IJIO
(International Journal of Industrial Optimization)
ISSN 2723-3022 (online) | 2714-6006 (printed)
Vol 6, No. 2, 147-163
https://doi.org/10.12928/ijio.v6i2.11739

Collaborative digital marketing and supply chain management for micro, small and medium enterprises

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ARTICLE INFO

Article history
Received: October 18, 2024
Revised: December 18, 2024
Accepted: April 26, 2025

Keywords
Digital marketing;
MSMEs;
Business Process;
Textile sector.

ABSTRACT

This study explores specific supply chain challenges faced by Batik Ayu Arimbi, a small-scale business in the batik industry, particularly how the manual calculations in its make-to-stock system impact its financial accuracy and operational efficiency. The company has been experiencing financial losses due to these inaccuracies. To address these issues, this research proposes improvements in supply chain management by implementing Business Process Model Notation (BPMN) to streamline process visualization and coordination among the artisans, showrooms, and production houses. The use of digital marketing platforms, particularly Instagram, is also suggested to optimize marketing efforts and achieve sales targets. This study contributes to the literature by emphasizing novel BPMN implementation aspects and demonstrating the effectiveness of digital marketing for MSMEs in the textile sector. The qualitative data was collected through semi-structured interviews, which provided insights into current practices and areas for improvement. The findings show that increased cooperation between supply chain actors reduces inventory errors by 20% and increases the accuracy of financial tracking by 15%, thereby reducing operational risks. Furthermore, the digital marketing strategies increased customer engagement rates by 25%, directly contributing to sales growth. The findings further suggest that the proposed solutions not only resolve the identified problems but also provide a scalable model for enhancing resilience in Batik Ayu Arimbi's supply chain operations as one of MSMEs. In conclusion, boosting sustainability and performance in MSMEs requires improved supply chain collaboration and the strategic application of digital tools.

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1. Introduction

Indonesia's micro, small, and medium enterprises (MSMEs) are crucial to national economic growth [1]. Ninety-five percent of all workers in the country are employed in the MSME sector, accounting for 61% of the GDP, or Rp9,580 trillion [2]. Despite such significant contributions, MSMEs often face challenges in managing their supply chains sustainably. Various studies show that fluctuations in raw materials, dependence on manual labor, and uncertainty of market demand are the main problems in supply chain management in the MSME sector [3]–[5]. In MSMEs such as

Batik Ayu Arimbi, the urgency of addressing supply chain inefficiencies becomes even more apparent due to its reliance on a conventional stock management and marketing system, which often results in inaccurate calculations and significant financial losses [6], [7].

One of the promising solutions to overcome such problems is implementing a collaborative digital marketing system. This system strengthens the relationship between MSMEs, suppliers, and consumers and creates a more open, fast, and integrated communication network [8], [9]. Moreover, such a system aligns with global trends in digital transformation, which are crucial for improving MSMEs' adaptability and competitiveness in an increasingly interconnected world. Digital technology makes marketing and distribution processes more efficient, reduces communication barriers, and ensures all parties can access relevant information immediately [10], [11]. Based on research by Susilayati et al.[12], Yang et al.[13], and Stroumpoulis et al.[14], integrating digital technology in the supply chain expands operational visibility and fosters streamlined collaboration between stakeholders, thereby supporting the creation of a more sustainable and resilient business ecosystem amid rapid change.

In addition to inefficiency, existing literature indicates specific weaknesses in digital marketing and Business Process Model Notation (BPMN) applications within MSMEs, such as limited integration frameworks and a lack of practical implementation strategies. Addressing these gaps, this study emphasizes how BPMN-based models can optimize collaborative networks and digital adoption among MSMEs, particularly in the batik industry. Study Dey et al. [15], Horváth et al. [16], Joshi et al. [17], and Miklosik et al. [18] state that digitalization allows MSMEs to share information in real-time, significantly impacting and accelerating decision-making. This reduces reliance on traditional distribution systems that are slow and tend to be expensive, especially in the context of logistics and delivery [19]. With digital platforms, MSMEs can reduce operational costs while minimizing negative environmental impacts, such as reducing paper and energy use [20], [21]. Additionally, digital transformation gives MSMEs the leverage to become more competitive in the global market, with broader access to international consumers [22]. The adoption of digital technology is not only relevant for surviving in the market competition but is also an important strategy to ensure long-term business sustainability, as seen in studies by Appel et al. [23] and López García et al. [24].

This research aims to design a supply chain system based on collaboration and digital marketing for a specific MSME, i.e., Batik Ayu Arimbi. Using Business Process Model Notation (BPMN) as a visualization tool, the study describes an efficient and integrated process flow [25]. This study is novel in that it combines supply chain collaboration and digital marketing into a single framework to support the reliability of small enterprises. Additionally, the study explicitly addresses the gap in supply chain frameworks that integrate collaborative digital marketing approaches for MSMEs, with a specific focus on operational and strategic challenges in batik production. The research uses qualitative descriptive methods to capture the empirical conditions in the field to improve the system [26]. Furthermore, this study contributes to strengthening supply chain resilience and enhancing competitiveness through digital transformation, ultimately supporting the long-term sustainability of MSMEs.

2. Method

2.1. Research Site and Participants

This study was carried out at Batik Ayu Arimbi, an MSME located in Pandowoharjo Village, Sleman Regency, Special Region of Yogyakarta, Indonesia. The participants of the study include owners and managers of MSMEs, workers, suppliers of raw materials, product distributors, and consumers involved in the batik supply chain ecosystem.

2.2. Research Design

This study uses a case study design to gain a thorough understanding of the conditions in Batik Ayu Arimbi, especially regarding the implementation of a collaborative digital marketing platform.

