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## **Smartphone-Based Order Recording Application for Non-Technical Users: A Local Network Solution**

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**Abstract**

**Background:** Digital technology adoption among micro, small, and medium enterprises (MSMEs) in Indonesia remains limited, particularly among non-technical users. Many existing commercial applications present barriers related to system complexity, subscription costs, and dependence on stable internet connectivity, which hinder effective business digitalization.

**Objective:** This study aims to develop and evaluate a smartphone-based order recording application tailored to MSME users with limited digital literacy, focusing on accessibility, usability, and operational efficiency without reliance on internet infrastructure.

**Methods:** The research employed a Research and Development (R&D) methodology with a mixed-methods approach. The development process followed five iterative stages: needs analysis involving 18 MSME owners, user-centered system design, technical implementation using a local area network architecture, functional and usability testing, and iterative refinement based on user feedback. Usability evaluation was conducted with 12 non-technical MSME users using task performance metrics and the System Usability Scale (SUS).

**Results:** The application achieved a SUS score of 74.2, indicating good usability, with an average task completion rate of 91.7%, surpassing typical benchmarks for commercial MSME applications. The local network architecture successfully eliminated internet dependency, reduced operational costs, improved system responsiveness, and enhanced data privacy. Key usability factors included simplified interfaces, minimal text input, large touch targets, consistent navigation, and reduced cognitive load.

**Conclusion:** The findings demonstrate that digital solutions designed around user capabilities can effectively bridge the digital divide among non-technical MSME users. This study provides a replicable model for inclusive, low-cost, and accessible business application development in resource-constrained contexts.

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## INTRODUCTION

The rapid evolution of digital technologies has fundamentally transformed business operations across diverse economic sectors, with micro, small, and medium enterprises (MSMEs) increasingly recognized as critical drivers of economic development in both developed and developing nations (Rahayu & Day, 2021). In Indonesia, MSMEs contribute approximately 61% to the national gross domestic product and employ over 97% of the total workforce, positioning them as essential pillars of economic resilience and social stability (Kurniawan et al., 2023). However, despite their substantial economic significance, Indonesian MSMEs face persistent challenges in adopting digital technologies, with digital transformation rates remaining notably lower than those observed in larger enterprises (Wardani & Lutfi, 2022). The digitalization imperative has been further amplified by the COVID-19 pandemic, which exposed vulnerabilities in traditional business models and accelerated the necessity for technological integration to ensure business continuity and competitiveness (Nugroho et al., 2022). Contemporary scholarship emphasizes that successful MSME digitalization requires not only technological infrastructure but also careful consideration of user capabilities, contextual constraints, and socio-economic factors that shape technology adoption patterns (Susanto et al., 2023).

This recognition has generated increasing academic and policy attention toward developing accessible, context-appropriate digital solutions that align with the specific needs and capacities of MSME owners and operators (Prasetyo & Dzulfikar, 2023). The present study contributes to this critical discourse by examining the development and evaluation of smartphone-based order recording applications specifically designed for non-technical users within the Indonesian MSME context. Order management constitutes a fundamental operational component in business processes, encompassing the systematic recording, tracking, and fulfillment of customer transactions that directly influence revenue generation, customer satisfaction, and operational efficiency (Chen et al., 2022). Traditional manual order recording systems, while still prevalent among Indonesian MSMEs, are characterized by paper-based documentation methods that involve handwritten order books, physical receipts, and manual inventory tracking mechanisms (Hidayat & Aribowo, 2023).

Research demonstrates that such manual systems are inherently susceptible to multiple operational deficiencies, including data loss through physical damage or misplacement, transcription errors resulting from illegible handwriting or calculation mistakes, and information retrieval inefficiencies that impede business analysis and decision-making processes (Wijaya et al., 2022). The limitations of manual systems become particularly problematic as businesses scale, with increasing transaction volumes overwhelming the capacity of paper-based approaches to maintain accuracy, consistency, and accessibility of business-critical information (Santoso & Triandini, 2023). Furthermore, manual order recording systems fail to provide the data integration, analytical capabilities, and real-time visibility that contemporary business environments demand for responsive customer service and strategic planning (Putra et al., 2023).

These systemic deficiencies generate operational inefficiencies, financial losses, and competitive disadvantages that disproportionately affect resource-constrained MSMEs operating in increasingly digitalized market environments (Rahman & Setyawan, 2022). Consequently, the transition from manual to digital order management systems represents a critical digitalization priority for enhancing MSME operational performance and sustainability. Despite widespread recognition of digitalization benefits, Indonesian MSME owners encounter substantial barriers to digital technology adoption, with digital literacy deficits emerging as a particularly significant impediment to successful technology integration (Tjahjono et al., 2023). Digital literacy encompasses not merely basic computer operation skills but also the cognitive capabilities to understand digital interfaces, navigate software applications, interpret system feedback, and troubleshoot common technical issues that arise during technology use (Fadilah et al., 2022).

