



Digitalizing MSME Financial Recording in Medan: The Development and Implementation of a User-Centered POS System

Okky Putra Barus¹, Ade Maulana², Triandes Sinaga³

^{1,2,3} Universitas Pelita Harapan

Email: okky.barus@uph.edu, ade.maulana@lecturer.uph.edu, triandes.sinaga@uph.edu

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Abstract: This community engagement project aimed to address operational challenges faced by Micro, Small, and Medium Enterprises (MSMEs) through an integrated Point of Sales (POS) system. A case study at Akane Beauty Studio and Salon used a User-Centered Design (UCD) and Rapid Application Development (RAD) approach, managed under the PMBOK framework. The implementation yielded a significant impact on operational efficiency, notably reducing transaction time from over one minute to under one minute. A comparison of the workflow also showed improvement, with a manual process that previously took four minutes now being completed in two minutes. User Acceptance Testing (UAT) confirmed the system was fully functional and easy to use. This project demonstrates that a user-centric digital solution can tangibly improve the efficiency, data accuracy, and business sustainability of MSMEs.



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Introduction

How can a business grow and compete in the digital era if its operational foundation is still built on stacks of paper and unintegrated data? This very question lies at the core of the challenges faced by millions of MSMEs today. The rapid development of digitalization has driven significant transformations across various industries, particularly for Micro, Small, and Medium Enterprises (MSMEs). Ironically, however, the massive adoption of technology has not been evenly distributed. In fact, data from the Ministry of Cooperatives and SMEs (2023) indicate that only 33.6% of Indonesian MSMEs have adopted digital business management systems, suggesting a vast potential for further digitalization in this sector¹. The implementation of technology is often hindered

¹ Peran Platform Digital Terhadap Pengembangan UMKM di Indonesia (INDEF, 2024), <https://indef.or.id/wp-content/uploads/2024/01/Laporan-Final-Peran-Platform-Digital-Terhadap-Pengembangan-UMKM-di-Indonesia-INDEF.pdf>.

by a lack of understanding and the unavailability of systems that suit the needs and capabilities of MSME owners². In line with global efforts toward sustainable development, this project directly supports the achievement of Sustainable Development Goals (SDGs), specifically SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure), by promoting technology adoption and boosting MSME productivity.

Manual record-keeping methods commonly used by MSMEs often create various operational problems that impede business growth³. A crucial issue is the inaccuracy of transaction records, which can result in financial losses. Furthermore, many MSME owners continue to face difficulties in separating their personal and business finances⁴. According to the OCBC Business Fitness Index report, over 50% of MSMEs experience this financial commingling, which significantly complicates the evaluation of business financial health⁵. On the other hand, a data mismatch between stock and sales often occurs⁶, making it difficult to track inventory and potentially causing losses due to overstocking or stockouts⁷. A study by Harvard Business Review reveals that implementing a digital inventory management system can increase operational efficiency by up to 25% and reduce stock losses due to mismanagement by as much as 30%.

Several previous studies have demonstrated that implementing a Point of Sale (POS) system can be an effective solution⁸. Other studies show that web-based POS systems can improve operational efficiency in the retail sector⁹, while cloud-based

² Nita Hernita and Yogi Ginanjar, "Managerial Aspect and Digital Marketing of Micro, Small and Medium Enterprises in West Java," *IOP Conference Series Earth and Environmental Science* 748, no. 1 (April 2021): 12035–12035, <https://doi.org/10.1088/1755-1315/748/1/012035>; Ivonne Helena Putong, "Digitalization Strategy of Small and Medium Enterprises (SMEs) of Agribusiness Sector at North Sulawesi," *International Journal of Academic Research in Business and Social Sciences* 13, no. 5 (May 2023), <https://doi.org/10.6007/ijarbss/v13-i5/16917>.

³ Sharon Buteau, "Roadmap for Digital Technology to Foster India's MSME Ecosystem—Opportunities and Challenges," *CSI Transactions on ICT* 9, no. 4 (December 2021): 233–44, <https://doi.org/10.1007/s40012-021-00345-4>.

⁴ Ferdinand Murni Hamundu et al., "Intention to Adopt Cloud Accounting: A Conceptual Model from Indonesian MSMEs Perspectives," *Journal of Asian Finance Economics and Business* 7, no. 12 (December 2020): 749–59, <https://doi.org/10.13106/jafeb.2020.vol7.no12.749>.

