Development of a Mini ERP Application Using Agile Methodology for Optimizing Production Processes in a Fabric Manufacturing Company

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Abstract

The rapid advancement of information technology has dramatically impacted various industries, prompting organizations to adopt computer-based systems that boost innovation and business efficiency. It has become an industry cornerstone, driven competition and enabling companies to enhance production efficiency, creating adaptable business models that align with Goal 9 of the 2030 Sustainable Development Goals (SDGs). This goal promotes strengthening infrastructure, fostering innovation, and supporting sustainable industrial growth, which is crucial for achieving sustainable development and community empowerment. In the textile manufacturing industry and among small to medium-sized enterprises (SMEs), companies often struggle to manage multiple operational areas due to a lack of integration in management systems like order processing, inventory, production, delivery, and finance. This reliance on manual processes can lead to errors, delays, and data inaccuracies, impacting customer satisfaction and competitiveness. To tackle these issues, this study proposes developing a mini-ERP system tailored to small and medium-sized companies, particularly textile manufacturers. This system aims to integrate various business functions into a centralized platform, enhancing operational efficiency, minimizing errors, and improving customer service. However, challenges such as customization, implementation costs, and staff training must be addressed. Using a qualitative approach, this research includes in-depth interviews, observations within textile companies, and document analysis. The waterfall model guides the development process, ensuring thorough task completion at each stage. The goal is to design and implement an ERP system that meets the unique needs of textile manufacturers while ensuring seamless adoption and maximum benefit.

Keywords: ERP System, Implementation, Innovation, Mini ERP, SDGs

1   Introduction

The rapid advancement of information technology has had a significant impact on various industrial sectors. Interest in adopting computer-based operating systems drives the industry to utilize information technology to improve innovation and business processes. Technology is becoming an essential element in the company, encouraging innovation and creating fierce competition in the industrial sector.(Andry et al., 2024; Kufeoglu, 2022)(Asteria et al., 2020)

Technological innovations in the industrial sector can improve production efficiency and develop more flexible business models. This is aligned with goal 9 of the (Afiah et al., 2024)*Sustainable Development Goals* (SDGs) 2030, which aims to strengthen infrastructure, stimulate innovation, and support sustainable industrial growth. The process of industrialization, driven by innovation and technology, is essential to achieving sustainable development and community empowerment. Therefore, applying technology plays a crucial role in achieving these goals, especially in increasing access to information technology that supports the progress of creative and innovative industries.(Godina et al., 2020)(Andry et al., 2023)(Fatmawati et al., 2023; Ibrahim et al., 2020)

Industries must implement information technology to face the challenges of fierce competition and rapid infrastructure development. Business processes must be well aligned to support infrastructure development and ensure that information technology becomes an integral element in the industry. This is also relevant for fabric clone companies, especially MSMEs in the textile industry, who face similar challenges in managing various aspects of their operations. Cloth clone companies, which are responsible for everything from selecting raw materials to delivering the final product according to the client's specifications, often need help maintaining operational efficiency as the industry develops and demand increases. Without an integrated system, manual processes still in use can result in delays, errors, and data inaccuracies, ultimately affecting customer satisfaction and the company's competitiveness in the market. By utilizing information technology effectively, industries can improve their operational efficiency and contribute to the achievement of the (Andry et al., 2024)(Marsudi & Pambudi, 2021)*2030* Sustainable Development Goals (SDGs).(Marsudi & Pambudi, 2021)

One of the significant challenges fabric clone companies is the inability to integrate systems that manage various crucial aspects of the business, including order management, inventory, production, delivery, and financial reporting. An integrated system is necessary for companies to rely on manual methods highly susceptible to human error, operational delays, and data inaccuracies. This condition not only hampers operational efficiency and productivity but also negatively impacts customer satisfaction, reducing the company's competitiveness in the market.(Khizbullina et al., 2024; Sergiy Gritsenko, OIga Karpun, 2023; TSILVIK, 2024)

To overcome this problem, developing mini-ERP *(Enterprise Resource Planning)* is a relevant and effective solution. Mini ERP is a system designed for small to medium-sized companies, including fabric clone companies, that allows the integration of various business functions in one centralized *platform*. By implementing mini-ERP, companies can improve operational efficiency, reduce errors, speed up business processes, and improve the quality of service to customers.