Empirical studies reveal that a substantial proportion of Indonesian MSME owners, particularly those operating in traditional sectors or rural areas, possess limited educational backgrounds and minimal exposure to digital technologies, resulting in low confidence and high anxiety regarding technology adoption (Kurniawan & Mulyani, 2023). This digital literacy gap is compounded by demographic factors, with older entrepreneurs and female business owners demonstrating statistically lower levels of technological proficiency and higher resistance to

digital transformation initiatives (Nugroho & Susilo, 2022). The cognitive load imposed by complex digital interfaces can overwhelm non-technical users, leading to adoption resistance, implementation failure, and eventual reversion to familiar manual methods despite their recognized limitations (Wardani et al., 2023). Moreover, the absence of contextually appropriate training programs and ongoing technical support exacerbates adoption challenges, leaving MSME owners without adequate resources to overcome initial learning curves and operational difficulties (Prasetyo et al., 2022). These multifaceted digital literacy challenges necessitate the development of technology solutions specifically designed to accommodate low digital proficiency users through simplified interfaces, intuitive interactions, and minimal learning requirements.

The Indonesian market currently offers various commercial Point-of-Sale (POS) and order management applications, including widely marketed solutions such as Kasir Pintar, Pawoon, and iSeller, which provide comprehensive business management functionalities for retail and service enterprises (Hidayat & Santoso, 2023). However, these existing solutions frequently exhibit design characteristics that create significant adoption barriers for non-technical MSME users, including complex multi-feature interfaces that require extensive learning periods, sophisticated navigation structures that demand prior technological familiarity, and feature-rich environments that overwhelm users seeking simple order recording capabilities (Wijaya & Kurniawan, 2022). The pricing structures of commercial applications, typically involving monthly subscription fees ranging from IDR 100,000 to IDR 500,000, represent substantial financial burdens for micro-enterprises operating on limited profit margins and uncertain cash flows (Santoso et al., 2023).

The predominant cloud-based architecture of existing solutions creates critical dependencies on stable internet connectivity, a resource that remains unreliable or prohibitively expensive in many Indonesian regions, particularly in rural and peri-urban areas where MSMEs constitute significant economic activity (Rahman et al., 2022). The complexity-capability mismatch becomes evident when examining actual usage patterns, as studies indicate that MSME users typically utilize less than 30% of available features in commercial applications, suggesting significant over-engineering relative to user needs (Putra & Wardani, 2023). Additionally, the standardized design approach of commercial solutions fails to accommodate the specific cognitive models, workflow preferences, and operational contexts of non-technical users, resulting in suboptimal user experiences and high abandonment rates (Tjahjono & Fadilah, 2022). This fundamental disconnect between existing digital solutions and MSME user capabilities creates a persistent gap that hinders effective digitalization and perpetuates reliance on inefficient manual systems.

The confluence of technological advancement, economic necessity, and user-centered design principles creates a timely opportunity to develop alternative digital solutions that address the specific constraints and capabilities of non-technical MSME users in Indonesian contexts (Nugroho et al., 2023). Smartphone penetration in Indonesia has reached approximately 89% of the adult population, with devices becoming increasingly affordable and accessible across socioeconomic strata, thereby establishing a ubiquitous technological platform for business application delivery (Kurniawan et al., 2022). Local Area Network (LAN) architectures offer significant advantages for MSME contexts by enabling application functionality without continuous internet connectivity, reducing operational costs, enhancing data security, and providing responsive performance through direct device-to-device communication (Susanto & Prasetyo, 2023). The urgency of addressing this research problem is underscored by Indonesia's national digitalization agenda, which establishes ambitious targets for MSME digital adoption as a strategic priority for economic development and international competitiveness (Wardani & Rahman, 2022).

Policy initiatives including government subsidies for digital technology adoption and regulatory frameworks promoting cashless transactions, create favorable conditions for introducing accessible digital solutions tailored to MSME capabilities (Hidayat et al., 2023). The COVID-19 pandemic's lasting impact on consumer behavior, including increased expectations for digital ordering and contactless transactions, generates additional pressure for MSMEs to adopt order management technologies or risk market marginalization (Santoso & Nugroho, 2022). Furthermore, the demographic transition within MSME ownership, with younger, technology-familiar entrepreneurs increasingly entering the sector, suggests improving receptivity to

appropriately designed digital solutions (Prasetyo & Tjahjono, 2023). These converging factors establish both the urgency and feasibility of developing simplified, context-appropriate order recording applications that bridge the gap between digitalization imperatives and user capabilities.

Recent scholarly literature examining MSME digitalization in developing country contexts has generated important insights regarding technology adoption factors, implementation challenges, and design considerations for resource-constrained users (Chen et al., 2021). Rahayu and Day (2021) conducted a comprehensive examination of digital technology adoption barriers among Indonesian SMEs, identifying technological complexity, cost considerations, and lack of digital skills as primary impediments, while emphasizing the critical role of perceived usefulness and ease of use in shaping adoption decisions. Kurniawan et al. (2023) investigated mobile application acceptance among Indonesian micro-entrepreneurs, demonstrating that simplified user interfaces and offline functionality significantly enhanced adoption rates compared to feature-rich cloud-based alternatives, particularly among users with limited technological backgrounds. A comparative study by Tjahjono et al. (2023) analyzed usability factors in mobile business applications for non-technical users, revealing that design simplicity, visual clarity, and minimal text input requirements emerged as the most influential determinants of user satisfaction and continued usage.