⁵ *OCBC Business Fitness Index* (OCBC NISP, 2024), https://api.ruangmenyala.com/api/uploads/on-c2-s3-ruangmenyala-prod/03692dfc-76f1-473c-a331-663259f6df92/BFI%202023%20FULL%20R2_compressed-2.pdf.

⁶ J. J. Pangaribuan et al., "Sales, Purchase, and Inventory Information System Design at SMEs," *2022 1st International Conference on Technology Innovation and Its Applications (ICTIIA)*, September 23, 2022, 1–6, <https://doi.org/10.1109/ICTIIA54654.2022.9935929>.

⁷ Nurhidayah Nurhidayah, Melsa Safitri, and Ismail Badollahi, "Penerapan Sistem Akuntansi Manajemen Dalam Meningkatkan Kinerja Bisnis Usaha Mikro, Kecil Dan Menengah," *Advances in Management & Financial Reporting* 3 (May 2025): 180–98, <https://doi.org/10.60079/amfr.v3i2.518>.

⁸ Adnan Nasution, "Sistem Informasi Peternakan Sebagai Pengembangan Media Promosi Pada Arjuna Farm Berbasis Web," *Jurnal Media Informatika* 6 (November 2024): 548–53, <https://doi.org/10.55338/jumin.v6i1.4348>.

⁹ J. J. Pangaribuan et al., "Sales, Purchase, and Inventory Information System Design at SMEs."

systems allow for real-time data access¹⁰. However, many systems available on the market do not fully align with the unique needs and habits of MSME owners¹¹. Complex systems often become new obstacles for those unfamiliar with technology. Therefore, a more user-focused development approach, namely User-Centered Design (UCD), is needed. This approach, which prioritizes user needs and experience, has been proven effective^{12,13}. Studies show that the UCD approach can increase user satisfaction by up to 35%¹⁴.

The Akane Beauty Studio and Salon was chosen as the implementation partner because it represents a typical service-sector MSME struggling with all the identified core challenges, including manual financial and inventory recording. Its specific operational needs, encompassing both product sales and service management, made it an ideal and representative case study for developing a user-centric solution.

Based on these research findings, there is still a gap in developing a POS system for the service industry that uses a UCD approach to improve user experience and operational efficiency. Thus, this community engagement project aims to address these issues by designing and developing a web-based POS system for an MSME, applying a UCD approach. Through this approach, the system is expected not only to have transaction recording and stock management features but also to be user-friendly and tailored to user needs, thereby improving financial transparency, optimizing stock management, and supporting sustainable business growth.

Method

This community engagement activity was carried out at Akane Beauty Studio and Salon, an MSME located in Medan City, which served as a case study for the implementation. The chosen methodological approach was a combination of User-Centered Design (UCD) and Rapid Application Development (RAD), organized within a project management framework based on the Project Management Institute's Project Management Body of Knowledge (PMBOK) life cycle¹⁵. This method was selected to

¹⁰ Adi Paramita, "Cloud Computing-Based Point-of-Sales Readiness for Surabaya's Small/Medium Enterprises," *International Journal of Advanced Trends in Computer Science and Engineering* 8 (November 2019): 333-38, <https://doi.org/10.30534/ijatcse/2019/5581.52019>.

¹¹ Bo Hu et al., "A Robust Retail POS System Based on Blockchain and Edge Computing," in *Lecture Notes in Computer Science* (Springer Science+Business Media, 2018), 99-110, https://doi.org/10.1007/978-3-319-94340-4_8.

¹² {Citation}

¹³ Buteau, "Roadmap for Digital Technology to Foster India's MSME Ecosystem—Opportunities and Challenges."

¹⁴ Rosita Darianty et al., "Penerapan UCD Dalam Aplikasi Tracking Kalori: OnTrack Solusi Kalori Seimbang," *Buletin Pagelaran Mahasiswa Nasional Bidang Teknologi Informasi Dan Komunikasi* 1, no. 1 (2023): 6-10.

¹⁵ *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Seventh Edition and The Standard for Project Management*, Seventh Edition (Project Management Institute, 2021).

ensure the POS system development process was not only technically effective but also well-managed from start to finish. Details of the executed stages are shown in Figure 1.

