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BUSINESS PROCESS MODEL AND NOTATION (BPMN) DESIGN FOR A BARCODE SCANNER-BASED SALES INFORMATION SYSTEM AT THE COOPERATIVE OF THE ACCOUNTING DEPARTMENT, STATE POLYTECHNIC OF MALANG

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Abstract
This study aims to design a Business Process Model and Notation (BPMN)-based sales information system integrated with barcode scanner technology at the Cooperative of the Accounting Department, State Polytechnic of Malang. The system is developed to address inefficiencies and weaknesses in sales report control, such as the absence of real-time monitoring, lack of structured authorization, and reliance on manual documentation. A qualitative case study method was employed, involving direct observation and interviews with cooperative staff and department administrators. Data were analyzed and modeled using BPMN to visualize both current (as-is) and redesigned (to-be) business processes. The proposed system introduces features such as automated transaction recording, role-based access, and a three-layer validation process. Reports are only accessible or printable upon authorization by the Head of Department, ensuring better financial transparency and data integrity. The result is a more accountable, efficient, and user-oriented cooperative management system.

Keywords: BPMN, Sales System, Barcode Scanner, Internal Control, Cooperative

1. Introduction

Information Technology (IT) has become a fundamental driver of transformation in human interaction, business processes, and access to information. The rapid evolution of IT has not only shaped modern society through global communication and data accessibility but has also fostered innovation across various sectors such as education, commerce, and entertainment. The emergence of the internet, smart devices, and cloud computing illustrates how IT redefines workflows and governance structures. Alongside these advancements, information security and internal control systems have become critical components in ensuring data integrity and reliability for informed decision-making.

In the context of higher education institutions in Indonesia, departmental cooperatives—commonly referred to as college student cooperatives—serve both as a medium for learning and as a support system for academic needs. One such example is the Accounting Department Cooperative at Politeknik Negeri Malang (Minimarket Eksis), which has been operating since 2004. Despite its long-standing existence, its internal control mechanisms for transaction recording and reporting remain underdeveloped. There is a significant lack of real-time access to transaction data for key stakeholders such as the department head and supervisors. Additionally, the absence of a structured authorization system allows financial reports or transactional data to be accessed and modified without formal approval or oversight, creating risks to data integrity and delays in evaluation and decision-making processes.

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Preliminary interviews with cooperative administrators revealed that the primary issues lie not only in transaction documentation but also in the lack of robust monitoring mechanisms and access control. Department heads and supervisors are unable to monitor transactions or reports directly through a centralized system, resulting in manual and periodic supervisory processes. Authorization procedures are unstructured, and there is no feature to restrict report printing or exporting unless it is approved by authorized personnel. This creates gaps that could lead to errors, data manipulation, and a general lack of transparency and accountability in cooperative management.