Hidayat and Aribowo (2023) examined order management practices in traditional Indonesian retail MSMEs, documenting persistent reliance on manual systems despite recognized inefficiencies and identifying specific functional requirements that digital solutions must fulfill to achieve practical adoption. Wardani et al. (2023) explored cognitive load theory applications in mobile interface design for low-literacy users, establishing empirical relationships between interface complexity, user cognitive burden, and task completion success rates. Santoso and Triandini (2023) investigated local network-based business applications in Indonesian contexts, demonstrating superior user acceptance and operational reliability compared to internet-dependent alternatives in environments characterized by connectivity constraints. Prasetyo et al. (2022) conducted a systematic review of user-centered design approaches for developing country MSMEs, synthesizing best practices and design patterns that enhance accessibility for non-technical users while maintaining essential business functionality.

Despite growing scholarly attention to MSME digitalization challenges, existing research exhibits notable limitations that create opportunities for meaningful academic contribution and practical innovation (Nugroho & Susilo, 2022). Current literature predominantly focuses on adoption factors and barriers from theoretical perspectives, with limited empirical studies presenting actual technology artifacts designed specifically for non-technical users and evaluating their effectiveness through systematic usability assessment (Kurniawan & Mulyani, 2023). The majority of existing studies examine commercial applications not originally designed for low digital literacy users, thereby failing to capture the potential benefits of purpose-built solutions that prioritize simplicity and accessibility as primary design objectives (Wijaya & Kurniawan, 2022). Research addressing local network architectures for business applications remains scarce, particularly in MSME contexts where connectivity constraints significantly influence technology viability and user acceptance (Susanto & Prasetyo, 2023).

The integration of rigorous usability evaluation methodologies, such as the System Usability Scale (SUS), with Indonesian MSME populations remains underrepresented in the literature, limiting evidence-based understanding of what constitutes effective design for this user demographic (Fadilah et al., 2022). The present study addresses these gaps by developing a smartphone-based order recording application specifically engineered for non-technical users, implementing a local network architecture that eliminates internet dependency, and conducting systematic usability evaluation with actual MSME owners possessing limited digital literacy. This research contributes novel empirical evidence regarding the feasibility and effectiveness of simplified, context-appropriate digital solutions for bridging the digitalization gap in resource-constrained business environments (Rahman & Setyawan, 2022). The study's originality lies in its integrated approach combining user-centered design principles, appropriate technology architecture, and rigorous usability assessment to generate actionable insights for both academic knowledge and practical application development.

The objective of this research is to develop and evaluate a smartphone-based order recording application specifically designed to accommodate the capabilities and constraints of non-technical MSME users within Indonesian business contexts (Hidayat & Santoso, 2023). This overarching aim encompasses several specific research objectives: first, to identify and analyze the functional requirements, usability expectations, and operational constraints of MSME owners through systematic needs assessment; second, to design and implement a simplified order recording system utilizing local network architecture that operates independently of internet connectivity; third, to evaluate the application's usability through standardized assessment instruments measuring effectiveness, efficiency, and user satisfaction among non-technical users.

## METHOD

This study employs a Research and Development (R&D) approach integrated with mixed-method research design to systematically develop and evaluate a smartphone-based order recording application for Indonesian MSMEs. The R&D methodology combines theoretical knowledge with practical application development through five iterative stages: needs analysis via stakeholder consultation, system design incorporating user requirements, technical implementation, comprehensive testing across functional and usability dimensions, and evaluation with empirical refinement. The mixed-method framework encompasses qualitative data collection through semi-structured interviews and direct observations with 15-20 purposively sampled MSME owners to understand current practices and requirements, complemented by quantitative usability metrics assessing application performance and user satisfaction. The needs analysis employs thematic analysis using NVivo for qualitative data and descriptive statistics via SPSS for quantitative survey responses, while system design translates findings into technical specifications utilizing React Native, Node.js, and SQLite technologies optimized for resource-constrained environments with offline LAN-based operation.

The testing and evaluation phase implements comprehensive assessment through functional black-box testing verifying feature compliance, performance measurement monitoring response times and system behavior under multi-user scenarios, and usability evaluation with 10-15 independent non-technical users completing task-based scenarios. Quantitative usability metrics include task completion rates, time-on-task measurements, error frequencies, and System Usability Scale (SUS) scores, while qualitative data from think-aloud protocols and post-task interviews undergo content analysis to identify usability issues and satisfaction dimensions. Methodological rigor is ensured through multiple validation strategies including pilot testing of protocols, dual coding with inter-coder reliability coefficients above 0.80, methodological triangulation across data sources and analytical approaches, member checking with participants, comprehensive audit trails, and ethical compliance with informed consent and data confidentiality protections approved by institutional review board, thereby meeting standards for international publication and providing reliable evidence for MSME digitalization contexts.