10.12928/ijio.v6i2.11739

The case study design allows researchers to explore the dynamics of technology implementation contextually in a natural environment. In this case, it provides a thorough understanding of the distinct operational and marketing problems that MSMEs encounter in the batik industry. In addition, this method is suitable for researching the interaction between MSMEs, suppliers, and consumers in the sustainable supply chain process. A quantitative method was not viable due to the complexity and context-specific character of the research subject, which necessitated a thorough qualitative investigation. The stages of this investigation are depicted in Fig. 1.

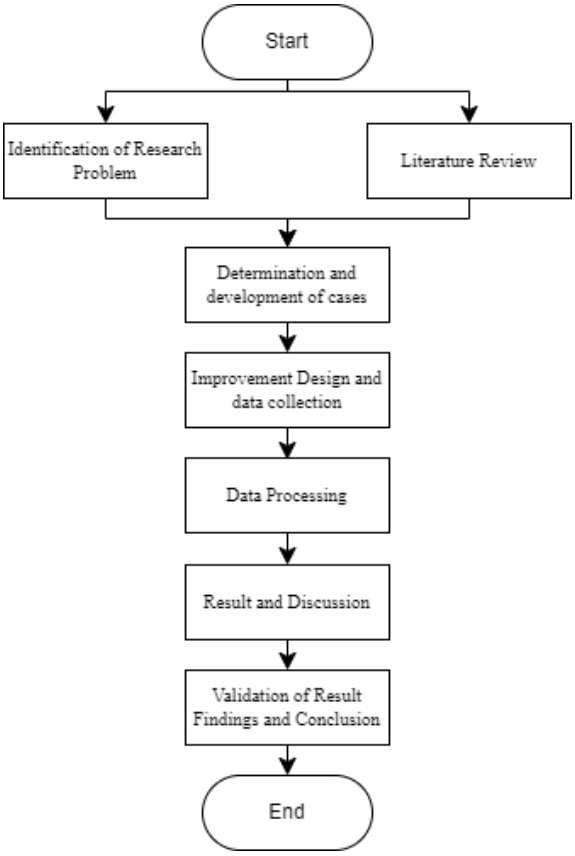


Fig. 1. The Flow Diagram

2.3. Identification of Research Problem and Literature Review

The first phase in the research process is to define the research problem, which entails defining the central issue of the study. This stage sets the direction of the research project and helps determine the purpose and scope of the investigation. A well-articulated research problem guides the methodology and informs the research question to be explored. Following this, conducting a relevant literature study is essential to understand better the theories, concepts, and findings from previous research related to the identified problem. By reviewing the existing literature, gaps in knowledge can be identified from earlier findings, resulting in refined research questions. This literature review review allows researchers to place their work within a broader academic discourse, ensuring their studies are relevant and significant.

2.4. Case Determination and Development

In this study, building a clear case is highly crucial to addressing the specific difficulties faced by small-scale businesses (MSMEs) [27]. By carefully examining a particular company, the study aims to uncover insights that can inform strategies to improve operational efficiency and supply chain management within the company, which may apply to the larger MSME sector [28]. In other words, this case study also highlights the contextual challenges that other MSMEs might face, ensuring that its findings are relevant to similar businesses. Determination and case development are significant in research, especially in understanding MSMEs' challenges. By selecting specific MSMEs, researchers

can identify common issues in supply chain management and operational efficiency and generate case profiles that deepen understanding of the company's unique conditions to apply to similar contexts.

Batik Ayu Arimbi was selected to examine specific challenges in the batik industry, especially regarding traditional stock management and digital marketing integration. This company's analysis reveals insights that can lead to practical improvements, such as the importance of interactions among supply chain stakeholders and the potential benefits of digital marketing strategies. This focused approach offers valuable lessons for other MSMEs that aim to adapt to market changes.

2.5. Improvement Design and Data Collection

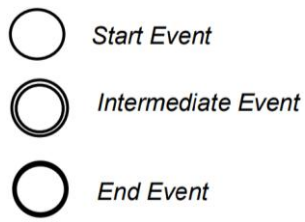
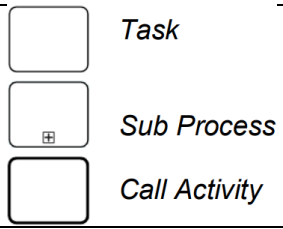
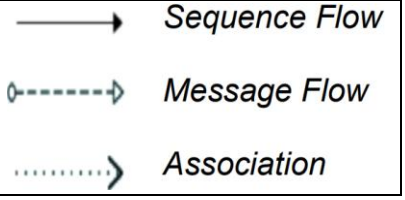
To effectively address the challenges faced by Batik Ayu Arimbi in its supply chain and marketing efforts, a structured approach is essential to enhance operational efficiency and optimize customer engagement. The following section details the proposed strategies and data collection methods used to achieve this improvement, highlighting the importance of leveraging qualitative data to inform decision-making processes in the context of SMEs [15].

In this study, pre-processing and data processing are essential steps that support Batik Ayu Arimbi's supply chain analysis and its digital marketing workflow. Data pre-processing involves collecting and organizing qualitative data from semi-structured interviews with stakeholders, including business owners, employees, suppliers, and consumers. The sample size and selection criteria for participants were specified to ensure replicability and transparency, with participants chosen based on their role in the supply chain and familiarity with the operational processes. This ensures data is cleaned and formatted to accurately capture perceptions and insights related to current practices in digital marketing and supply chain management [29].

2.6. Data Processing

Semi-structured interviews, direct observation, and document analysis were used to gather data, which was then processed using the Business Process Model Notation (BPMN) method. BPMN is a business process modeling standard that uses graphic notation to describe business process diagrams [30]. It offers intuitive notation standards for all business users and can represent complex business processes [31] by using four basic elements: flow objects, connecting objects, swimlanes, and artifacts [32], as Table 1 describes.