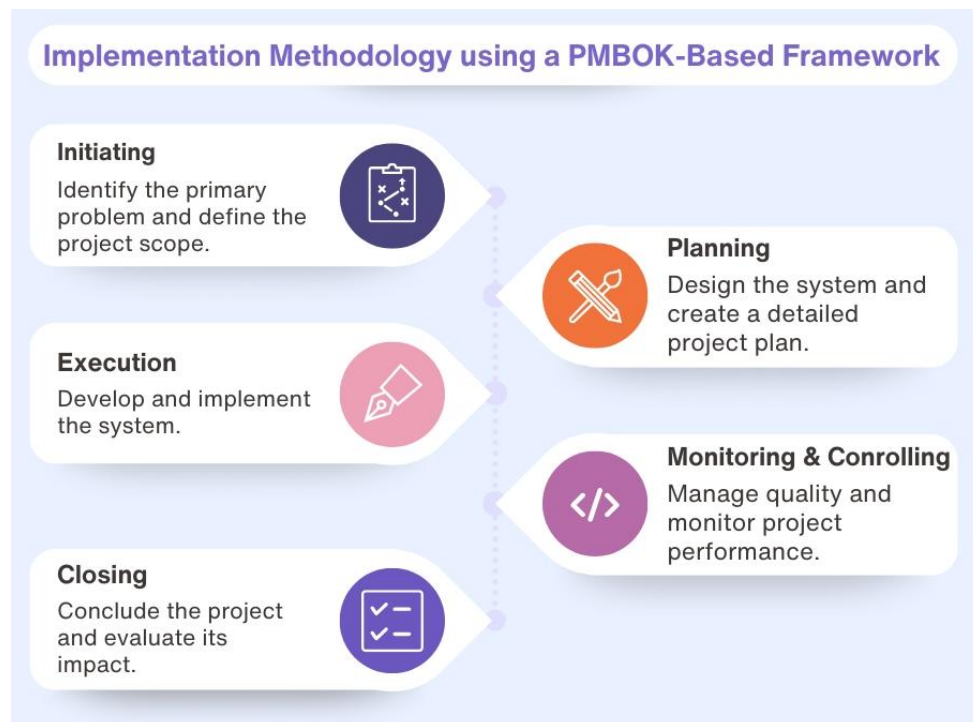


Figure 1. Implementation Methodology using a PMBOK-Based Framework

During the initiation phase, the team identified key problems faced by the MSME, namely inefficiency in manual record-keeping and a lack of integrated data for decision-making. The activity aimed to develop a POS system as a digitalization solution, which would be implemented at the case study partner, Akane Beauty Studio and Salon.

Following this, the planning phase focused on detailed system design and project planning. The team conducted needs identification through interviews and observation with the salon owner and staff to understand their workflow and existing challenges. Based on the collected data, key features were formulated, including sales recording, stock management, and automated reporting. The system development plan was also established, incorporating the selection of UCD and RAD approaches, as well as technologies such as React.js, Laravel, and MySQL.

In the execution phase, all plans were implemented. The team developed the system according to the design. It was built using the Laravel framework for the backend and React.js for the frontend. Once the system was complete, it was directly implemented at Akane Beauty Studio and Salon, followed by intensive training for all staff and the owner.

The monitoring and controlling phase ran in parallel with the execution phase. The team continuously monitored project progress and controlled system quality through a series of tests. White-box testing was performed to verify the functionality and logic of

the code, while User Acceptance Testing (UAT) was conducted directly by the users to measure their satisfaction and ease of use. These tests ensured the system was functioning optimally and met the partner's needs.

In the closing phase, this community engagement activity concluded with a system impact evaluation. A final report was compiled, summarizing the entire process from problem identification to the implementation results. The developed system was formally handed over to Akane Beauty Studio and Salon for full use, with the hope of providing long-term benefits in improving operational efficiency and business growth.

Result

Project Design and Planning

In the initial phase, the team conducted an in-depth problem identification with the community engagement partner, Akane Beauty Studio and Salon, through direct interviews and workflow observation. This process revealed various operational challenges, including the manual recording of sales and stock using notebooks and the Numbers application as the primary system.

To visually understand the inefficiencies of the existing workflow, the team analyzed the business process and translated it into a BPMN (Business Process Model and Notation) diagram. This analysis revealed that the manual recording process necessitated additional time for recapitulation and was susceptible to human error, resulting in data discrepancies between stock and sales and hindering the ability to generate statistical analyses required for informed strategic decision-making. The BPMN Diagram for the partner's daily operational flow before system implementation is shown in Figure 2. The total duration of this process was 4 minutes, not including the service duration.