However, mini-ERP development also faces challenges in its implementation, such as adjusting to the company's specific needs, implementation costs, and employee training. Therefore, it is important to design an ERP system that can be adapted to the scale and needs of the fabric clone company while ensuring that its implementation and use can run smoothly and provide optimal benefits for the company.

2 Research Methodology

The research method applied in this study is a qualitative approach, where the research results are based on data obtained directly from the field. This research involves intensive interaction with farmers, large collectors, and traders to understand their needs, experiences, and views on digitalization in the context of Makloon Kain. This process includes in-depth discussions and interviews with relevant parties to uncover relevant information about the challenges and opportunities they face in adopting digital technology. In addition, participatory observation is carried out to directly observe the supply chain process from start to finish in the field. This method allows researchers to gain more concrete and accurate insights into the dynamics that occur in the field.(Hadi et al., 2024)

During the research period, mobile phones were used to record and document various information obtained from interviews and observations. This mobile phone technology allows for efficient and accessible data collection and supports more in-depth analysis. In the application development phase, the waterfall method was chosen as the approach used.

This method follows a sequence of steps that must be carried out in stages, from needs analysis, system design, development, and testing to implementation and maintenance. By applying the waterfall method, each stage must be entirely completed before moving on to the next stage. This approach ensures that every aspect of application development can be thoroughly considered and executed according to a predetermined plan, resulting in a structured and effective solution.

a. Problem Identification and Research Objectives

This research began by identifying the main problems fabric clone companies face in operational management and system integration. One of the main challenges is the

need for more integration between various business functions such as order management, inventory, production, shipping, and financial reporting. The absence of an integrated system leads to a reliance on manual processes that often result in human error, delays, and data inaccuracies, hindering productivity and lowering customer satisfaction. The purpose of this research is to develop and implement an integrated ERP system that can address these problems by improving operational efficiency, reducing the possibility of errors, and ultimately improving customer satisfaction in fabric clone companies.

b. Data Collection

Data collection was conducted through surveys and interviews with managers and staff at fabric clone companies to gain an in-depth understanding of the production process, the challenges faced, and the specific needs. The data collected includes raw material management, production process, quality control, and packing. In addition, document analysis is also carried out to collect and analyze documents related to existing production processes, such as standard operating procedures, quality reports, and inventory data.

c. Needs Analysis

In the requirements analysis stage, existing business processes are mapped to identify and document workflows from raw materials to finished goods. This mapping includes stages such as the production process, QC, packing, and finish goods, which will help design the appropriate ERP system. In addition, gap analysis is carried out to identify gaps between current business processes and the functional needs of the desired ERP system. This analysis helps determine the features and modules required in the ERP system.

d. System Design

System design involves designing an ERP system architecture with critical modules such as order management, inventory, production, QC, packing, and financial reporting. At this stage, the technology platform will also be determined, including programming languages, databases, and frameworks. In addition, the user interface design was created to ensure that the ERP system is easy to use and

allows for easy logging of incoming goods, cutting, packing, and reporting.

e. System Development

System development includes creating ERP system modules according to the design that has been made, including programming, database integration, and user interface development. System testing is done thoroughly to ensure the ERP system functions according to specifications and requirements, including functional, integration, and performance testing.

f. Implementation and Training

The implementation of an ERP system involves migrating data, configuring the system, and integrating it with the existing system. Company staff is trained to ensure they understand how to use the ERP system, including recording goods, cutting, packing, and reporting.

g. Evaluation and Feedback

After implementation, the ERP system's performance is evaluated by measuring operational efficiency, data accuracy, and user satisfaction. Users' feedback is collected to identify areas that need improvement. Based on this feedback, adjustments, and improvements are made to improve the ERP system's performance and functionality.

