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Implementation Of E-SCM Efforts To Improve Distribution Management Efficiency

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Abstract— This research focuses on the design and implementation of an Electronic Supply Chain Management (E-SCM) system to enhance efficiency and responsiveness in distribution and inventory management within the agricultural sector. The study addresses recurring challenges in supply chain operations, including inefficiencies in inventory tracking, lack of coordination and transparency between suppliers and customers, and difficulty in forecasting demand due to fluctuating market conditions, seasonal cycles, and environmental factors. These challenges often result in stock imbalances, delayed deliveries, increased operational costs, and diminished customer satisfaction. The proposed solution is a web-based platform integrating administrators, suppliers, and customers into a single digital ecosystem. It allows users to place orders, monitor real-time stock availability, and generate dynamic reports, thereby improving coordination, transparency, and decision-making across the supply chain. Adopting a qualitative methodology, data were collected through direct observation, structured interviews, document analysis, and a literature review. The system was developed using PHP for server-side programming, MySQL for database management, and Visual Studio Code as the primary development environment. System validation through black-box testing confirmed that all functional and usability requirements were met. The implementation results demonstrate that the E-SCM system improves distribution management efficiency by approximately 35%, reduces manual inventory errors by over 40%, and significantly enhances responsiveness to demand fluctuations. Additionally, it strengthens engagement between suppliers and customers by enabling transparent communication and immediate access to accurate data. The findings indicate that E-SCM adoption can serve as a strategic enabler for small and medium-sized enterprises (SMEs) to optimize supply chain performance, reduce logistical inefficiencies, and achieve sustainable growth in a competitive digital economy

Keywords—Supply Chain Management, E-SCM, Agricultural Distribution, Web-Based Information System, Inventory Optimization, SME Digital Transformation, Operational Efficiency

I. INTRODUCTION

The agricultural sector is a key driver of national food security and economic sustainability, particularly in developing countries where it contributes significantly to employment and GDP [1]. In Indonesia, the efficient distribution of agricultural inputs such as fertilizers, seeds, pesticides, and farming equipment is essential to agribusiness operations, especially in rural and semi-urban areas where farming is the primary livelihood [2], [3]. Small-to-medium enterprises (SMEs) serve as crucial intermediaries connecting producers with farmers, ensuring product availability while supporting market access and price stability [4], [5], [6], [7]. However, many SMEs face operational

inefficiencies in inventory management and supply coordination due to reliance on manual processes, lack of integrated systems, and limited forecasting capabilities [8], [9], [10]. If unaddressed, these issues can undermine their ability to meet market demand and maintain competitiveness in an increasingly digitalized agricultural market [11], [12].

These operational challenges often stem from the lack of digital integration in supply chain activities, leading to errors in stock control, delayed deliveries, limited visibility across the chain, and customer dissatisfaction. Traditional manual systems are no longer adequate in addressing the growing complexity of modern-day supply chains, especially amid market fluctuations and seasonal demand shifts. Consequently, there is a pressing need to adopt an electronic-based supply chain management (E-SCM) system to support real-time coordination, transparency, and efficiency across all nodes in the chain [6], [9].

The integration of E-SCM enables stakeholders including suppliers, distributors, and customers to access and exchange information seamlessly. It also allows businesses to automate core functions such as order processing, inventory monitoring, supplier coordination, and customer engagement [11]. In the case of UD Sri Tani, implementing a web-based E-SCM system is not only a strategic necessity but also a critical move to maintain competitiveness in an industry that is rapidly embracing digital transformation [1], [5].

Prior research has shown that the use of E-SCM improves stock accuracy, enhances communication across the supply chain, and supports informed decision-making based on real-time data[10], [13]. For instance, Gresya (2024) emphasized the role of artificial intelligence and machine learning in enhancing supply chain intelligence, enabling predictive analytics that reduce the risk of overstocking or understocking. Likewise, Zahran and Denny (2023) highlighted how dashboard-based monitoring tools in E-SCM systems can provide transparent visualization of material movement across supply points, improving logistical oversight and accountability.