Table 1. Business Process Modeling Notation (BPMN) Symbols

Element	Description	Symbol
Event	The circular depiction of the event provides a comprehensive understanding of the events at each event. Events can be categorized into stages: start, intermediate, and end. Each stage affects the overall development of the process and often triggers the following action (trigger) or produces an impact (result).	
Activity	The activity represents a task or action that needs to be completed. Activities are usually divided into functions, sub-processes, and call activities.	
Flow	The connecting elements in the diagram illustrate the relationships between components and the movement of messages in the process. The three main symbols used are sequence flow for process execution paths, message flows for information	

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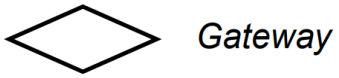
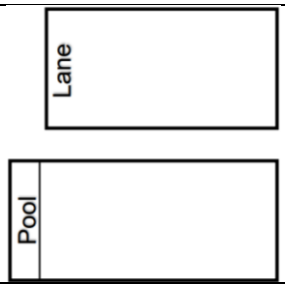
Element	Description	Symbol
	exchange between processes, and associations to connect objects with diagram elements.	
Gateway	The gateway controls the divergence and convergence of the sequence flow, ensuring the proper transition between different paths	
Swimlanes	The components of the diagram are arranged visually through the use of swimlanes. There are two types of swimlanes: pool and lane. Lanes nest within the pool, providing a finer classification of objects within the pool.	

This study uses BPMN as a visualization tool to analyze the process flow in stock management and the Batik Ayu Arimbi digital marketing system. The data collected includes interactions between business owners, workers, suppliers, and consumers in the Batik Ayu Arimbi supply chain by involving pre-processing to clean and organize the data to ensure consistency. This stage is followed by thematic coding of the interview data to identify key process bottlenecks and areas for improvement.

2.7. Results and Discussion

After data processing, the research findings are analyzed, and relevant theories are discussed. The findings of the study demonstrate that cooperation within the supply chain is crucial to raising Batik Ayu Arimbi's operational effectiveness, especially in stock management and digital marketing strategies. For example, the implementation of an integrated digital collaboration system between showrooms and production houses has been found to increase stock transparency and speed up response times to customer orders. In addition, Instagram-based marketing strategies have expanded market reach and increased customer engagement. A more detailed discussion showed that using BPMN facilitates workflow visualization and provides deeper insights to improve efficiency and collaboration across various supply chain segments.

2.8. Validation of Result and Conclusion

To guarantee that the findings in this study are credible and reliable, data triangulation was performed by involving various data sources to cross-verify the collected information [32]. Thematic analysis and coding strategies were applied to ensure consistency in the interpretation of the qualitative data. Data triangulation also helps validate results by strengthening the business owner's perspective with actual inventory levels and sales data [33]. Therefore, data were collected from semi-structured interviews, direct observations, and document analysis to provide a full understanding of the operating process at Batik Ayu Arimbi.

In addition to data triangulation, statistical tests such as normality and t-tests are performed to corroborate the findings. The normality test showed that the data was normally distributed [34], thus allowing the use of an independent sample t-test to compare the conditions before and after the implementation of digital marketing [35]. This combination of triangulation and statistical analysis ensures the robustness of the research and its application to broader MSME strategies in supply chains and digital marketing. The sample's representativeness is also discussed to note potential biases and generalizability limitations.

3. Results and Discussion

3.1. MSMEs and Supply Chain Collaboration

Batik Ayu Arimbi in Yogyakarta is classified as a micro, small, and medium enterprise (MSME) that focuses on producing batik garments and clothing. The MSME implements a make-to-order system, meaning the production process only initiates once an agreement is made with customers regarding order details, including the specified quantity and price. Additionally, Batik Ayu Arimbi employs a make-to-stock system by producing a certain amount of goods to sell to resellers and other batik shops. The stages of batik production involve several processes, such as fabric selection, printing, steaming, rolling, washing, and drying. The types of batik are generally divided into two: written batik and screen printing.

In Batik Ayu Arimbi's operational system, supply chain collaboration is fundamental in integrating activities between production, raw material management, and final product distribution. This is evident in the following stages: planning (Plan), raw material procurement (Source), production (Make), and product distribution (Deliver). At the planning stage, the focus is on planning stock levels of products and raw materials to ensure resource availability, avoiding excess or shortages that could hinder production. The procurement of raw materials and production equipment requires a robust pricing analysis and strong supplier relationships.

The production stage (Make) is an essential phase in supply chain management. Good planning can reduce lead times and the risk of production errors, which will positively impact overall supply chain performance. Furthermore, at the delivery stage (Delivery), the finished product is sent to the showroom for quality checking, packaging, and delivery to customers by selecting reliable expedition services to avoid delivery delays.

The implementation of integrated supply chain collaboration supports daily operational processes and helps adapt to changes in the dynamic business environment. Online marketing strategies, flexible stock management, and solid cooperation between suppliers and distributors are essential foundations for business continuity, particularly when confronted with major obstacles like the COVID-19 pandemic that caused a global health crisis.

The operational strategies of Batik Ayu Arimbi align significantly with findings from past studies on barriers and enablers to sustainable supply chain management (SSCM) implementation within the textile sector, stating that collaboration plays a vital role in overcoming barriers to sustainability [36], [37]. Integrating a joint sustainability mission and fostering cross-functional collaboration within organizations are seen as key enablers. Likewise, Batik Ayu Arimbi also seeks to enhance supply chain efficiency by building strong relationships between suppliers, production teams, and distributors. Embedding sustainability within corporate strategies and operational objectives is also emphasized, as well as creating organizational structures that encourage innovation and communication at all levels.