3 Results and Discussion
3.1 Identify Problems and research objectives.

Table 1 is a brief explanation of the problems, impacts, and solutions offered.

Table 1. Research Problems and Solutions

Problems	Impact	Solutions offered
The display of incoming goods records may not always be accurate, leading to inconsistent data or loss of information.	Difficulties in stock tracking and accuracy of inventory data.	Development of a more accurate and automated item recording module in the ERP system.
The process of cutting and packing fabrics is carried out without clear standards, resulting in inaccuracies in the size and quality of the final product.	Inconsistent end products and customer dissatisfaction.	Implementation of standard procedures and automated supervision in ERP system for cutting and packing.
The process of checking and removing defective	Waste of materials and decrease in	Integration of QC system in ERP for real-time

Problems	Impact	Solutions offered
fabrics is not carried out efficiently, which can result in the accumulation of unusable materials.	production efficiency.	monitoring and management of defective fabrics.
The process of re-measuring and numbering goods with barcodes is done manually, increasing the risk of errors and inaccuracies.	Potential errors in numbering and measurement, which impacts shipping.	Automate measurement and numbering processes with an integrated ERP system.
Daily, monthly, and yearly production recaps may not always be available or accurate, hindering analysis andplanning.	Difficulties in performance analysis and strategic planning.	Development of an automated report module in the ERP system for more accurate and integrated production recaps.

3.2 Data Collection

In this study, data was collected through surveys and interviews with managers and staff at fabric clone companies to gain an in-depth understanding of the production process and the challenges faced. The information collected includes raw material management, production process, quality control (QC), and packing. This interview revealed that the management of raw materials and production processes is often not well standardized, which hcouldresult in inaccuracies in the final product and decreased customer satisfaction. In addition, the QC and packing processes also show shortcomings in monitoring and handling defective fabrics and manual re-measurements.

3.3 Needs Analysis

Table 2 describes the detailed requirements and features of the ERP system proposed by the researcher.

Table 2. Needs Analysis

Needs Aspect	Detail Requirements	ERP System Features
Recording of Incoming Goods	- Incoming goods management display. - Input data such as the type of goods, quantity, and receipt status. - Efficient data storage.	- Goods recording module. - Data integration with other modules.
Production Process	- Recording the size of the cut fabric.- Report	- Fabric cutting module.-

Needs Aspect	Detail Requirements	ERP System Features
	on the cutting results.- Supervision and management of the cutting process.	Cutting report and process control.
Quality Control (QC)	- Monitoring and recording of quality check results.- Identification and marking of defective fabrics.- Defective fabric disposal process.	- QC module.- Quality reporting and analysis features.
Proses Packing	- Recording of fabric re-measurement.- Packing process and handling of defective fabrics.- Numbering of goods with barcodes.	- Module packing.- Features handling of defective fabrics and barcodes.
Numbering and Barcodes	- Barcode printing and management for the final product. - Barcode integration with product data.	- Barcode module.- Integration of product data with barcodes.
Production Recap	- Daily, monthly, and yearly production reports.- Information such as production numbers, defective products, and other relevant data.- Production data analysis tools.	- Production report module.- Data analysis feature.

3.4 System Design

The research results should be written clearly and concisely. This section discusses them related to the design results. Based on surveys and interviews in several MSME companies, especially fabric clone companies, the production process that occurs can be identified. The production process can be described as follows.
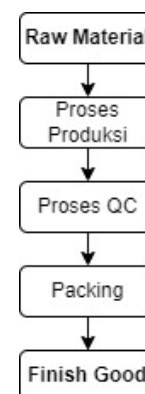

Figure 1. System Design

- *Raw Material* : for raw material in the form of plain fabric that has not been given a certain color or pattern/motif. A very large fabric that will be ready to be printed.
- *Production Process* : the production process is carried out by providing color, printed by providing a certain pattern according to the demand for the fabric pattern of interest.
- The production process can be carried out by the company or by other places or suppliers.
- *QC (Quality Control) process*: a process to ensure the result of the fabric print, whether it is good or defective. If there is a defect, it is discarded. This process can also be done at the same time as measuring the fabric and cutting it based on certain needs.
- *Packing* : at this stage, packing is carried out by rolling the fabric on the container and equipped with wrapping like plastic.
- *Finish Good* : This production process will produce finished goods that are ready to be sold in smaller sizes.