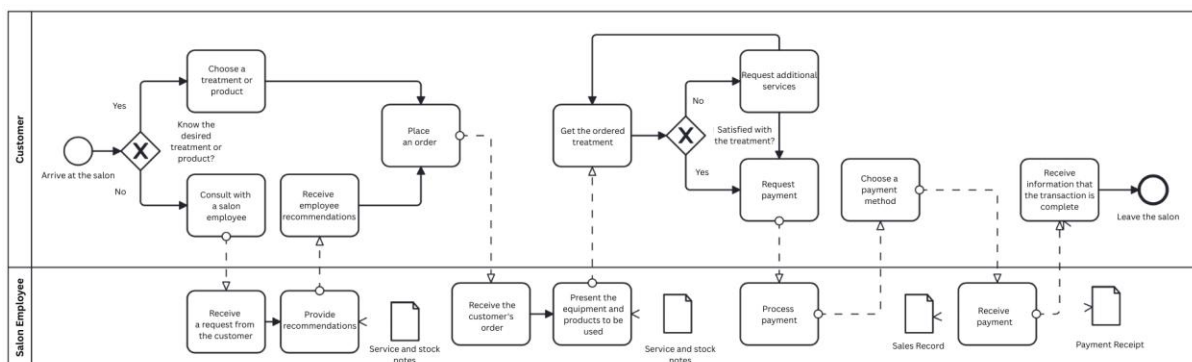


Figure 2. BPMN Diagram – Daily Operational Flow

Based on these identified problems, a solution was formulated: the development and implementation of an integrated Point of Sales (POS) system. This system was designed to automate transaction recording and inventory management, thereby

improving operational efficiency and supporting data-driven decision-making. The result of the redesigned BPMN Diagram after the POS system was implemented shows a more efficient workflow, with the total process duration reduced to 2 minutes, not including service duration (Figure 3).

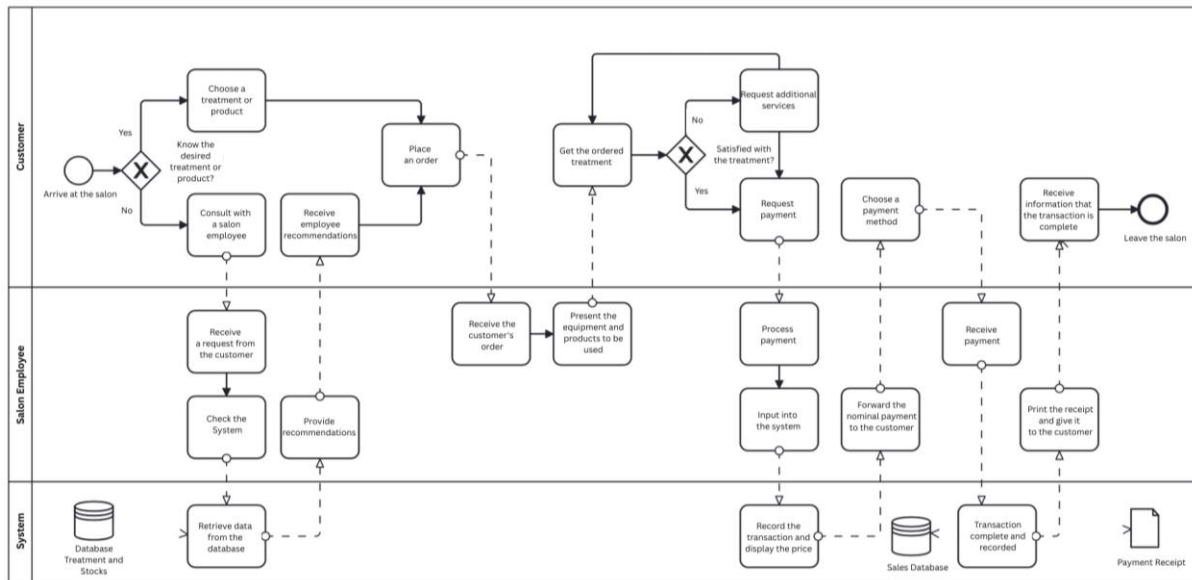


Figure 3. Redesign BPMN Diagram PoS System – Daily Operational Flow

Development and Implementation of Solutions

At this stage, all the plans that have been made were realized through the system development and implementation process. The Point of Sales (POS) system was developed using a Rapid Application Development (RAD) approach for a fast and iterative development cycle, as well as a User-Centered Design (UCD) to ensure an intuitive and functional interface. The team utilized React.js for the user interface (frontend) and Laravel, paired with the PHP programming language, for the backend. The MySQL database was used to efficiently manage operational data, including transaction records, inventory, and customer information.