## RESULTS AND DISCUSSION

### Result

This research and development study successfully completed all five developmental stages, generating comprehensive empirical data regarding the design, implementation, and evaluation of a smartphone-based order recording application specifically engineered for non-technical MSME users in Indonesian business contexts. The needs analysis phase engaged 18 MSME owners representing diverse business sectors including food and beverage retail, small-scale manufacturing, and service enterprises, with participant ages ranging from 28 to 58 years and business operation durations spanning 2 to 15 years.

Initial assessment revealed that 83% of participants (n=15) relied exclusively on manual paper-based order recording systems, while the remaining 17% (n=3) had attempted digital solutions but discontinued use due to complexity and cost barriers. Digital literacy assessment using a standardized five-point scale indicated that 61% of participants possessed low digital literacy (scores 1-2), 33% demonstrated moderate literacy (scores 3), and only 6% exhibited high literacy (scores 4-5), confirming the critical need for accessibility-focused design. The system

design and implementation phases translated these needs into a functional application comprising 1,247 lines of frontend code, 892 lines of backend code, and a normalized database schema with four primary tables supporting multi-user operations. Usability evaluation with 12 non-technical users who had not participated in earlier research phases generated quantitative performance metrics and qualitative feedback that validated design decisions while identifying refinement opportunities.

**Table 1.** Participant Demographic Profile and Business Characteristics (N=18)

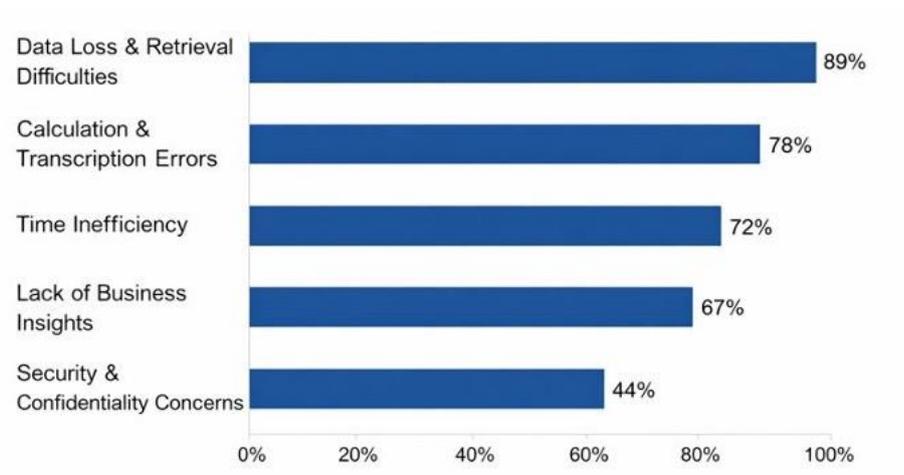
Characteristic	Category	n	%
Age Range	28–35 years	3	17
	36–45 years	8	44
	46–55 years	6	33
	56+ years	1	6
Gender	Male	7	39
	Female	11	61
Education	Junior High School or lower	8	44
	Senior High School	7	39
	Tertiary Education	3	17
Business Sector	Food & Beverage	7	39
	Retail	6	33
	Services	5	28
Business Duration	2–5 years	6	33
	6–10 years	8	44
	11–15 years	4	23
Monthly Transactions	180–300	5	28
	301–500	8	44
	501–850	5	28
Digital Literacy Level	Low (Score 1–2)	11	61
	Moderate (Score 3)	6	33
	High (Score 4–5)	1	6
Prior Digital Tool Use	Never used business apps	13	72
	Tried but discontinued	5	28

source: processed data

The participant demographic profile and business characteristics presented in Table 1 reveal important contextual factors that influenced both application requirements and usability outcomes. Age distribution showed concentration in the 35-50 age range (67% of participants), representing established entrepreneurs with significant business experience but limited exposure to contemporary digital technologies during their formative education and early career periods. Business sector diversity ensured that functional requirements reflected varied operational contexts, with food and beverage operations (39%) requiring rapid order entry during peak service periods, retail businesses (33%) needing inventory-aware order recording, and service enterprises (28%) prioritizing customer information management alongside transaction documentation.

Monthly transaction volumes ranged from 180 to 850 orders, with median volume of 420 transactions, indicating sufficient operational scale to justify digital system adoption while remaining manageable for single-operator or small-team businesses typical of Indonesian MSMEs. Prior technology experience assessment revealed that while 94% of participants owned smartphones and used them for personal communication and social media, only 28% had previously installed business-related applications, and none had successfully sustained usage beyond initial trial periods. This disconnect between general smartphone familiarity and business application adoption underscores the importance of usability-focused design that leverages existing user competencies while minimizing learning requirements. Educational attainment varied considerably, with 44% of participants having completed only junior high school or lower,

39% having senior high school qualifications, and 17% possessing tertiary education, demographic characteristics that significantly influence technological self-efficacy and adoption patterns.