However, a key distinction lies in scale and application. The study on SSCM within the textile sector focuses on intra-industry collaboration and institutional frameworks to address global supply chain fragmentation [38], [39]. In contrast, Batik Ayu Arimbi’s approach remains localized. The use of digital marketing strategies is more about integrating traditional craft production with modern supply chain practices. Nonetheless, both approaches underscore the importance of collaboration in mitigating barriers such as resource constraints and inefficient communication, as well as enabling sustainable supply chain practices. Industry-wide collaboration as highlighted in the SSCM study also helps conserve resources, facilitates knowledge exchange on sustainability issues, and strengthens relationships with suppliers.

3.2. Problem Identification

The Ayu Arimbi Batik MSME faces several critical challenges that impact its supply chain efficiency and operational performance, which include stock management, financial accuracy, and digital marketing strategies. Identifying and addressing these problems is essential to improving both operational processes and market competitiveness.

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3.2.1. Stock Updates and Raw Material Inputs

The first major issue identified concerns the stock management system. The lack of real-time updates regarding stock levels in the showroom leads to inefficiencies in inventory management. When stock runs out or is low, the production house does not receive this information promptly, which results in delays in the replenishment of raw materials. This delay leads to stock imbalances, creating a scenario where the company is either overstocked or understocked, both of which impact the ability to meet customer demand effectively.

This condition slows down the production cycle, leading to missed sales opportunities and customer dissatisfaction. In addition, such inefficiencies make it difficult for the MSME to anticipate demand fluctuations and respond quickly, ultimately affecting its competitiveness and profitability. The absence of a fully integrated inventory management system exacerbates this problem, creating a bottleneck in the supply chain.

3.2.2. Cash Flow Miscalculation

Another significant issue identified in the business's operations is the reliance on a manual bookkeeping system for tracking cash flow. This conventional accounting approach is prone to human errors, which can lead to critical miscalculations in financial records. These inaccuracies have a direct effect on the company's decision-making, particularly in areas such as production cost management, resource allocation, and overall financial strategy.

The inability to track cash flow accurately also hinders the MSME's ability to plan for future investments or manage short-term liquidity effectively. Inaccurate financial data could result in misallocated resources, inefficient cost management, and missed growth opportunities due to the inability to make timely and informed decisions.

3.2.3. Digital Marketing Strategies and Sales Systems Are Not Optimal

A third critical problem facing Ayu Arimbi Batik is the underutilization of digital marketing tools and the lack of integration within its sales systems. In today's competitive industry, digital marketing is critical for reaching a larger audience and increasing revenue. However, Ayu Arimbi Batik has not fully integrated modern channels such as social media and e-commerce, which limits its market reach.

Furthermore, there is a lack of integration between the sales systems and other operational areas, such as inventory management and order fulfillment. This results in inefficiencies in tracking sales data, which, in turn, delays the distribution process. The absence of seamless communication between these systems leads to slow responses to market demands, making it difficult for the business to manage orders, process sales, and ensure timely deliveries. A robust and integrated digital marketing strategy is essential for increasing the visibility of Ayu Arimbi Batik products and ensuring its long-term growth in an increasingly digital marketplace.

3.3. BPMN Implementation

3.3.1. The Flow of Ayu Arimbi Batik's Management System

This research aims to analyze the business process in Ayu Arimbi Batik, identify problems in the supply chain, stock management, and sales system, and provide appropriate solutions to improve operational efficiency. This process needs to be integrated between parts to avoid slow response and incomplete information.

Fig. 2 illustrates the flow of the stock management process at Batik Ayu Arimbi before evaluating and improving the system. This process is still performed manually and needs to be appropriately integrated between the showroom and the production house. In the initial stage, the showroom receives goods from the production house and sells the products. Once the item is sold, the product is packaged as needed and recorded as "stock sold." However, there is no automated system that can track stock availability. If the stock in the showroom runs out, the information is not immediately passed on to the production house, which causes a delay in meeting demand. A clearer picture of the stock is needed in the showroom to avoid late replenishing.

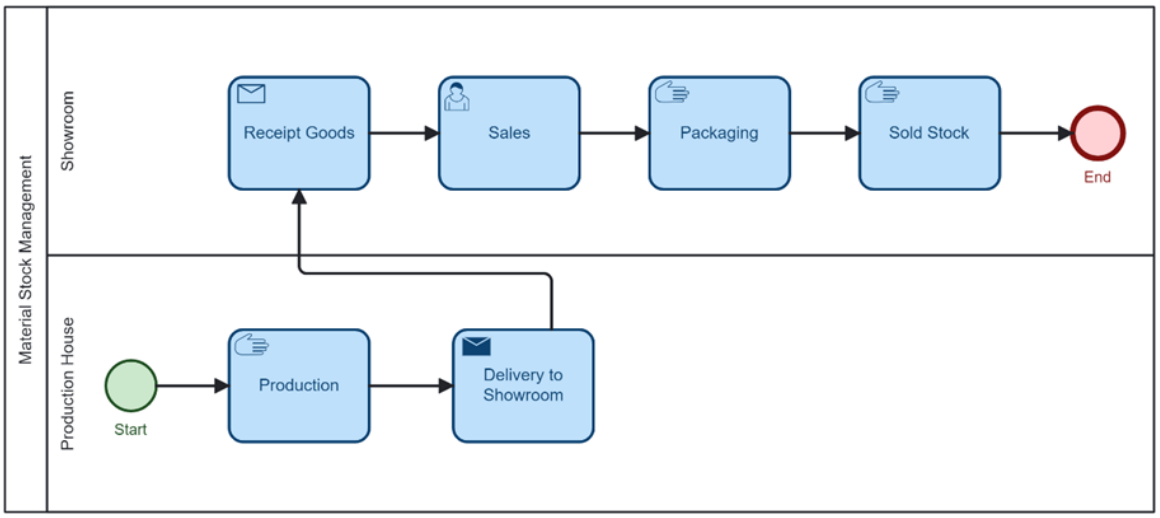

Fig. 2. Material Stock Management

At the production stage, the process starts with production activities based on orders made by customers. After the production, the goods are sent to the showroom for sale. Because there is no integrated system, the production house only relies on manual information from the showroom to identify the next goods production. The disconnected flow of information between the showroom and the production house results in a rushed stock demand and shortages of goods in the showroom.