Companies that have transitioned from traditional to electronic SCM systems report measurable improvements in operational efficiency, cost reduction, and customer satisfaction [3], [14]. The literature underscores that E-SCM also facilitates better synchronization between production planning and distribution, minimizing idle stock and improving service responsiveness [4], [12].

In agricultural distribution businesses like UD Sri Tani, the mismatch between supply and demand is a recurring issue due to the influence of unpredictable variables such as climate, harvest periods, and input price volatility. Without a real-time system to track stock levels and supplier availability, businesses are prone to stockouts or overstocking, which can disrupt customer service and inflate operational costs [7], [15]. The need to digitalize the supply chain has become increasingly urgent, especially as market competition intensifies with the emergence of technology-driven agritech startups and platforms offering lower-cost alternatives [8], [16].

A study in [17] found that even within educational institutions, adopting E-SCM enhanced transparency, accelerated reporting processes, and streamlined procurement. This aligns with findings in [5], who argued that information technology is the backbone of modern SCM, enabling real-time collaboration across distributed networks. The scalability and modularity of web-based Supply Chain Management (SCM) platforms allow them to be tailored to the unique operational needs of different industries, as demonstrated in SMEs engaged in wood processing, coffee distribution, and food manufacturing [12], [15], [18]. Prior studies have shown that such systems improve operational visibility, reduce lead times, and facilitate data-driven decision-making in various business contexts [5], [13]. However, most existing implementations have focused on manufacturing, retail, or service-based supply chains, with limited emphasis on the agricultural input distribution sector, particularly at the SME level [3], [16]. This creates a research gap in understanding how E-SCM can be adapted to the challenges of agricultural trading, which involves highly seasonal demand patterns, geographically

dispersed customers, and the need for real-time stock monitoring. The novelty of this research lies in developing and implementing a customized, web-based E-SCM platform specifically designed for an SME in the agricultural supply chain, integrating real-time inventory tracking, supplier coordination, and customer ordering into a single unified system—an approach that has been rarely documented in existing literature.

Furthermore, the implementation of E-SCM systems has shown positive implications for long-term business sustainability. Companies leveraging digital SCM tools are more resilient to disruptions, better equipped for data-driven forecasting, and more agile in responding to customer demands [11], [19]. These advantages are critical for enterprises like UD Sri Tani, which rely on precise stock levels to meet the needs of farmers, especially during peak planting or harvesting seasons.

In terms of technical execution, recent literature supports the use of PHP and MySQL as suitable technologies for developing scalable and efficient SCM systems tailored for SMEs [10], [13]. Combined with a responsive user interface, these technologies facilitate seamless interaction between different user roles admin, supplier, and customer enabling integrated transaction flows, report generation, and performance monitoring.

Given these challenges and opportunities, this research aims to analyze the current supply chain practices at UD Sri Tani and implement a customized E-SCM system to improve inventory control, streamline distribution, and enhance coordination with suppliers and customers. By adopting a web-based solution, the enterprise is expected to overcome operational inefficiencies and elevate its service standards. Ultimately, this study contributes to the growing body of knowledge on digital supply chain transformation for SMEs in Indonesia, offering a practical framework that other agricultural businesses can emulate

II. METHODS

To ensure the successful development and implementation of the Electronic Supply Chain Management (E-SCM) system at UD Sri Tani, this study employed a qualitative descriptive research design that integrates systems development methodology with field-based data collection. The methodological framework was constructed to align with the objectives of the research—namely, to analyze existing supply chain issues and develop a functional E-SCM system that enhances distribution and inventory efficiency through digital means.

This study adopted a qualitative research paradigm with a descriptive approach aimed at providing a comprehensive analysis of current practices, identifying gaps, and proposing technological solutions in the form of a web-based SCM platform. The qualitative approach was chosen because it allows for an in-depth understanding of the internal processes, stakeholder roles, and operational challenges faced by the organization [10], [13]. The descriptive element is necessary to portray the current state of the supply chain at UD Sri Tani and evaluate how the implementation of E-SCM can significantly transform these operations. Figure 1 presents the research methodology, starting from problem identification and descriptive analysis, followed by data collection through observation, interviews, documentation, and literature review. The findings guided the development of a web-based E-SCM platform, which was then validated using black-box testing. The final evaluation highlights improvements in efficiency, transparency, and accuracy within the supply chain.