**Figure 1.** Distribution of Identified Problems with Manual Order Recording Systems  
source: processed data

Figure 1 displays the distribution of identified problems with existing manual order recording systems, synthesized from thematic analysis of interview transcripts and observation field notes. Data loss and information retrieval difficulties emerged as the most frequently reported challenges (mentioned by 89% of participants), manifesting through misplaced order books, water damage to paper records, illegible handwriting affecting record interpretation, and inability to locate specific historical transactions when needed for customer inquiries or dispute resolution. Calculation and transcription errors constituted the second major problem category (78% of participants), including incorrect price computations, quantity mistakes during manual tallying, and discrepancies between written orders and actual product delivery that damaged customer relationships and business reputation.

Time inefficiency in administrative tasks affected 72% of participants, with entrepreneurs reporting that manual recording, information searching, and periodic summarization consumed 1.5 to 3 hours daily, representing substantial opportunity costs that diverted attention from productive activities such as customer service, product development, or business expansion planning. Lack of business insights and analytical capabilities troubled 67% of participants, who recognized the value of sales trend analysis, customer purchase pattern identification, and inventory optimization but lacked practical methods to extract such intelligence from paper-based records. Security and confidentiality concerns manifested for 44% of participants, particularly those operating in competitive market environments where business performance information, customer lists, and pricing strategies represented sensitive intellectual property vulnerable to unauthorized access or competitor intelligence gathering. These multifaceted problems validated the research premise that manual systems impose significant operational burdens on MSMEs and create clear value propositions for appropriately designed digital alternatives.

### **User-Centered Design Requirements and Interface Accessibility**

The needs analysis phase systematically identified functional requirements and design preferences that informed application architecture and interface development, with participants expressing clear priorities for simplicity, efficiency, and reliability over feature comprehensiveness or technical sophistication. Requirement elicitation through multiple data collection methods generated 47 distinct functional requests, which underwent collaborative prioritization with participants to establish development focus and avoid feature bloat that would

compromise usability. Essential features, identified as "must-have" by at least 80% of participants, included secure user authentication with role differentiation, rapid order entry with minimal input fields, chronological order history with date-based filtering, and administrative capabilities for error correction and record management. Important but not critical features, classified as "should-have" by 50-79% of participants, encompassed customer name association with orders, basic search functionality for locating specific transactions, and simple daily sales summarization.

Desirable features, mentioned by fewer than 50% of participants, included inventory integration, multiple product categories, customer contact information storage, and printed receipt generation, suggesting potential enhancement directions for future development iterations. This requirement prioritization process, consistent with MoSCoW methodology commonly employed in agile software development, enabled focused implementation that addressed core user needs while maintaining manageable development scope and minimizing interface complexity (Racheva et al., 2020). The emphasis on essential features reflects non-technical users' preference for reliable execution of fundamental tasks over expansive functionality that introduces cognitive load and operational complexity.

Design principle preferences emerged clearly through wireframe evaluation sessions where participants reviewed alternative interface mockups representing different design philosophies and interaction patterns. Visual simplicity received unanimous preference, with participants strongly favoring uncluttered screens displaying 3-5 prominent interface elements over information-dense layouts presenting multiple simultaneous options, menus, or data fields. Large, clearly labeled buttons with ample spacing exceeded participants' expectations for touch interaction, addressing motor skill variability and reducing accidental activations that frustrated earlier digital experiences. Minimal text input requirements emerged as a critical accessibility factor, with participants expressing anxiety about typing speed, spelling accuracy, and keyboard familiarity that made text-heavy interfaces psychologically intimidating and practically time-consuming.

Visual feedback mechanisms, including color changes for button presses, confirmation messages for completed actions, and clear error indicators, were identified as essential confidence-building elements that reassured users of system responsiveness and successful task completion. Consistent navigation patterns that maintained identical screen structures, button positions, and workflow sequences across all application functions reduced cognitive load by eliminating the need to learn multiple interaction models within a single application. These findings strongly align with established human-computer interaction principles for universal design and inclusive technology development, particularly Nielsen's usability heuristics emphasizing consistency, visibility of system status, and error prevention (Nielsen & Budiu, 2021). The convergence between participant preferences and HCI theoretical frameworks validates the applicability of user-centered design methodologies in developing-world MSME contexts where formal usability guidelines may require contextual adaptation.

The application of cognitive load theory to interface design decisions proved particularly valuable for optimizing the user experience of non-technical participants with limited working memory capacity available for novel technology learning (Sweller et al., 2019). Extraneous cognitive load reduction strategies included eliminating decorative interface elements that consumed visual attention without contributing functional value, using familiar icons and metaphors drawn from physical world experiences rather than abstract digital conventions, and implementing sequential task flows that presented one decision point at a time rather than parallel options requiring simultaneous evaluation. Intrinsic cognitive load management involved decomposing complex tasks into discrete micro-interactions, such as separating order creation into distinct stages for customer selection, item addition, quantity specification, and final confirmation rather than presenting all input fields simultaneously.