After the development process was complete, the system was deployed to the server and implemented directly at the partner's location. The system infrastructure design is illustrated in Figure 4, which includes integrated hosting and database services.

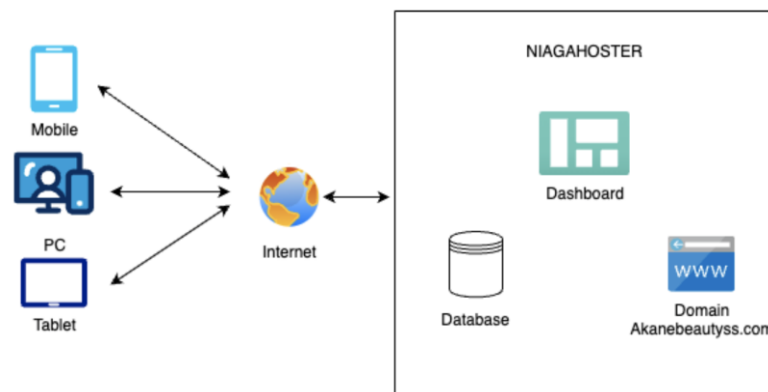


Figure 4. System Infrastructure

The implementation stage was followed by intensive training for the owner and staff of Akane Beauty Studio and Salon. This training was crucial to ensure that users could adapt to the new system and utilize its features optimally. To measure the success of the system, a series of tests was conducted. White-box testing was performed to check the program's logic and internal system functionality. In addition, a User Acceptance Test (UAT) was carried out directly by the end-users to assess the ease of use and the suitability of the system for their daily operational needs, thereby ensuring that the system functions optimally and meets the needs of the partner.

Functional Analysis and User Interface

This section presents the results of the system design, which focuses on functionality and interface design, developed based on an in-depth needs analysis of the partner. The Point of Sales (POS) system was designed to solve various operational problems, such as inaccurate manual recording and difficulty in tracking stock. The system's primary functionalities include recording sales and purchase transactions, managing stock, and providing integrated operational reporting.

The system was developed with a User-Centered Design (UCD) approach, which places the user at the center of the design process. The user interface (UI) design was crafted to be simple and intuitive, without unnecessary complexity. The system's main page, the Dashboard, displays a summary of sales, purchases, and stock data in an easy-to-understand graphical format, providing better business insights for decision-making. Figure 5 shows this intuitive Dashboard interface.

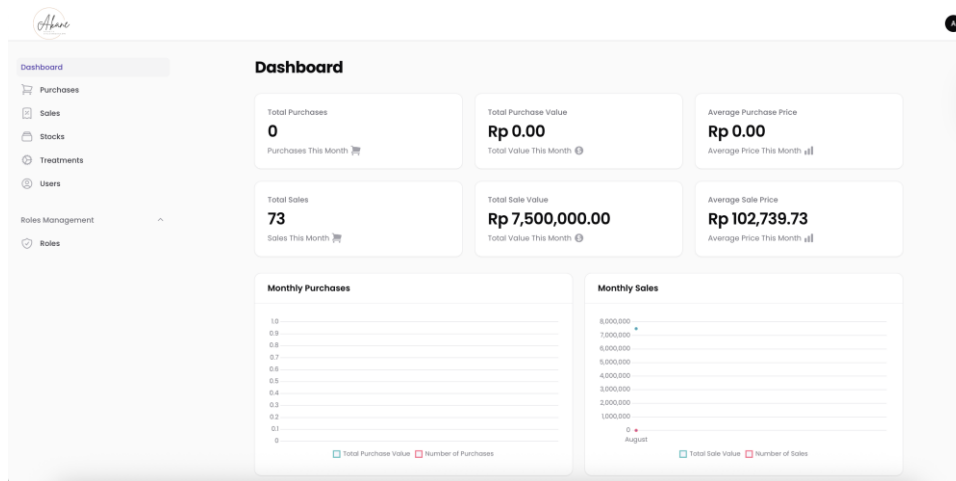


Figure 5. Intuitive Dashboard Interface

Functionally, the system allows users to manage various operational aspects. The organized database structure for managing operational data and the relationships between entities, such as users, sales, stock, purchases, and treatments, is presented in the Entity-Relationship Diagram (ERD) in Figure 6.