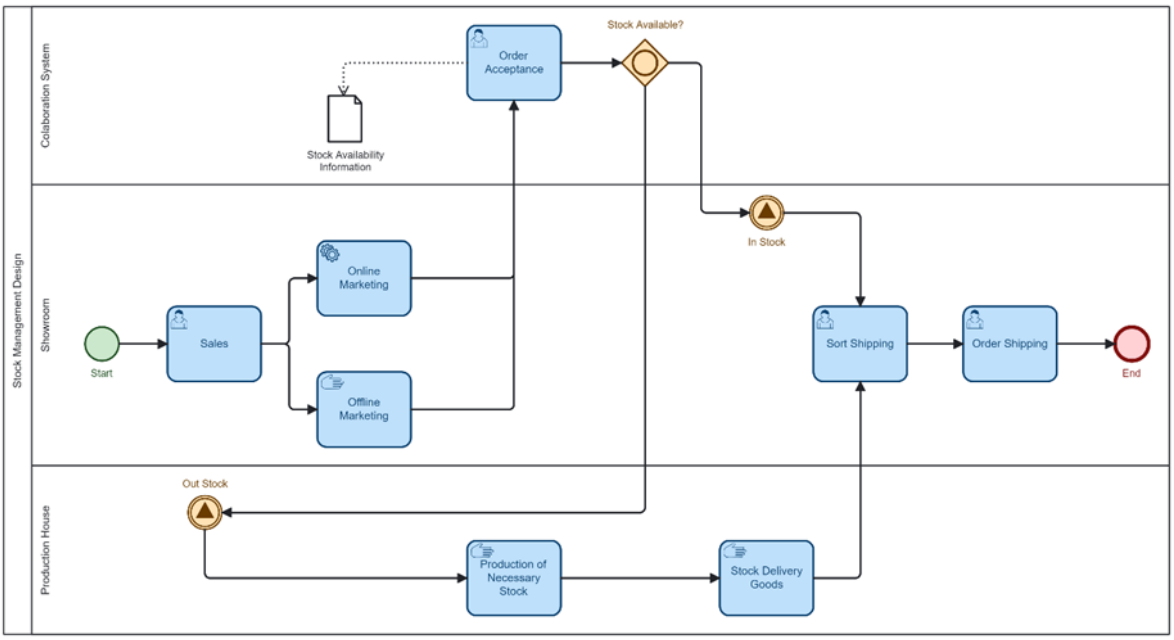

Fig. 3. Stock Management Design

Fig. 3 shows the implementation of a more integrated digital collaboration system based on system evaluation, which shows significant changes in stock management. This system connects all process parts, from showrooms and production houses to stock monitoring systems. The main change is the ability to track stock availability in real-time and automatically. In the early stages, the sales process in the showroom is carried out in two ways: online and offline. When an order is received, the showroom can check stock availability using the collaboration system.

Furthermore, the system will display stock availability information in the showroom and decide whether the stock is sufficient to fulfill orders or needs to be replenished. If the stock is available, the order can be processed immediately and delivered to the customer. However, if stock is unavailable,

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the showroom can directly send a request to the production house through the system. At this stage, information on stock needs can be sent without delay.

At the production house, the collaboration system will signal if there is a demand for new goods. The production house will then start the production process according to the demand recorded on the system. After the production, the goods are sent to the showroom for sale. In addition, the collaboration system also helps monitor the delivery of goods so showrooms can track the status of goods being delivered.

Implementing this collaboration system provides various significant benefits for Batik Ayu Arimbi. First, it allows for more efficient and real-time monitoring of stock availability. Second, the response time to order requests can be accelerated because showrooms and production houses can access the same information through the system. Third, it helps reduce the risk of stock shortages in showrooms by providing early notifications when stock starts to run low.

Overall, this change from a manual system to a digital collaboration system creates a more transparent and efficient flow of information. This change also ensures that the production house can be more responsive in meeting demands so that the sales and stock management process becomes more optimal. This system improvement is expected to provide long-term benefits for smooth operations and improve company performance. Previous studies also emphasize the importance of real-time inventory tracking in reducing operational bottlenecks and enhancing customer responsiveness [40], emphasizing the value of integrated systems in boosting supply chain visibility and avoiding stockout risks [41]. Digital collaboration systems enable MSMEs like Batik Ayu Arimbi to optimize their operations, reduce inefficiencies, and remain competitive in dynamic markets.

By transitioning from manual systems to a fully integrated digital collaboration platform, Batik Ayu Arimbi has created a more transparent and efficient flow of information. This system not only ensures that production houses can promptly meet showroom demands but also enhances coordination, allowing for faster and more accurate order fulfillment. Such advancements are expected to yield long-term benefits, including smoother operational processes, better resource utilization, and improved overall company performance, making Batik Ayu Arimbi a model for other MSMEs in adopting digital transformation.