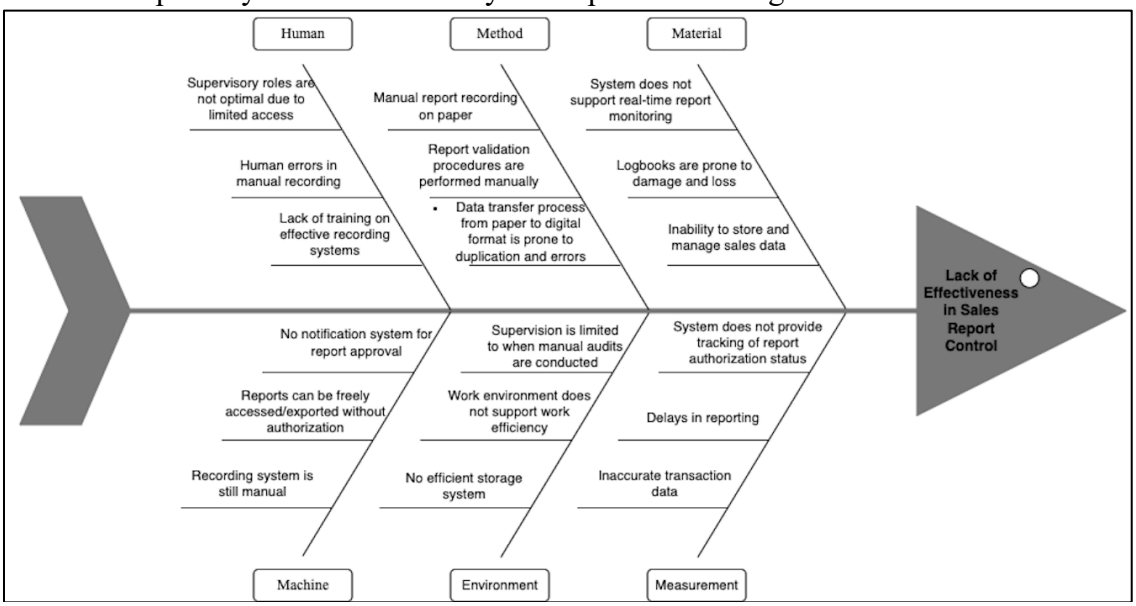

Figure 1. Fishbone Diagram
Source: Data processed by the author (2024)

Based on the fishbone diagram analysis, the lack of effectiveness in sales report control is attributed to six main categories: human, method, material, machine, environment, and measurement. The human factor relates to limited access for supervisors to real-time reports and a lack of training, leading to frequent human errors. In terms of methods, the sales reporting and validation processes are still performed manually without clear authorization procedures, making the system prone to data manipulation. Materials such as logbooks are not designed for long-term data storage and do not support efficient tracking. The machine factor highlights the absence of a digital system that enables notifications and access control over reports. The work environment also fails to support continuous monitoring, which weakens internal supervision. Lastly, in terms of measurement, the system lacks tracking of report authorization status, which results in delays and data inaccuracy. These findings indicate that the core issue lies not only in manual transaction recording, but also in the absence of a digital, real-time, and authorization-based reporting control system.

To address these concerns, this study proposes the design of a Business Process Model and Notation (BPMN) framework as a conceptual approach to develop an information system that enhances internal control capabilities. BPMN provides a structured and intuitive process visualization that can be understood by all stakeholders. The modeling effort focuses not only on transaction flows but also on establishing control elements such as access authorization, activity tracking, and conditional report export based on department head approval. Although previous studies have explored the implementation

of information systems in educational cooperatives, few have explicitly focused on BPMN-based design to support oversight and authorization in a structured manner.

The contribution of this study lies in the development of a BPMN model centered on internal control systems, rather than purely technical efficiency. The model is designed to allow department heads and supervisors to access real-time reports, authorize financial report generation, and manage user permissions based on roles and responsibilities. Thus, this research offers not only a technical solution for information management but also strengthens accountability, transparency, and governance within an educational institution context. The primary objective is to provide a process framework that ensures all presented data has undergone legitimate control and authorization procedures, thereby supporting more credible and timely decision-making.

2. Theoretical Background

2.1 Business Process Modelling Notation (BPMN)

Business Process Modeling Notation (BPMN) is a graphical standard used to model business processes in the form of diagrams that are easy to understand by various parties, both technical and non-technical. According to (Supit & Pratasik, 2021) BPMN is a standard business process model that provides comprehensive graphical notation to describe business processes. Business process management (BPM) requires expertise in methodology, information technology (IT), organizational culture, human resource management, and synchronization of company strategies to model and evaluate business processes, as well as adopt innovations and change the way things work to be more efficient (Kosidin et al., 2020). BPMN describes a technology-based business process flow diagram that is compiled to provide a graphical model of an organization with operational flows and controls that determine the work cycle.

2.2 Sales Information System in Educational Cooperatives

Educational cooperatives serve not only as retail units but also as platforms for applying cooperative-based learning. However, many cooperatives still rely on manual transaction recording, which hinders operational efficiency and transparency. Studies show that the absence of digital systems leads to problems in transaction speed, report accuracy, and inventory control. For instance, the school cooperative at SMP Miftahurrohman Benjeng struggled with transaction delays and inventory mismanagement due to its paper-based system (Nisa & Chotijah, 2024). Similar issues are observed in KUD Pakis, where the lack of systematized transaction recording and internal control has prompted the need for restructuring sales procedures (Mory & Puspita, 2022).