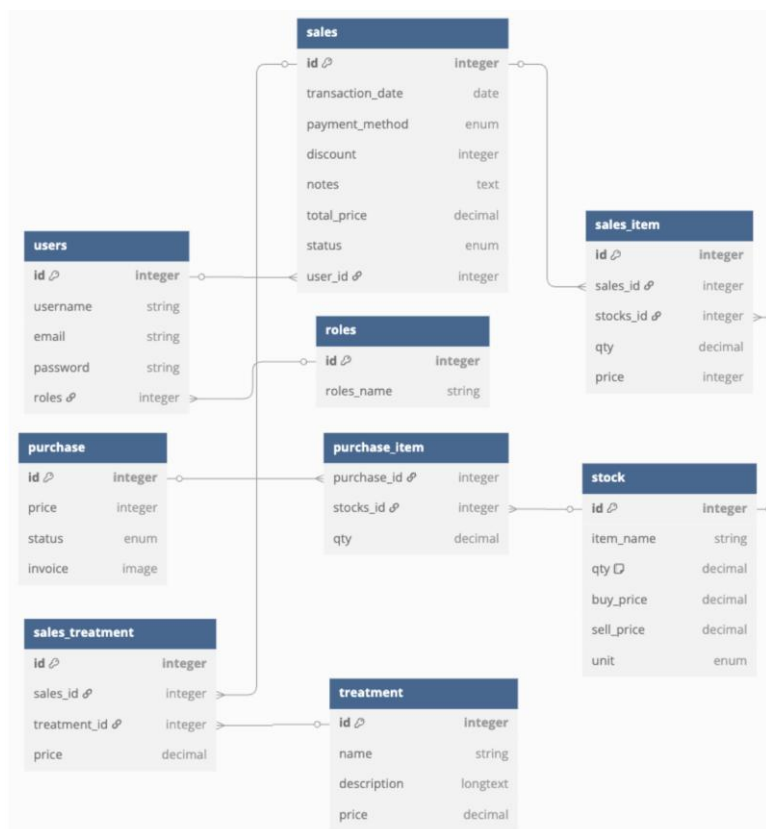


Figure 6. Entity Relationship Diagram

The functional analysis and system workflow, from user interaction to data flow between components, were also formulated through the use of Use Cases, Activity diagrams, and Sequence diagrams. Meanwhile, the user interface for the system's core

features, such as recording sales transactions, is shown in Figure 7. This well-designed interface is a key factor in the system's successful implementation.

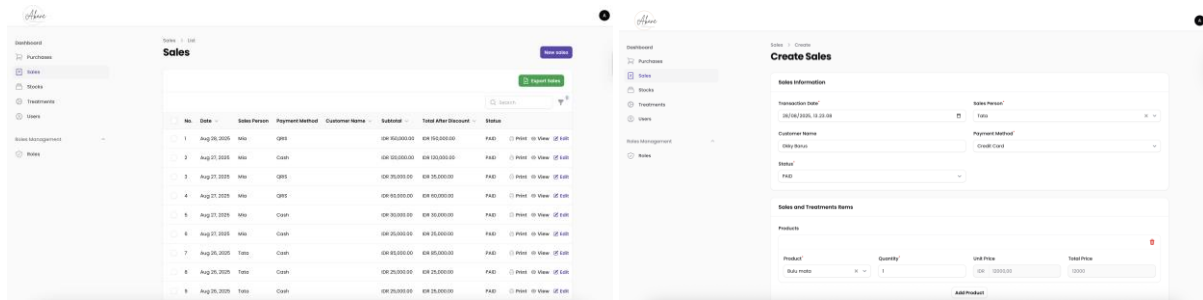


Figure 7. Create Purchases and Sales Pages Interface

Impact and Sustainability Evaluation

To ensure the system functioned optimally and met expectations, two types of tests were conducted. White-box testing was performed to check the program's logic and internal system functionality. Additionally, a User Acceptance Test (UAT) was undertaken directly by the end-users (the owner and staff) to assess the ease of use and the suitability of the system for their daily operational needs. The results of the UAT showed that all system features and functionalities ran well, with no technical issues or bugs found. All respondents (consisting of 1 owner and six staff) gave a positive response with an "Excellent" rating.