3.3.2. The Flow of Ayu Arimbi Batik's Marketing System

This section compares the marketing flow designed using Instagram, described through the Business Process Model and Notation (BPMN). Instagram as a marketing platform is considered necessary because this social media can increase product visibility and market reach, especially for small-scale businesses like Batik Ayu Arimbi. With more than 160 million active users in Indonesia, Instagram provides opportunities for businesses to connect directly with potential consumers through engaging and interactive visual content. The marketing flow of Batik Ayu Arimbi is still conventional and less efficient due to the minimal use of social media, so the promotion process and updating stock information cannot be carried out in real time, which causes delays in responding to orders and market demand.

Fig. 4 demonstrates the flow of the marketing process, starting from a showroom that sells stock goods, where stock sales are divided into two parts, offline and online sales through Instagram. Online marketing is carried out to generate leads who may make purchases. The process continues to the order stage to the Ayu Arimbi Batik showroom. The receipt of orders at the showroom continues with the packaging process. When the packaging has been completed, the showroom will make deliveries according to the orders. Items that have been sold from Instagram posts will be updated so that sold items can be removed to maintain customer trust. This indicates that social media, especially Instagram, has excellent potential as an effective marketing tool to reach more consumers.

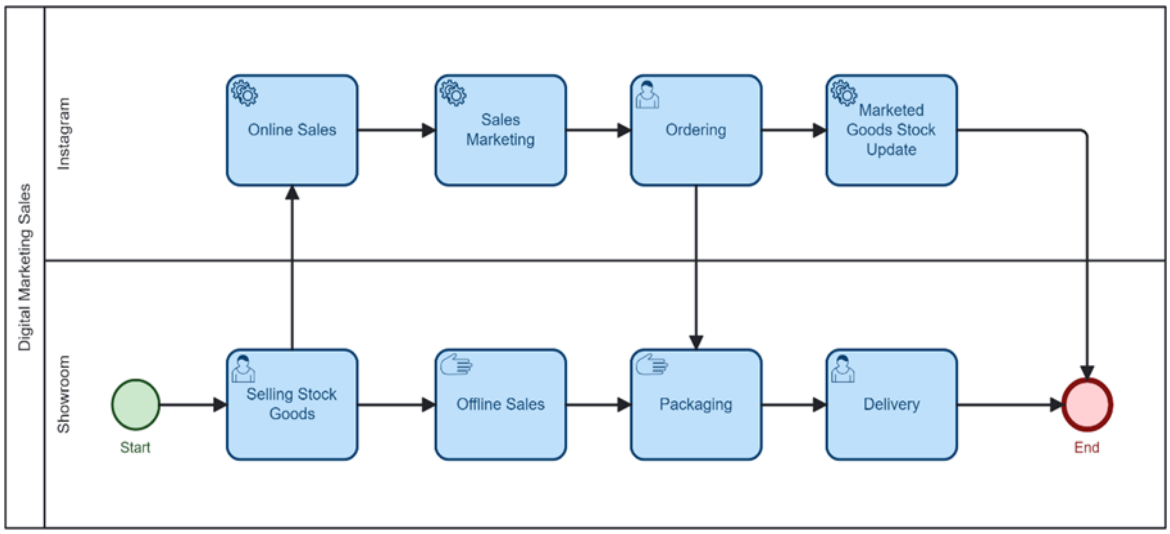

Fig. 4. Digital Marketing Sales

Fig. 5 shows the digital marketing process to do maximum marketing on Instagram. The use of Instagram in the process flow begins with the login activity on the Batik Ayu Arimbi account; then, in the profile section, various marketing features are used, such as stories, story highlights, profile edits, and post feeds. Each feature has stages; the story continues by choosing the best photo to market so buyers will be interested. Next, a caption or hashtag on the story is created to review the item, continued by posting. Story highlights are used to archive stories and display products on Batik Ayu Arimbi's Instagram profile. In the profile edit section, store reviews are provided, making it easier for consumers to understand the store, such as addresses, ordering links, etc.

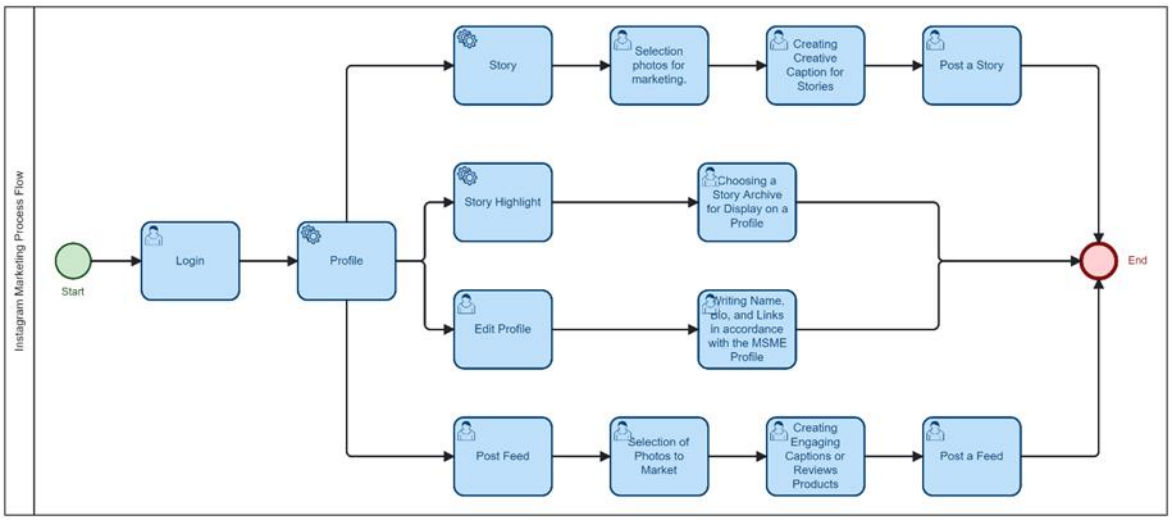

Fig. 5 Marketing Process Flow

In designing a collaboration system, the order link is directed to the contact person, the WhatsApp application, to place an order. When the admin receives an order, the admin will use the collaboration system to check the stock. Instagram post feeds help showcase the goods being sold and optimize them. The selection of quality photos, caption reviews, and competitive prices are very influential in attracting customers, so they trust Batik Ayu Arimbi. Before evaluating and implementing digital marketing strategies, Batik Ayu Arimbi relied on conventional sales methods. The online sales have yet to be appropriately optimized because they are not integrated with popular digital platforms. At this stage, marketing is only done through showcases in showrooms and simple e-commerce platforms that cannot maximize consumer reach.

