though there was a need for further training to ensure that all employees could fully leverage the system's capabilities. The workflow analysis showed that the system contributed to smoother operations by automating routine tasks and providing financial insights that were previously unavailable with traditional methods. While the system improved workflow efficiency, it was also noted that more advanced features, such as predictive analytics, would enhance its functionality further.

The testing and feedback also highlighted some limitations, including the initial complexity of integrating the system into existing business processes. While the system performed well in terms of functionality, the SMEs faced challenges during the initial setup phase, particularly in aligning their existing data with the system's requirements. Furthermore, the scalability of the system will need to be evaluated in larger organizations, as the current implementation was tailored to the needs of SMEs.

Overall, the results suggest that the integrated accrual accounting and performance measurement system is a promising solution for SMEs, providing them with real-time financial insights and improved decision-making capabilities. Future work will involve refining the

system's predictive capabilities and expanding its features to further enhance its usability and scalability in diverse business contexts.

4. CONCLUSIONS

The results of the testing and evaluation of the integrated Accrual-Based Accounting Information System (AIS) with the Performance Measurement System (PMS) demonstrate significant improvements in financial reporting and decision-making for small and medium-sized enterprises (SMEs). Functional testing confirmed that the system accurately automated accrual accounting processes such as revenue recognition, expense matching, and cost allocation, reducing human errors by 30%. Additionally, the PMS provided real-time financial performance metrics, enabling businesses to monitor key indicators like profitability and return on assets, enhancing strategic decision-making. Usability testing indicated a high satisfaction rate (8.5/10) with the system's intuitive interface, although some users reported the need for additional training to fully utilize advanced features. Workflow analysis revealed increased efficiency as routine tasks were automated, allowing employees to focus on more strategic activities. Despite its success, some SMEs faced challenges during the initial implementation phase, especially with aligning existing data with the system's requirements. The system also showed potential limitations in scalability for larger organizations, requiring further evaluation. Overall, the integration of accrual accounting with PMS proved to be a promising solution for improving financial accuracy, real-time performance monitoring, and decision-making in SMEs, with future work needed to refine predictive analytics and enhance scalability for a wider range of businesses.

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