2.3 Business Process Modeling and BPMN

Business Process Model and Notation (BPMN) is a standardized graphical representation used for specifying business processes. In the context of cooperative systems, BPMN helps map out workflows clearly, identify inefficiencies, and guide system development. A study at ABC University utilized BPMN to represent sales and procurement flows within their cooperative system, facilitating effective system analysis before design and implementation. BPMN diagrams are particularly effective in illustrating actor responsibilities, document flows, and real-time interactions, which are crucial in ensuring transparency and authorization trails in cooperative operations (Armiati, Prasetio, & Rinaldi, 2024).

2.4 Barcode Scanner Integration in Information Systems

The use of barcode scanners in transaction systems enables faster item identification, reduces manual errors, and supports real-time inventory updates. A case study in a retail cooperative highlights the scanner's role in automating sales entry, generating receipts, and streamlining report generation at shift closing. Integrating this hardware with web-based systems ensures accuracy in data entry and helps enforce control over inventory movement and cash flow (Saputra, Pramiudi, & Hartanto, 2022).

2.5 Internal Control and Authorization in Cooperative Systems

Strong internal control systems are critical in maintaining the accuracy and integrity of financial reports. According to Mulyadi (2016), internal control involves organizational structure, authorization procedures, and reliable data processing systems. In the case of KUD Pakis, insufficient separation of duties between cashier and accounting staff led to control gaps and reporting delays (Mory & Puspita, 2022). Implementing a system with role-based access control and report authorization workflows helps ensure that only verified and approved data is included in reports.

2.6 Web and Mobile Platforms for Sales Systems

Several studies support the adoption of integrated web and mobile platforms to facilitate access, streamline workflows, and improve transparency. A study on a school cooperative web system showed that real-time access to purchase data and automated reporting significantly reduced administrative burdens (Zasmadyansyah, Ismayanti, Riyayatsyah, Haerullah, & Hairah, 2023). Furthermore, user interfaces built using tools like Figma aid in designing accessible systems, while mobile access allows for flexible monitoring by authorized users such as supervisors and department heads (Armiati, Prasetio, & Rinaldi, 2024).

3. Methods

This study uses a qualitative method with a case study approach to design and model a barcode scanner-based sales information system using Business Process Model and Notation (BPMN). The qualitative approach was selected as it allows for a comprehensive and contextual understanding of actual field conditions, especially in identifying workflow inefficiencies, control weaknesses, and user needs in the cooperative environment (Scott, 2011). The study focuses on the Cooperative of the Accounting Department at the State Polytechnic of Malang, which faces challenges in the accuracy, timeliness, and authorization of its sales report due to manual recording and the absence of an integrated system.

Primary data was collected through direct observation of sales transaction workflows and reporting practices within the cooperative, as well as in-depth interviews with cooperative supervisors, cashiers, and the head of the department. These observations and interviews aim to understand the current transaction processes, identify pain points in the sales report authorization flow, and document user requirements for system development.

Secondary data was obtained from literature reviews relevant to information systems, internal control, BPMN methodology, and the use of barcode scanner technology in small-scale enterprises. This includes academic journals, conference papers, and reference books. In addition, internal cooperative documents such as sales logbooks, Excel-based reports, credit transaction records, and administrative communication notes were used as supporting materials in the system modeling process.

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All the collected data served as the basis for designing the business process using the BPMN approach. This modeling framework helps visualize and validate each process step, user role, and control mechanism before system development. The resulting BPMN diagrams are intended to serve as blueprints for building a digital sales information system that incorporates barcode scanner functionality, real-time access, and a structured authorization workflow.