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The sales flow starts from the showroom that sells stock of goods, then continues with packaging and delivery when there is an order. A proper marketing strategy must be used to attract consumer interest through social media effectively. In online sales that have been implemented, showrooms only use Instagram to post available goods without a comprehensive marketing strategy. Items that have been sold are sometimes updated late on the Instagram page, which may cause distrust. In addition, the business needs to take advantage of the marketing features available on Instagram, such as story highlights, exciting captions, or relevant hashtags to increase the visibility of the content.

After an evaluation, the sales and marketing process flow at Batik Ayu Arimbi was significantly changed by utilizing a social media-based digital marketing strategy, especially Instagram. Marketing is not just about posting goods; it has been designed to create better consumer engagement through various marketing features on Instagram. The new marketing process flow starts with logging in to Ayu Arimbi's Batik Instagram account and then using features such as stories, highlights, and post feeds to display the products sold. Each feature is used for a specific purpose.

For example, the story feature displays the best product photos with attractive captions and relevant hashtags to reach a wider audience. The story highlights feature is used as an archive of stories that have been uploaded so that potential consumers can see previous products easily. In the profile edit section, clear information about the store, such as address, order contact, and a brief description of Batik Ayu Arimbi, is given in detail to help buyers understand this business profile. In addition, this digital marketing is also integrated with a new collaboration system, where the order link on the Instagram profile directly targets potential buyers to WhatsApp to communicate with the admin. The admin will then check stock availability using an integrated collaboration system.

With this system, information about the availability of goods, order receipt, and production and delivery processes can be done automatically and centrally. This makes it easier for showrooms and production houses to coordinate and fulfill orders faster and more efficiently. Implementing this collaboration system provides various significant benefits for Batik Ayu Arimbi. First, good integration between the showroom and the production house allows for more efficient and real-time monitoring of stock availability. Second, the response time to order requests can be accelerated since showrooms and production houses can now access the same information through the system. Third, using this system helps reduce the risk of stock shortages in showrooms because the system can provide early notifications when stock starts to run low.

The transformation from conventional marketing to Instagram-based digital marketing shows a significant shift in how Batik Ayu Arimbi reaches its consumers. If previously marketing was only conducted manually and limitedly, now marketing can be performed online using more structured Instagram features. Digital marketing helps this business reach more potential customers, create trust through consistent content management, and provide a more comfortable and easy shopping experience. It is anticipated that putting this digital marketing approach into practice will boost sales and broaden the market, as well as position Batik Ayu Arimbi as one of the MSME actors who is adaptive to the development of digital technology in this modern era.

The integration of Instagram's marketing features with a collaborative system at Batik Ayu Arimbi aligns with findings in prior studies that emphasize the impact of digital tools on operational efficiency and customer engagement. Social media marketing significantly enhances brand visibility and trust, leading to improved customer acquisition and retention [42]. Previous studies also highlight the effectiveness of leveraging features such as hashtags and visual content in expanding consumer reach, much like Batik Ayu Arimbi's use of Instagram Stories and Story Highlights to display product photos and provide an accessible archive for potential customers. Additionally, the integration of WhatsApp as a direct communication channel reflects best practices in digital marketing, where real-time customer interactions contribute to faster order processing and increased customer satisfaction.

Previous studies also emphasize the importance of integrating technology into business processes to enhance efficiency and sustainability [43], underscoring that digital tools must be combined with optimization and mindset shifts to create long-term value. This is mirrored in Batik Ayu Arimbi's implementation of a centralized collaboration system, which automates stock monitoring and

improves coordination between showrooms and production houses. By addressing operational inefficiencies, the system reduces stock shortages and response times, ensuring better alignment between production and consumer demand. These studies collectively affirm the transformative potential of digital tools in enabling MSMEs like Batik Ayu Arimbi to achieve competitive advantages and sustainable growth.

3.3.3. Results of Digital Marketing Implementation (Instagram)

The adoption of digital marketing by utilizing Instagram as a promotional medium was chosen because this social media is widespread and can increase visibility and direct interaction with potential customers. Instagram is considered appropriate because it has many features that support visual marketing, such as post feeds, stories, and story highlights, and the ability to connect with customers in real-time. However, implementing marketing with Instagram also requires a good understanding of the strategy for using its features in order to be able to attract buyers optimally. Table 2. presents various aspects that illustrate the circumstances both prior to and following the implementation of digital marketing.