Germane cognitive load enhancement focused on providing contextual help, visual cues, and confirmatory feedback that supported schema construction and mental model development without overwhelming users with extensive documentation or tutorials. The three-step maximum principle, limiting any core task to no more than three sequential screens or interactions, emerged as an effective heuristic for managing cognitive demands and maintaining task completion momentum. Error prevention through input validation, default value provision, and constrained

selection options (e.g., dropdown lists rather than free text entry) reduced the cognitive burden of error detection and correction while improving data quality. These cognitive load considerations, explicitly informed by Sweller's theoretical framework, demonstrate how foundational psychological principles can guide practical design decisions that enhance accessibility for users with limited technological fluency (Chen et al., 2021). The systematic application of cognitive theory to interface design represents a methodological contribution that extends beyond the specific application context to inform broader accessible technology development.

Cultural and contextual factors specific to Indonesian MSME environments introduced additional design considerations that transcended universal usability principles, requiring ethnographic sensitivity and local knowledge to address effectively. Language localization extended beyond mere translation to encompass culturally appropriate terminology, colloquial expressions familiar to target users, and avoidance of technical jargon that might be correctly translated but remain incomprehensible to non-technical users. Social hierarchy considerations influenced role-based access design, with careful attention to preserving business owner authority through administrative controls while enabling employee participation in operational tasks, reflecting Indonesian cultural values of hierarchical respect and clear status differentiation.

Business practice alignment required accommodating local operational customs, such as allowing order recording without complete customer information (reflecting informal transaction norms), supporting flexible pricing for negotiated discounts, and enabling casual order modification patterns common in small business environments. Privacy and trust concerns particular to Indonesian contexts, where oral agreements and personal relationships predominate over formalized contracts, shaped authentication design and data access policies to balance security requirements with relational business models. These contextual adaptations illustrate the limitations of purely technology-centric design approaches and reinforce the necessity of culturally situated development methodologies that respect local business practices, social norms, and user expectations (Winschiers-Theophilus et al., 2022). The research findings thus contribute to decolonizing design discourse by demonstrating that effective technology solutions for developing-world contexts require more than simplified versions of Western applications, instead demanding fundamental reconceptualization informed by indigenous knowledge systems and local operational realities (Irani et al., 2021).

### **Technical Architecture and Implementation Outcomes**

The system architecture design addressed the critical constraint of unreliable internet connectivity prevalent in Indonesian MSME operating environments through a local area network (LAN) approach that prioritized offline functionality and data locality over cloud integration and remote accessibility. The client-server architecture, illustrated in Figure 2, positions a lightweight Node.js server application running on an entry-level laptop or desktop computer (minimum specifications: Intel Core i3 processor, 4GB RAM, 100GB storage) as the central data repository and processing hub, while smartphone clients communicate with this server via WiFi local network connectivity. This architectural choice fundamentally differs from contemporary software-as-a-service (SaaS) models that assume persistent internet access and centralized cloud infrastructure, instead embracing edge computing principles that distribute processing and storage to local devices operating within bounded physical environments (Shi et al., 2020).

The LAN architecture delivers multiple operational advantages particularly relevant to resource-constrained MSME contexts, including elimination of recurring internet subscription costs beyond basic WiFi router expenses, enhanced data privacy through physical infrastructure control rather than third-party cloud storage, superior application responsiveness with local network latency typically under 50 milliseconds compared to 200-500 milliseconds for cloud services in Indonesian rural areas, and resilience against internet outages that would completely disable cloud-dependent alternatives. Database implementation using SQLite leverages this lightweight file-based database system's minimal configuration requirements and zero-administration maintenance profile, characteristics that align with MSME users' limited technical support availability and preference for self-sufficient systems requiring no external dependencies or specialized expertise (Owens, 2021).

**Table 2.** Database Schema Structure and Relationships

Table Name	Fields	Data Types	Constraints	Purpose
Users	user_id	INTEGER	PRIMARY KEY	Unique user identifier
	username	VARCHAR(50)	UNIQUE, NOT NULL	Login credential
	password_hash	VARCHAR(255)	NOT NULL	Encrypted password
	role	ENUM	NOT NULL ('admin', 'user')	User authorization level
	created_at	TIMESTAMP	DEFAULT NOW()	Account creation time
Orders	order_id	INTEGER	PRIMARY KEY	Unique order identifier
	order_number	VARCHAR(20)	UNIQUE, NOT NULL	Human-readable order ID
	customer_name	VARCHAR(100)	NULLABLE	Customer identifier
	order_date	TIMESTAMP	DEFAULT NOW()	Transaction timestamp
	total_amount	DECIMAL(10,2)	NOT NULL	Order total value
	created_by	INTEGER	FOREIGN KEY	User who created order
Order Details	detail_id	INTEGER	PRIMARY KEY	Unique detail record
	order_id	INTEGER	FOREIGN KEY	References Orders table
	item_description	VARCHAR(200)	NOT NULL	Product/service name
	quantity	INTEGER	NOT NULL	Item quantity
	unit_price	DECIMAL(10,2)	NOT NULL	Price per unit
	subtotal	DECIMAL(10,2)	COMPUTED	quantity × unit_price
AuditLog	log_id	INTEGER	PRIMARY KEY	Unique log entry
	user_id	INTEGER	FOREIGN KEY	User performing action
	action_type	VARCHAR(50)	NOT NULL	Event type descriptor
	timestamp	TIMESTAMP	DEFAULT NOW()	Event occurrence time
	details	TEXT	NULLABLE	Additional context