4. Results and Discussion

This study identifies the main issues in the sales reporting process at the Accounting Department Cooperative, primarily focusing on the absence of an effective digital control system. Observations and interviews show that the current reporting flow still heavily depends on manual data entry using logbooks and Excel spreadsheets. As a result, data inaccuracy, reporting delays, and lack of transparency frequently occur. Department heads and supervisors are unable to access sales reports in real time, and there is no structured authorization process for report validation, increasing the risk of data manipulation by unauthorized individuals (Scott, 2011).

4.1 Business Process Modeling (As-Is and To-Be)

4.1.1 BPMN As-Is: Consignment Goods Process

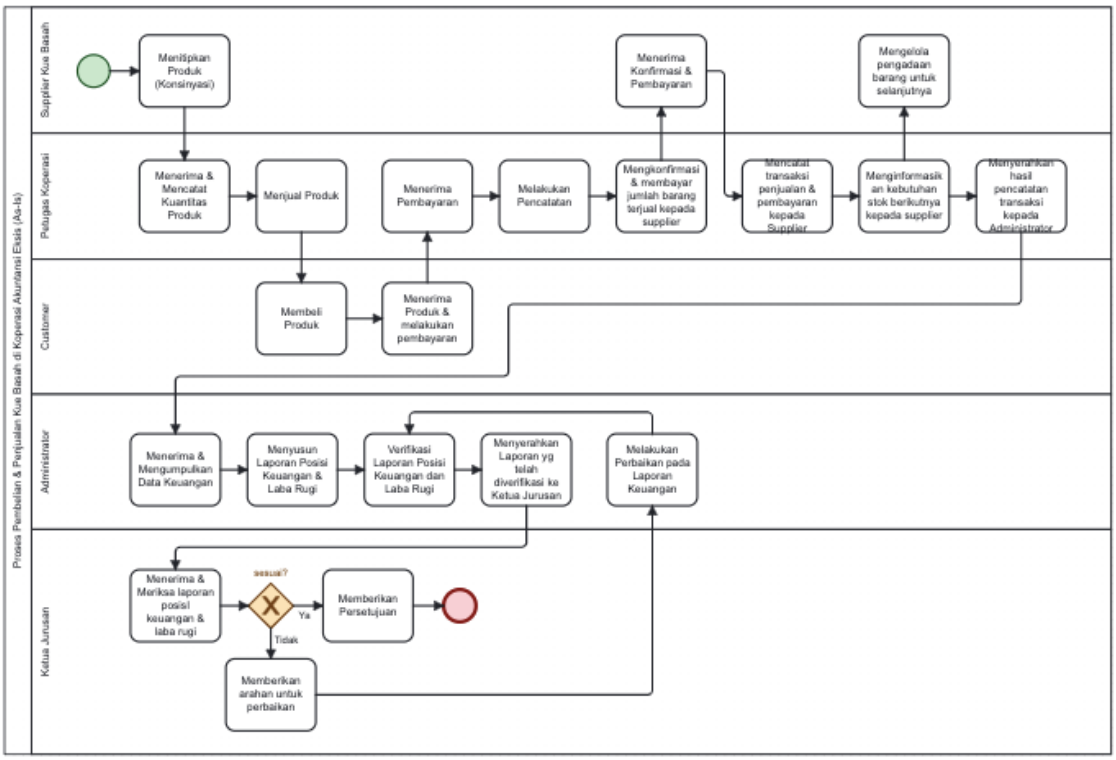

Figure 2. BPMN As-Is: Consignment Goods Process
Source: Data processed by the author (2024)

Figure 2 illustrates the current (as-is) BPMN for consignment goods. The process begins with recording all sales transactions, including item details, payment amounts, and customer information. Next, the cooperative confirms the quantity of sold goods to the supplier. Once the supplier receives confirmation, payment is issued and recorded into the cooperative's financial system. Stock adjustments or restocking plans are then made based on demand. The administrator prepares the financial position report and income statement, which are verified and submitted to the Head of Department for approval or feedback.