Table 2. Result of Implementing Digital Marketing

Aspects	Before Implementation	After Implementation
Marketing Funnel	Manual marketing with two paths: offline and limited online.	Instagram-based digital marketing with the BPMN approach.
Marketing Media	Offline sales in showrooms, online by phone/text message.	Using Instagram as the primary medium for sales.
Customer Reach	Limited in reaching a wider range of customers.	Wider customer reach through Instagram features.
Stock Transparency	Limited stock information between showrooms and production houses	Real-time stock updates between showrooms and production houses
Stock Management	The stock management process is inefficient, there are often delays.	Manage stock more efficiently with automatic alerts for replenishment.
Consumer Interaction	Passive, limited interaction with customers	Active and intense interaction through story highlights and informative captions.
Consumer Trust	Limited, there is no clear visual media.	Improve through structured and informative product displays.
Obstacles Faced	Ignoring technology trends that lead to a loss of customer appeal	Limited understanding of digital marketing strategies through Instagram

Overall, the results of implementing digital marketing with Instagram show a significant improvement in the efficiency of the marketing process at Batik Ayu Arimbi. This can be seen from the improvement of essential variables in marketing management, such as increased response speed in orders, transparency of stock information, and improvements in financial management and sales recording. The evaluation of the changes that occurred was carried out using a quantitative approach in the form of questionnaires given to the workers and related stakeholders. This questionnaire measures the extent of their understanding and acceptance of the changes that occur after the implementation of Instagram-based marketing. The questionnaire results showed that most respondents gave a positive assessment of the efficiency and effectiveness of the new marketing proces.

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Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Penjualan_Sebelum	.106	30	.200*	.956	30	.239
Penjualan_Sesudah	.088	30	.200*	.971	30	.571

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Fig.6. Normality Test

In addition to questionnaires, results of the normality test using Kolmogorov-Smirnov show that for the "Sales Before" data (before the implementation of digital marketing), the significance value (p-value) is 0.200, and for the "Sales After" data (after the implementation of digital marketing), the significance value is also 0.200. Because both p-values are higher than 0.05, we may assume that sales data before and after digital marketing deployment follow a normal distribution.

These results were justified by t-test testing, in which the paired t-test results show that the difference in the average sales is -5.03333, with a standard deviation of 0.41384. The difference in means has a standard error of 0.07556, with a 95% confidence interval of -5.18786 to -4.87880. The t-value obtained is -66.617, with 29 degrees of freedom. The significance level (p-value) is 0.000, which is less than the threshold of 0.05, showing a statistically significant difference in sales before and after digital marketing deployment. Thus, the findings of the paired t-test show that digital marketing methods have a considerable impact on Ayu Arimbi Batik's sales outcomes.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Penjualan_Sebelum - Penjualan_Sesudah	-5.03333	.41384	.07556	-5.18786	-4.87880	-66.617	29	.000

Fig.7. Paired Sample T-Test

With an integrated collaboration system between showrooms and production houses, as well as the use of Instagram as the primary marketing medium, Batik Ayu Arimbi can respond to orders faster, monitor stock availability more accurately, and create better engagement with consumers through digital interaction. These findings are consistent with past research, such as those by [44], which highlight the usefulness of social media platforms in improving operational efficiency and encouraging consumer involvement for small firms. Additionally, this study develops previous research by providing specific evidence of how Instagram's unique features, such as story highlights and real-time interactions, can be leveraged to improve marketing outcomes in the batik industry, which has not been extensively addressed in earlier works. Compared to studies by [45], which emphasized Facebook as a preferred medium for MSMEs, this research indicates that Instagram offers distinct advantages in visual-focused industries. Thus, the findings add to the growing body of knowledge by validating and building on previous insights into digital marketing techniques, while showcasing the applicability of Instagram as a viable tool for MSMEs. The success achieved by Batik Ayu Arimbi suggests that applying Instagram-based marketing strategies can serve as a development model for other MSMEs aiming to transition to digital marketing, expand market reach, and increase competitiveness in the current digital era.

The findings of this study also corroborate previous findings about the necessity of collaboration in the supply chain and the use of digital marketing. The implementation of a digital collaboration system in MSMEs has been proved to improve operational efficiency and build customer interactions, which is in line with the concept of technology integration in the supply chain to improve performance and competitiveness. In addition, these results strengthen the digital marketing theory, which shows that intensive interactions through digital platforms such as social media can increase customer

engagement. Thus, this study provides a theoretical contribution by expanding the understanding of the role of supply chain collaboration and digital marketing in MSMEs.

4. Conclusion

The findings of the study conclude that the deployment of a collaborative system leads to an increase in efficiency in Batik Ayu Arimbi. The system is designed based on supply chain analysis using Business Process Model Notation (BPMN). The design results in an integrated process flow among showrooms, production houses, and batik groups, improving efficiency from production to sales. In addition, the digital marketing strategy developed using the Instagram platform is based on collaboration with showrooms, supporting the smooth supply chain and increasing sales. The test results indicated significant differences before and after the implementation of the improvements, with the system design proving to be more efficient.

Furthermore, these findings hold broader implications for other MSMEs in traditional industries, showcasing how the integration of digital collaboration systems and digital marketing strategies can optimize operations and expand market reach. Specifically, the study underscores the potential for industries reliant on traditional crafts to transition into modern supply chain practices while maintaining their cultural identity.

This research also highlights the long-term benefits of adopting technology integration, including enhanced sustainability and improved operational resilience. For policymakers, the study offers actionable recommendations to encourage digital transformation among MSMEs, such as providing training on digital tools and incentivizing the adoption of digital marketing platforms. Such initiatives can significantly enhance the competitiveness of MSMEs, which is vital for developing economies.

Finally, while focusing on Batik Ayu Arimbi, the findings suggest potential applications for similar industries, particularly in leveraging BPMN to streamline supply chain processes and employ social media strategies to boost customer engagement. The combination of BPMN and digital marketing not only improves efficiency but is also in line with sustainability objectives, ensuring that MSMEs remain competitive in a continuously changing market scenario.

Acknowledgment: We thank the Directorate of Research and Community Service and the Department of Industrial Engineering at the Islamic University of Indonesia for their financial support of the research.

Conflicts of Interest: The authors declare no conflict of interest.

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