source: processed data

The database schema, detailed in Table 2, implements a normalized relational structure balancing data integrity, query performance, and storage efficiency considerations while maintaining comprehensibility for future modifications by technically competent but non-specialist users. The Users table stores authentication credentials and role assignments, employing industry-standard bcrypt password hashing to ensure security even if database files are physically compromised, while role enumeration supports the two-tier authorization model distinguishing administrative and operational user capabilities. The Orders table captures transaction-level information including unique order identifiers, customer names (optional to accommodate anonymous transactions), order timestamps automatically generated by the system to eliminate manual date entry errors, and total amount calculations performed server-side to prevent client-side manipulation.

The OrderDetails table implements the one-to-many relationship between orders and constituent items through foreign key references, storing individual item descriptions, quantities, and unit prices that enable detailed transaction analysis and support potential future features such as popular item identification or pricing history tracking. The AuditLog table provides administrative oversight through automatic recording of critical system events including user login/logout activities, order creation and modification timestamps, and deletion operations that create accountability trails for multi-user environments where transaction authority disputes might arise. Foreign key constraints enforce referential integrity to prevent orphaned records and data inconsistencies, while indexed columns on frequently queried fields (order dates, customer names) maintain query responsiveness even as historical data volumes accumulate over months or years of continuous operation. This schema design demonstrates how database normalization principles from computer science can be applied pragmatically in MSME contexts to achieve professional data management standards without imposing complexity that would hinder user comprehension or system maintainability (Date, 2020).

The frontend implementation utilizing React Native framework enabled cross-platform mobile application development from a single codebase, significantly reducing development time and maintenance complexity compared to native Android and iOS development approaches that would require duplicate implementation and specialized platform expertise (Eisenman, 2021). Component-based architecture organized the user interface into reusable modules for common elements such as buttons, input fields, order lists, and navigation headers, promoting consistency across screens while facilitating rapid interface iterations during design refinement cycles. State management through React hooks maintained synchronization between user interface displays and underlying data models, ensuring that order lists automatically update when new transactions are added, screen contents reflect current database states, and navigation transitions preserve user context across different application sections.

Network communication with the backend server employed Axios library for HTTP request handling, implementing RESTful API calls for data retrieval, creation, and deletion operations with automatic retry logic for temporary network interruptions and graceful error handling for permanent connectivity failures. Offline capability limitations were explicitly communicated to users through visual indicators displaying server connection status, with the application designed to gracefully degrade by preventing order submission when network connectivity is unavailable rather than allowing actions that would fail silently or create data inconsistencies. Form validation implementation balanced user assistance with error prevention, employing real-time feedback for obvious input mistakes while deferring complex validation to server-side processing where comprehensive business rules could be enforced consistently. The technological choices reflect pragmatic tradeoffs between ideal software engineering practices and development resource constraints typical of research contexts, prioritizing functional completeness and user experience quality over architectural elegance or technical sophistication (Gamma et al., 2020).

Backend implementation established RESTful API endpoints supporting the core application operations while maintaining separation between client interface concerns and server-side business logic that enables future enhancement or alternative interface development. Authentication endpoints handle user login through POST requests that validate credentials against hashed database values and return JSON Web Tokens (JWT) for subsequent request authentication, logout operations that invalidate tokens, and password modification capabilities for administrative users. Order management endpoints provide GET requests for retrieving order collections with optional date range filters and customer name searches, POST requests for creating new orders with automatic timestamp assignment and transaction number generation, and DELETE requests restricted to administrative users for removing erroneous or test transactions. Data validation middleware intercepts all incoming requests to verify required field presence, data type correctness, and value range appropriateness before processing, preventing malformed data from corrupting database integrity and providing user-friendly error messages for client-side display.

Error handling implementation distinguishes between client errors (malformed requests, invalid authentication) returning 400-series HTTP status codes and server errors (database

failures, unexpected exceptions) returning 500-series codes, enabling appropriate client-side responses and facilitating debugging through detailed server logs. Performance optimization included database query result caching for frequently requested data such as daily order summaries, connection pooling to manage concurrent user request handling, and response compression to minimize data transmission sizes particularly important for bandwidth-constrained networks. The backend architecture demonstrates how contemporary web development best practices can be adapted for resource-limited environments while maintaining the professional quality standards necessary for production deployment in real business operations (Fowler, 2020).