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A significant issue in the As-Is BPMN is the weakness in internal control. Sales reports are still in physical document form, with no dashboard available for real-time monitoring. The Head of Department and supervisors do not have direct access to the reports, making supervisory roles suboptimal. Report validation is conducted manually and is not digitally documented. There is no authorization system to ensure that only authorized personnel can access the reports. Additionally, the system does not support user activity tracking, resulting in no digital audit trail. Supervision only occurs during manual audits, which are reactive and not continuous (Mulyadi, 2016).

4.1.2 BPMN As-Is: Regular Goods Process

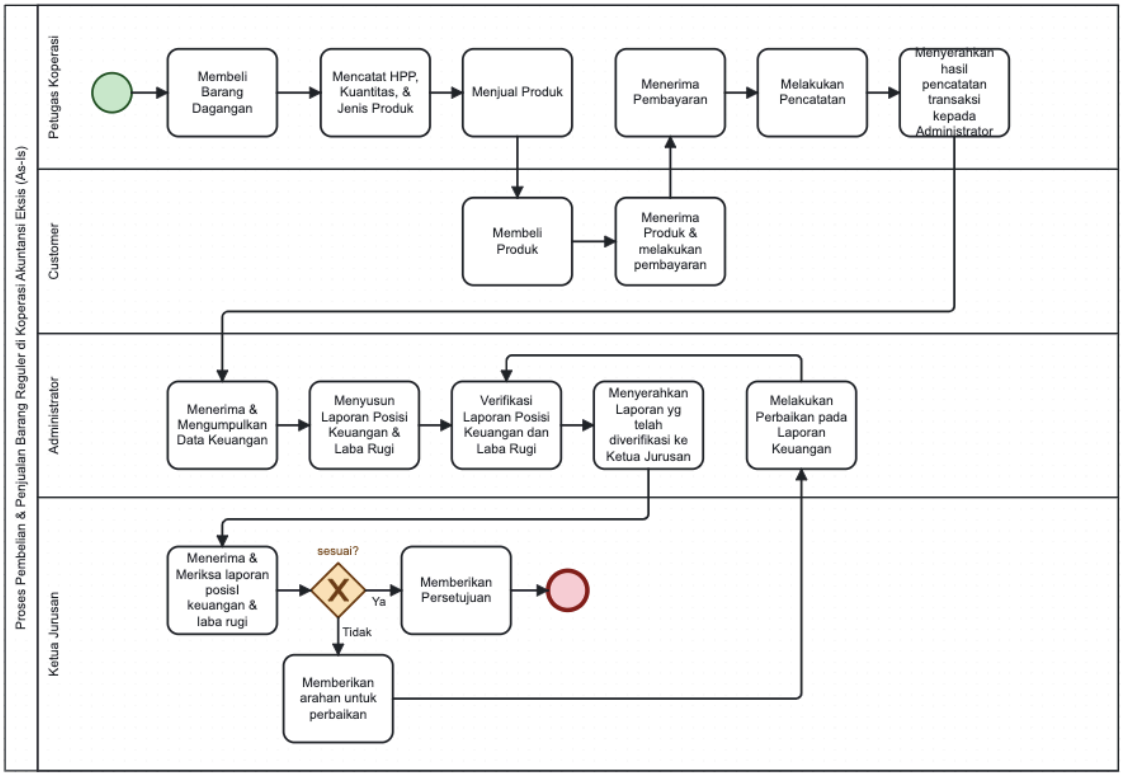

Figure 3. BPMN As-Is: Regular Goods Process
Source: Data processed by the author (2024)

Figure 3 shows the BPMN for regular goods sales. This process involves direct purchase from suppliers (non-consignment), inventory logging, product sales, and transaction confirmation. Administrators compile and verify financial reports based on transaction records, which are then reviewed and approved by the Head of Department. Similar to the consignment process, this flow also faces challenges in report control. Financial reports are not accessible in real time, and there is no digital system in place for authorization or tracking.