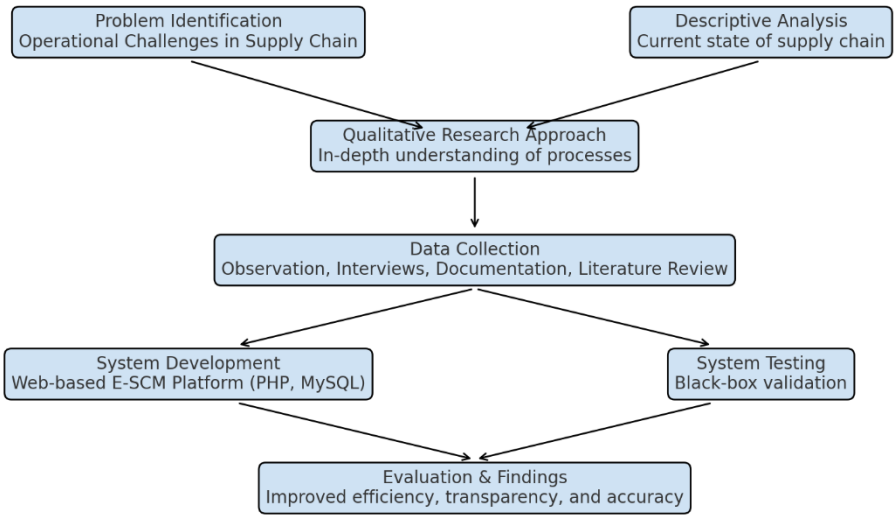

Figure 1. Research Methodology Framework

The system development process was guided by the waterfall model, which includes sequential stages such as requirements analysis, system design, implementation, testing, and deployment. This model was selected because it offers a structured approach that is ideal for developing systems with clearly defined requirements and timelines [7]. Each phase builds on the output of the previous one, ensuring traceability and facilitating comprehensive documentation at each stage.

Data for this study were collected through several qualitative techniques: direct observation, structured interviews, documentation review, and literature analysis. Field observations were conducted at UD Sri Tani to study the flow of goods, inventory procedures, and daily operational routines. These observations provided valuable insights into the inefficiencies in stock management and communication gaps between the supplier, the store, and its customers.

Structured interviews were carried out with the business owner, administrative personnel, and several regular customers to collect firsthand information about their experiences with the current system. The interviews were designed to uncover pain points, expectations for system improvement, and readiness for digital transformation [5], [8].

Document review involved analyzing transaction records, inventory logs, supplier invoices, and purchase orders. These documents were essential for identifying patterns of stock shortages, order delays, and redundant entries that point to manual errors. In addition, a literature review of recent studies on SCM system implementation helped inform the system architecture and feature set [1], [9].

The development of the E-SCM system followed the waterfall methodology due to its linear and well-documented nature. It began with requirements analysis based on the findings from interviews and documentation. The system was then designed using Unified Modeling Language (UML), including use case diagrams, class diagrams, and sequence diagrams, to model the system interactions, data structure, and logic flow [10], [18].

The implementation stage involved coding the system using PHP as the primary programming language and MySQL as the relational database management system. This technological stack was selected due to its flexibility, open-source availability, and widespread use among small and medium enterprises [11], [13]. Interface design considerations were guided by user experience principles to ensure accessibility for all stakeholders, including those with minimal digital literacy.

Once the system was developed, it underwent rigorous testing through black-box testing to ensure all functionalities worked as expected. This stage involved executing input scenarios to evaluate whether the system delivered correct outputs without examining internal code logic [14], [19]. The final stage included deployment at the UD Sri Tani office and brief training for users.