3.5 Implementation Results

Display for inbound item recording.
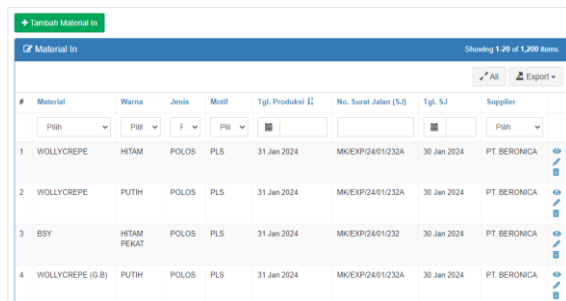
Figure 2. Display for inbound item recording

The process of adding incoming items can be displayed in the following Figure.

Figure 3. Inbound item addition

The process that occurs in the production process is to check and cut the fabrics to be cut in smaller sizes.

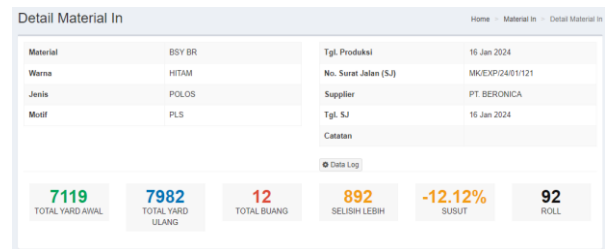This process is equipped with a process for packing goods to be cut into smaller sizes.

Figure 4. Packing goods

In this part, information on the results of cuts on the fabric will be added as well as checking the fabric that is thrown away because it is considered bad.
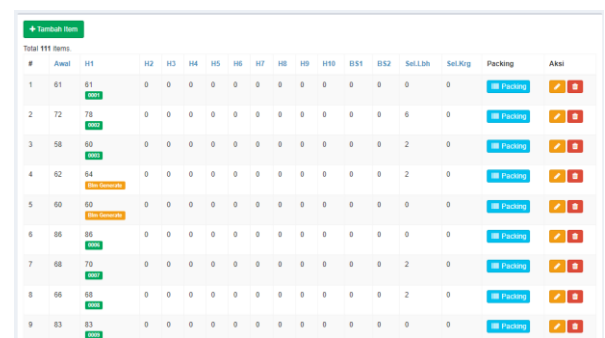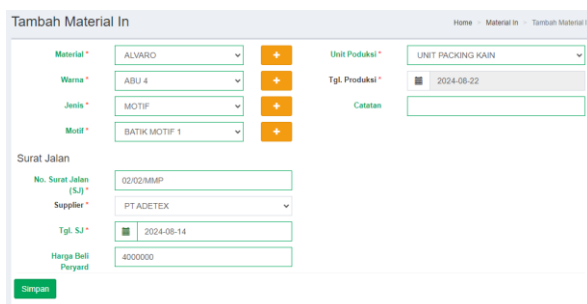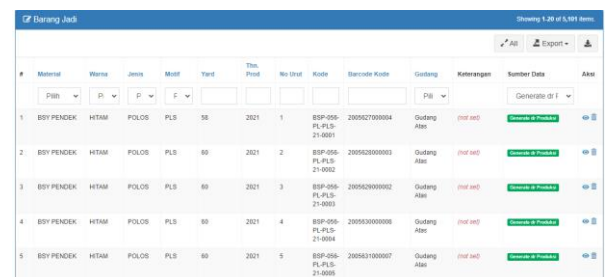

Figure 5. Packing details

During this packing process, several things happen, such as re-measurement (yard), packing, and disposal if there is a defect. When this process has been completed, finished goods will be produced that are ready to be packed and equipped with numbering using a certain barcode code. The following display shows an example of the shape of the finished item.