4.1.3 BPMN To-Be: Integrated Sales Administration Process

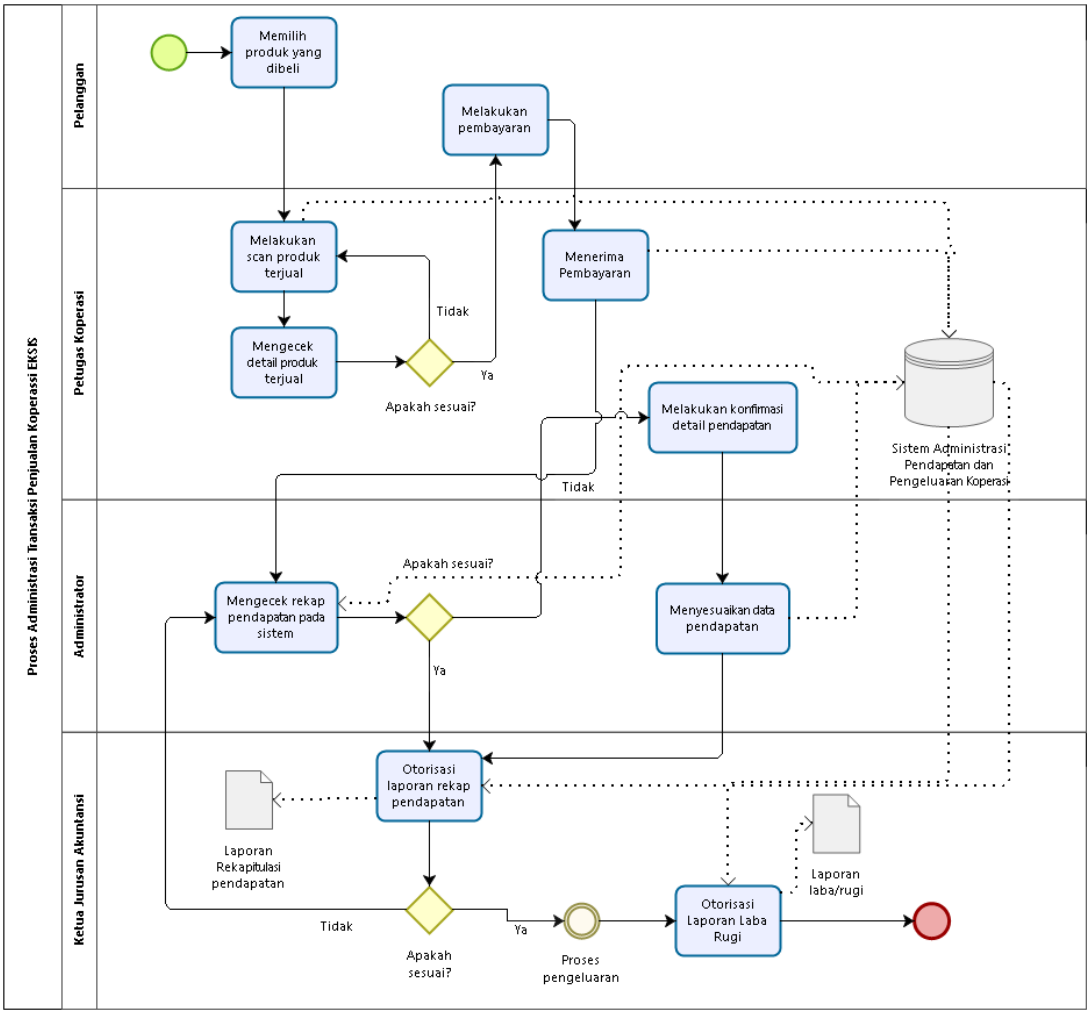

Figure 4. BPMN To-Be: Integrated Sales Administration Process
Source: Data processed by the author (2025)

Figure 4 presents the redesigned (to-be) BPMN for managing both regular and consignment product sales. The process begins with the customer selecting and purchasing products. Items are scanned and verified, and sales data is immediately recorded into the system. The administrator reviews and reconciles the income summary, and the verified report is forwarded to the Head of Department or accountant for authorization.