The sustainability of the intervention was secured through a structured community mentoring program. Training was conducted over multiple hands-on sessions, employing an active learning model where staff immediately practiced using the application. The mentoring focused on core operational tasks—specifically, real-time sales transaction input, precise stock update procedures, and accessing automated financial reports. This interactive model successfully fostered community participation, particularly in problem-solving dynamics, such as addressing initial resistance to digital input and demonstrating how to generate the first comprehensive financial statements autonomously. Evaluation during these sessions indicated a high knowledge transfer success rate; staff members were able to independently operate the core features within the first two hours of practice. This high adoption rate, which is often a critical challenge for MSMEs adopting new technology, validates the effectiveness of the UCD approach used in the system's design and confirms the successful transfer of digital competency.

A comparison of operational efficiency between the manual process and the POS system showed a significant improvement. This comparison data is presented concisely in Table 1, which illustrates how the new system outperforms in terms of transaction speed, data accuracy, and stock management.

Table 1. Operational Efficiency Comparison Table

Aspect	POS (Point of Sales) System	Manual Recording
Transaction Speed	Fast (< 1 minute)	Slow (>= 1 minute)
Data Accuracy	High accuracy due to minimal human error	Low accuracy and prone to human error
Data Tracking	Real-time, can view automatic graphs and reports	Must manually recap, time-consuming
Stock Management	Automatically decreases during a transaction	Must check stock manually
Data Security	Stored digitally, can be backed up and has role-based access	At risk of being lost/damaged, everyone has access
Reporting Convenience	Automatic, can export to Excel and graphs	Must create reports yourself
Data Access	Can be accessed anytime	Limited

With the POS system, transaction speed, which previously took more than one minute, can now be completed in under one minute. Data recording accuracy also increased due to the minimal human error that often occurred in the manual method. The system also streamlined stock management, which had previously been done manually, by automating the process. Data security is more assured, and report generation is automated, enabling the owner to monitor business performance in real-time.

As proof of this implementation and collaboration, a moment of the system handover and togetherness with the entire team and partners was documented in the following image.



Figure 8. Documentation of the Handover of the POS Information System to Akane Beauty Studio and Salon

Overall, the implementation of the POS system not only improved daily operational efficiency but also provided long-term benefits for Akane Beauty Studio and Salon. With this system, management can monitor sales, purchases, and stock in a more organized and data-accurate manner. A system designed with a user-oriented approach demonstrates that technology can make a significant contribution to enhancing business processes and supporting the sustainable growth of MSMEs. It is hoped that this system can serve as a model for other MSMEs facing similar challenges.

Discussion

Key findings from this project confirm that developing a structured digital solution is an adequate response to the challenges of MSME digitalization. The integration of a User-Centered Design (UCD) approach and the structured project management methodology of PMBOK proved crucial to the project's success. Using PMBOK ensured project governance from initiation to closure, a vital factor for successful information system implementation, particularly in resource-constrained MSME environments¹⁶. Meanwhile, UCD mitigated the risk of technology rejection by designing the system to be easily adopted and aligned with the end-users' operational habits¹⁷.

The developed system not only solved the problem of inefficiency in manual recording but also provided measurable positive impacts. The increased transaction speed and the reduction in daily workflow duration (from 4 minutes to 2 minutes) are a direct result of process automation and the elimination of redundant manual steps, such as daily data recapitulation. This time efficiency directly improves service throughput, which is consistent with prior research on the benefits of POS systems in the retail and service sectors¹⁸.

The most significant aspect is how the system empowers business owners by providing accurate and real-time operational data, a capability previously unavailable.

¹⁶ Maricielo Hinojosa et al., "Application of PMBOK to Improve the Deadline of Projects in SMEs Engineering Consultancies," in *Smart Innovation, Systems and Technologies* (Springer Nature, 2019), 487–94, https://doi.org/10.1007/978-3-030-16053-1_47; Maria Clara Egie, "Project Management Maturity Level and PMBOK 7th Recommendations: Case Study of an IT Service Provider Company," *Indonesian Journal of Computer Science* 13, no. 4 (August 2024), <https://doi.org/10.33022/ijcs.v13i4.4290>.

¹⁷ Fachri Munandar and Harry Budi Santoso, "User Interface Improvement by Evaluating Usability and User Experience: Case Study of Indonesia's Government Financial Management Information System," *Indonesian Journal of Computer Science* 14, no. 1 (February 2025), <https://doi.org/10.33022/ijcs.v14i1.4630>; Widyasari Puspa Permata Witra et al., "RAD-UCD Implementation in Project Management Information System," *Journal of Development Research* 8, no. 2 (November 2024), <https://doi.org/10.28926/jdr.v8i2.398>.