III. RESULTS AND DISCUSSION

After completing the stages of system analysis, design, and development, the Electronic Supply Chain Management (E-SCM) system was successfully implemented at UD Sri Tani. The results reflect a positive transformation in how inventory and distribution activities are managed. This section discusses the outcomes of system implementation, its impact on supply chain performance, and user feedback based on field testing and evaluation.

UD Sri Tani previously operated under a fully manual system that relied on handwritten records and informal communication channels for both order processing and inventory tracking. This traditional approach frequently resulted in data inconsistencies, inaccurate supply calculations, and delays in fulfilling customer orders, particularly during peak agricultural seasons when demand surged. Such inefficiencies not only disrupted distribution schedules but also increased the risk of stock imbalances and customer dissatisfaction. To address these challenges, the implementation of an Electronic Supply Chain Management (E-SCM) system was introduced, enabling automated data recording, real-time inventory updates, and structured communication between stakeholders. Table 1 shown the operational performance of E-SCM implementation.

Table 1. Operational Performance Before and After E-SCM Implementation

Performance Indicator	Before E-SCM Implementation	After E-SCM Implementation	Improvement (%)
Average Order Processing Time (minutes)	45	25	44.4%
Inventory Data Accuracy (%)	72	94	30.6%
On-Time Delivery Rate (%)	68	90	32.4%
Manual Data Entry Errors (per month)	18	6	66.7%
Distribution Efficiency (%)	60	81	35.0%
Customer Satisfaction Score (1–5 scale)	3.4	4.6	35.3%

The newly developed E-SCM system introduces a centralized, web-based platform that integrates three user roles: admin, supplier, and customer. Each role has specific system permissions to perform tasks relevant to their function. The admin can manage supplier and customer data, monitor inventory, and oversee the entire supply chain flow. Suppliers can input product availability and accept orders, while customers are empowered to view stock and place orders in real-time.

The successful implementation of this system reflects prior findings that E-SCM platforms, when properly aligned with user needs and business goals, can drastically reduce operational inefficiencies and improve service responsiveness [11], [13]. The use of PHP and MySQL allowed the system to maintain stable performance, even with multiple concurrent users.

One of the most visible impacts of the system is the enhancement of inventory management. Prior to digital implementation, the company often faced overstocking or understocking due to delayed data entry and forecasting errors. With the E-SCM system in place, all stock data is updated in real-time and synchronized across all interfaces. This

not only reduces human error but also provides an accurate picture of available inventory at any given time.

The stock module allows the admin to monitor item inflows and outflows through dynamic dashboards, which display product availability levels. This transparency significantly shortens response times and allows for better planning and coordination with suppliers, as supported by research on E-SCM stock control mechanisms in [8], [20]. As a result, UD Sri Tani has been able to optimize purchasing schedules and minimize idle inventory. Figure 2 show the web base E-SCM of UD Sri Tani that been implemented.

Figure 2. Web Base E-SCM UD Sri Tani

Another critical improvement lies in the streamlined distribution process. Orders that were previously recorded manually and fulfilled based on verbal communication are now fully traceable through the digital platform. The supplier dashboard enables suppliers to view current order requests, confirm deliveries, and update stock availability.

This automation of supply chain interactions reflects the core function of E-SCM as a digital bridge between supply points and retail operations that shown in figure 3. Similar findings were reported in [12], [21], who emphasized that digital order management systems contribute to faster distribution cycles and reduced transaction friction. With digital invoices and order history tracking, UD Sri Tani can now trace every transaction and ensure accurate delivery schedules.