The core focus of this To-Be BPMN is strengthening the control system for sales reporting. Reports can now be monitored in real time by department heads and supervisors via a digital dashboard. Report validation is no longer manual but automated through the system. An authorization system is applied to ensure that reports can only be printed or exported (in PDF/Excel format) after being approved by the authorized personnel. This prevents unverified reports from being accessed freely. Digital audit trails are logged, and user access is limited by role (role-based access), making the system significantly more secure and transparent (Nugroho, Tolle, & Santoso, 2020).

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4.1.4 BPMN To-Be: Expenditure and Procurement Administration Process

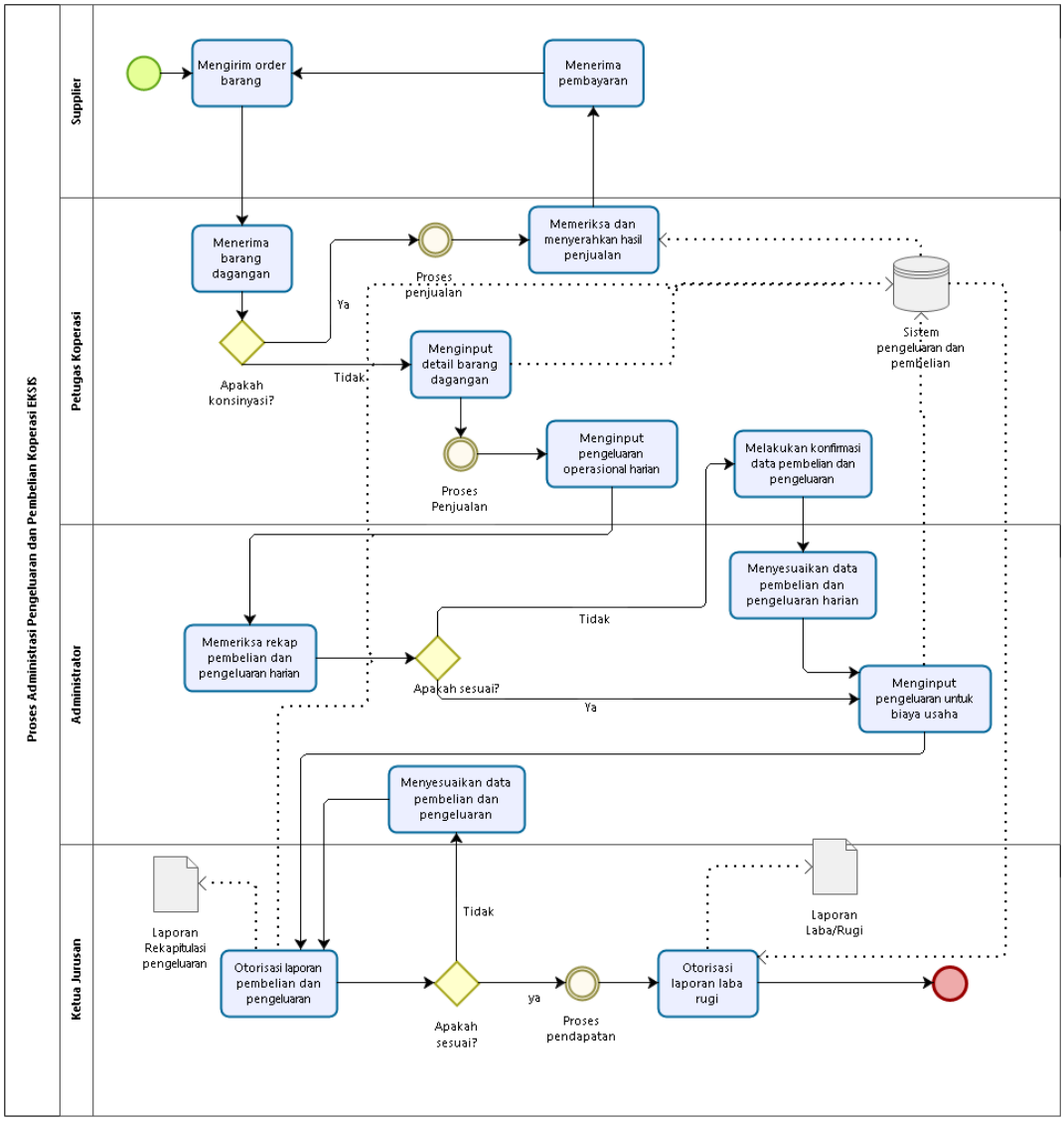

Figure 5. BPMN To-Be: Expenditure & Procurement Administration Process
Source: Data processed by the author (2025)

Figure 5 illustrates the proposed BPMN for purchasing and expenditure management of both regular and consignment goods. The supplier delivers goods, and cooperative staff inputs product and daily expense details into the system. Administrators review the purchase and expense summaries and then submit the reports to the Head of Department for authorization. This process ensures accurate financial documentation and accountability through validation by staff, administrators, and the department head. As with the sales process, reports can only be accessed or printed after formal authorization.

4.2 System Integration and Control Features

In the proposed system, integration with a barcode scanner improves item identification accuracy, eliminates double entry, and accelerates transaction processing. Each scanned item is automatically logged into the database, supporting real-time reporting and inventory synchronization. Furthermore, the system enables authorized users to monitor sales trends and generate analytical reports that were previously difficult to produce manually (Siregar & Harahap, 2018).

The authorization feature ensures that financial data cannot be accessed or manipulated by unauthorized parties. Reports can only be printed or downloaded after digital approval. Notifications are sent to supervisors and department heads for verification, creating a control mechanism previously unavailable in the manual system and addressing key weaknesses in the cooperative's internal control (Rahmawati, Pramana, & Syahputra, 2021).

4.3 Impact and Expected Benefits

The redesigned process is expected to yield several advantages:

1) Improved Report Accuracy: Direct digital recording reduces human error.
2) Enhanced Transparency: Real-time access and audit trails enable supervision by department heads and supervisors.