¹⁸ Enrica Ryan Geminarqi and Hery Purnomo, "Improving Operational Management Efficiency in the Food and Beverage Industry: A Systematic Literature Review," *Open Access Indonesia Journal of Social Sciences* 6, no. 5 (July 2023): 1143–49, <https://doi.org/10.37275/oaijss.v6i5.184>; Dhruv Grewal et al., "Leveraging In-Store Technology and AI: Increasing Customer and Employee Efficiency and Enhancing Their Experiences," *Journal of Retailing* 99, no. 4 (2023): 487–504, <https://doi.org/10.1016/j.jretai.2023.10.002>.

This finding aligns with organizational theory, which posits that access to timely and relevant information significantly improves organizational agility and decision-making quality¹⁹. The ability to separate personal and business finances and obtain integrated stock and sales reports demonstrates that digital investment can make a substantial contribution to financial transparency and business sustainability for MSMEs²⁰. Furthermore, this finding aligns with literature stating that digitizing inventory management can reduce losses by up to 30%, thereby enhancing profitability²¹.

This project confirms the importance of community engagement oriented toward real needs and the implementation of measurable solutions. The results of this case study show that social change can occur through the adoption of appropriately designed technology²². The high user satisfaction score (UAT) and the subsequent high adoption rate observed during mentoring indicate that the system aligns strongly with the criteria of the Technology Acceptance Model (TAM), suggesting high intention to use among the staff²³. By improving MSME productivity and supporting digital innovation, this activity directly contributes to achieving the Sustainable Development Goals (SDGs), specifically SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure). The potential for replication serves as a reference model for other institutions aiming to support MSMEs in navigating the challenges of the digital era.

Conclusion

Overall, this community engagement project, which focused on developing and implementing a Point of Sale (POS) system at Akane Beauty Studio and Salon, successfully achieved its goals. The system, designed with a User-Centered Design (UCD) and Rapid Application Development (RAD) approach, proved capable of solving the operational problems faced by the partner.

The implementation of this system significantly improved operational efficiency and business process effectiveness. Transaction speed increased drastically, from over

¹⁹ Shadi AboAbdo, Abdulaziz Aldhoiena, and Hashbol Al-Amrib, "Implementing Enterprise Resource Planning ERP System in a Large Construction Company in KSA," *Procedia Computer Science* 164 (January 2019): 463–70, <https://doi.org/10.1016/j.procs.2019.12.207>.

²⁰ Iman Supriadi, Rahma Ulfa Maghfiroh, and Rukhul Abadi, "Transforming MSMEs through Innovation and Technology: Driving Growth and Sustainability in the Digital Age," in *Advances in Economics, Business and Management Research/Advances in Economics, Business and Management Research* (Atlantis Press, 2023), 241–51, https://doi.org/10.2991/978-94-6463-302-3_28.

²¹ Supriadi, Maghfiroh, and Abadi, "Transforming MSMEs through Innovation and Technology: Driving Growth and Sustainability in the Digital Age."

²² Manasi Patil et al., "Assessing a Digital Technology-Supported Community Child Health Programme in India Using the Social Return on Investment Framework," *PLOS Digital Health* 2, no. 11 (November 2023), <https://doi.org/10.1371/journal.pdig.0000363>.

²³ María García de Blanes Sebastián et al., "UTAUT-2 Predictors and Satisfaction: Implications for Mobile-Learning Adoption among University Students," *Education and Information Technologies*, ahead of print, Springer Science+Business Media, August 2024, <https://doi.org/10.1007/s10639-024-12927-1>.

one minute to under one minute. Furthermore, the system was able to automatically integrate sales, purchase, and stock reports, thus minimizing manual recording errors. The high level of user satisfaction indicates that the system is easy to adapt to and well-received, demonstrating that a user-centered approach can yield effective and beneficial technology solutions for MSMEs.

Based on the results of the implementation and evaluation, several suggestions are proposed for future system development to provide greater benefits for Akane Beauty Studio and Salon. Given the importance of efficient communication with customers, it is recommended to develop a WhatsApp bot that can automatically handle orders and bookings, thereby reducing the administrative burden on staff. Additionally, to help management understand customer preferences, the system needs to be equipped with an analysis feature that can identify the most popular types of services. Lastly, to maintain product stock availability and prevent running out of essential items, it is recommended to add an automated notification or reminder feature. This feature would alert staff when a product's stock reaches a minimum level, allowing for timely procurement and uninterrupted salon operations.

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