Figure 6. Finished goods menu

For details of the product, you can see it as shown in the following Figure.

Figure 7. Finished goods details

The barcode printing process can be seen as shown in the image below.

Figure 8. Cetak barcode number

From the production information, you can see the production recap for daily, monthly and yearly. An example of how it looks can be seen as in the image below.
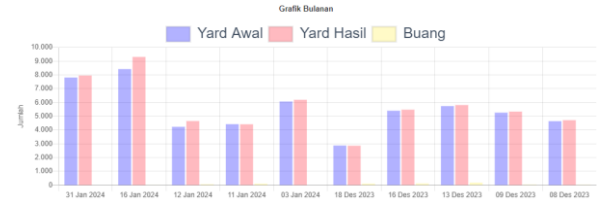

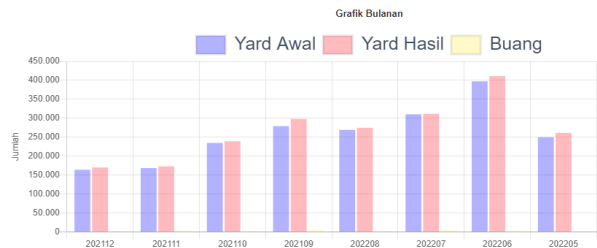

Figure 9. Daily recap

Figure 10. Monthly recap

Figure 11. Annual recap

3.6 User Acceptance Test (UAT)

The User Acceptance Test Plan (UAT) table presented aims to ensure that the mini-ERP system developed meets the standards and needs of the end user.(Kananta & Putranda Kristianto, 2024; Zen & Dea Putra Ananda, 2024)

Test Aspects	Success Criteria	Accepted (Yes/No)
Recording of Incoming Goods	Testing the accuracy of recording incoming goods in the ERP system. Recording data according to specifications, accurate reporting.	Yes
Cutting and Packing Process	Testing cutting and packing procedures to ensure the accuracy of the size and quality of the final product. The size and quality of the final product are as standard.	Yes
Proses Quality Control (QC)	Testing the efficiency and accuracy of QC processes, including the management of defective fabrics and cutting. The QC process runs	Yes

Test Aspects	Success Criteria	Accepted (Yes/No)
	efficiently, the defective fabric is well managed.	
Re-Measurement and Barcode Numbering	Testing the automation of re-measurement and numbering of goods with barcodes. Accurate measurement and numbering, without errors.	Yes
Production Recap	Testing the creation of daily, monthly, and annual reports for accuracy and completeness of data. Daily, monthly, and yearly recap reports are accurate and complete.	Yes

4 Conclusion

This research shows that implementing a mini-ERP system can overcome various operational problems faced by fabric clone companies, including inaccurate recording of goods, unclear cutting and packing standards, and inefficient quality checking. The developed ERP system has increased efficiency and accuracy, reduced errors, and accelerated business processes. As a step forward, this system can be expanded and integrated with the sales module to create a more comprehensive and integrated solution, thus better supporting the overall management and growth of the business. In the future, the modules that have been developed will be integrated with the sales module. This integration is expected to further enhance the company's ability to handle various operational and strategic aspects and contribute to achieving long-term goals and sustainable growth.

5 Future Work

Order to improve the effectiveness of the mini-ERP system in a fabric clone company, several steps need to be taken. First, integrate the sales module to manage the entire business cycle in a single platform, improving department visibility and coordination. Second, update and adjust system features regularly based on user feedback to meet the company's specific needs. Third, advanced training and technical support should be provided so staff can use the system optimally. Additionally, periodically evaluate and adjust the system to maintain its relevance and effectiveness. Additional process automation and integration with external systems should also be considered to expand the scope of the ERP system and improve operational efficiency.

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