3) Stronger Internal Control: Role-based access ensures that data export and report printing are only possible after proper authorization.
4) More Efficient Workflow: By minimizing paper usage and automating repetitive tasks, administrative workload is reduced.

By applying BPMN as a system modeling tool, the cooperative gains a structured foundation for developing an integrated sales information system. This transformation from manual to digital workflows not only improves technological efficiency but also strengthens internal control and institutional information governance.

5. Conclusion

This study concludes that the current manual system used by the Accounting Department Cooperative at the State Polytechnic of Malang poses significant limitations in terms of internal control, transparency, and efficiency. The absence of real-time access to sales data, lack of an authorization system, and reliance on physical documentation hinder effective supervision and increase the risk of errors and data manipulation.

The redesigned business process, modeled using Business Process Model and Notation (BPMN), offers a structured solution through an integrated web- and mobile-based sales information system. The proposed system includes features such as barcode scanner integration, role-based access control, real-time reporting, and automated report authorization. These enhancements are expected to improve report accuracy, strengthen financial governance, and support efficient cooperative management practices.

For optimal implementation and sustainability of the proposed system, the following recommendations are presented:

1) System Development and Pilot Testing: The BPMN-based design should be translated into a working prototype and tested in a controlled environment to ensure functionality and usability before full-scale deployment.
2) Training for Cooperative Staff: Training programs must be conducted to enhance digital literacy and ensure all users understand the system’s functionalities and compliance requirements, especially regarding report authorization and data input.
3) Regular Monitoring and Evaluation: Periodic system audits and evaluations should be established to ensure the system remains effective and aligned with evolving operational and reporting needs.
4) Scalability and Integration: Future development should consider integrating the sales system with other academic or institutional systems, such as student billing or procurement platforms, to enhance overall institutional data management.

5) Policy Alignment: Institutional policies regarding digital financial reporting, data protection, and internal audit procedures must be updated to support the digital transformation initiated by this BPMN-based system.

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