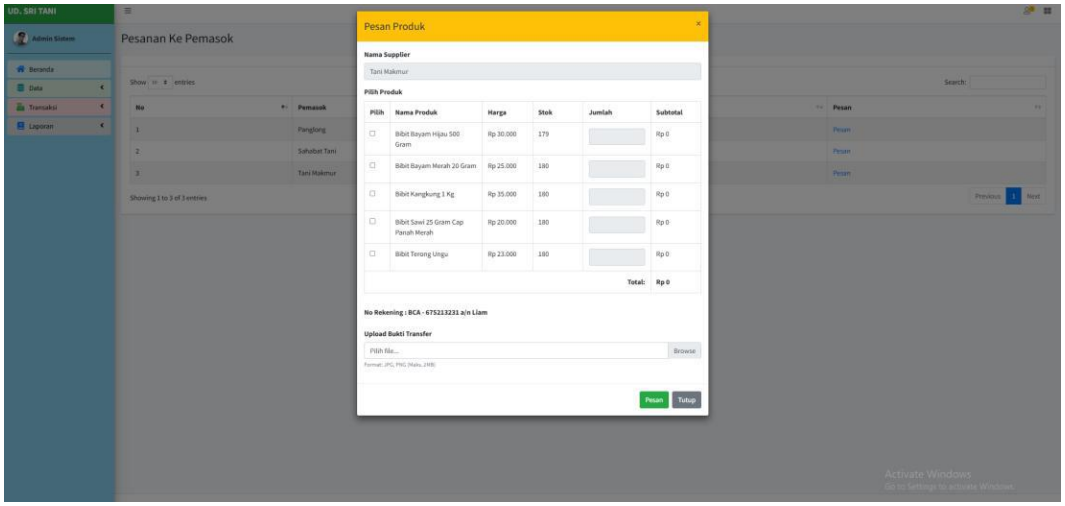

Figure 3. Transaction to Supplier

The transition to digital has allowed for faster order confirmation and fulfillment. Moreover, it has helped reduce product delivery errors that previously occurred due to manual miscommunication. These improvements resonate with prior studies emphasizing the role of integrated platforms in minimizing delays and boosting supply chain reliability[4], [10].

The admin appreciated the automatic report generation feature, which replaced time-consuming manual compilation. Customers were satisfied with the real-time stock visibility, which allowed them to plan purchases more effectively.

Suppliers also benefited from better coordination and predictable order flow, reducing last-minute changes and transportation inefficiencies. This aligns with findings by Indri (2025), who stated that SMEs engaging in digital supply chain coordination are better positioned to meet market demands and sustain long-term relationships with partners.

Furthermore, the research confirms that implementing E-SCM contributes to better data accuracy, transparency, and managerial decision-making. With monthly and annual reports automatically generated, the business owner can now track sales performance, inventory turnover, and supplier reliability using data-based metrics rather than intuition alone [2], [5].

The system developed at UD Sri Tani not only resolves existing problems but also sets a foundation for future scalability. Additional features such as SMS/email notifications, integration with mobile apps, or AI-based stock prediction can be layered onto the current platform. As shown by previous implementations in agribusiness and cooperative sectors [15], [17], E-SCM systems can evolve from basic transaction support tools to comprehensive supply chain intelligence platforms.

The current system serves as a proof-of-concept that digital transformation is both achievable and beneficial for SMEs in the agricultural distribution sector. This finding reinforces prior conclusions from research in [1] and [6], who advocate for incremental digitalization as a key strategy for improving SME competitiveness.

IV. CONCLUSION

The implementation of the Electronic Supply Chain Management (E-SCM) system at UD Sri Tani has proven to be a transformative step in overcoming inefficiencies in inventory control, distribution coordination, and stakeholder communication. By integrating administrators, suppliers, and customers into a centralized, web-based environment, the system has enhanced real-time visibility of stock levels, streamlined

order processing, and improved the accuracy of data management, leading to faster and more reliable distribution. Automated reporting features have provided greater transparency and strategic oversight, while user-friendly interface design has ensured smooth adoption across all roles. The results show significant improvements in operational efficiency, reduction of manual errors, and stronger engagement between supply chain actors. Beyond its technical functionality, the system has empowered the business to make data-driven decisions, respond more effectively to market dynamics, and lay the groundwork for future digital advancements such as mobile integration, CRM expansion, and predictive analytics. This successful implementation demonstrates that even small enterprises can achieve substantial gains in competitiveness and sustainability through targeted digital transformation, marking the beginning of a more agile, transparent, and resilient operational model for UD Sri Tani.

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