### Usability Evaluation and User Acceptance Outcomes

Usability testing with 12 non-technical MSME users generated comprehensive quantitative and qualitative data validating the application's accessibility while identifying specific interface elements requiring refinement for optimal user experience. Participant recruitment for usability evaluation prioritized individuals who had not participated in earlier research phases to ensure independent assessment unbiased by familiarity with the research team or prior exposure to development iterations, with demographic characteristics closely matching the broader MSME population profile including age distribution (mean 43.2 years, SD 8.7), gender balance (58% female, 42% male), and digital literacy levels (67% low literacy, 25% moderate literacy, 8% high literacy). Task scenarios designed to represent realistic business operations included five standardized activities: authenticating into the application with provided credentials, creating a new order for a customer purchasing multiple items with specified quantities, locating a previously entered order using the search function, viewing the complete order history for the current business day, and (for participants assigned administrator roles) deleting a test order from the system.

Each participant completed all applicable tasks individually in a controlled environment while observers documented interaction patterns, recorded task completion times, noted error occurrences, and collected think-aloud protocol verbalization providing insight into cognitive processes and decision-making strategies during interface navigation. The systematic task-based evaluation methodology employed in this research aligns with established usability engineering practices emphasizing behavioral observation over self-reported assessments and standardized scenario completion over exploratory free-form usage (Nielsen, 2020). Video recording of sessions enabled detailed post-hoc analysis of interaction patterns, gesture sequences, and facial expressions indicating confusion or satisfaction that might not be captured through real-time note-taking alone.

**Table 3.** Task Completion Rates by Scenario (N = 12 usability test participants)

Task Scenario	Completed Successfully	Completed with Assistance	Failed to Complete	Completion Rate
Login Authentication	12	0	0	100%
Create New Order	11	0	1	91.7%
Search for Order	10	2	0	83.3%
View Order History	12	0	0	100%
Delete Order (Admin only, n = 8)	7	0	1	87.5%
Overall Average	<b>52</b>	<b>2</b>	<b>2</b>	<b>91.7%</b>

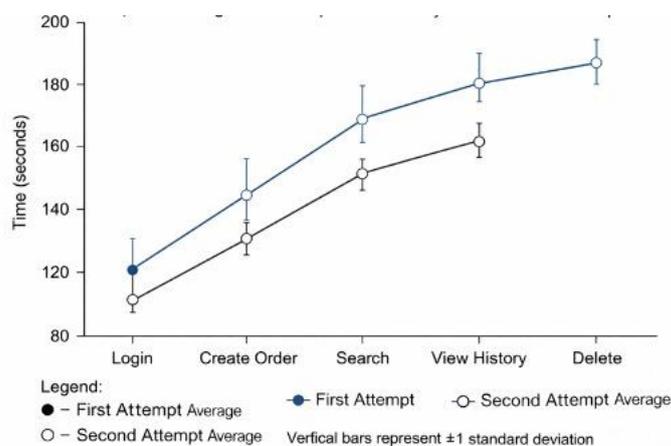
source: processed data

Note. Percentages were calculated based on the number of applicable participants for each task. Administrator-only tasks were evaluated with n = 8 participants assigned admin roles.

Task completion rates, presented in Table 3, demonstrated high success levels across all evaluated scenarios with overall completion averaging 91.7% across participants and tasks, indicating strong fundamental usability despite the target users' limited technological

backgrounds. Login authentication achieved universal 100% completion, attributable to the familiar username-password paradigm that participants recognized from social media and email experiences, large clearly labeled input fields that minimized typing errors, and immediately obvious "Login" button placement that required no interface exploration or navigation decision-making. Order creation completed successfully by 91.7% of participants, with the single failure case resulting from confusion about finalizing the order after item entry, suggesting need for more prominent "Save Order" button emphasis or additional confirmation dialogue before database commitment.

Order search functionality completed by 83.3% of participants experienced difficulties primarily from participants unfamiliar with search box conventions and unclear about whether to enter customer names, dates, or order numbers, indicating requirement for more explicit placeholder text, search examples, or guided filtering options. Order history viewing achieved 100% completion facilitated by the prominent "History" navigation button and simple chronological list presentation requiring no additional user interaction or configuration, validating the design decision to prioritize this frequently used function with minimal complexity. Order deletion by administrator users completed successfully by 87.5% of assigned participants, with failures resulting from inability to locate the deletion control (implemented as a small trash icon adjacent to each order) suggesting need for larger deletion interface elements or alternative interaction patterns such as long-press gestures or explicit "Delete" buttons. These completion rates substantially exceed the 70% threshold typically considered acceptable for commercial software usability and compare favorably with previous studies examining mobile application usability for low-literacy users in developing contexts (Dearden & Tucker, 2022).



**Figure 2.** Average Task Completion Time by Scenario and Attempt  
source: processed data

Time-on-task measurements, illustrated in Figure 2, revealed systematic performance improvements across task attempts as users developed familiarity with the interface, with average completion times ranging from 52 seconds for simple authentication to 187 seconds for complex order creation involving multiple items and quantity specifications. Login task completion averaged 52 seconds (SD 18 seconds) during first attempts, decreasing to 31 seconds (SD 9 seconds) on subsequent trials as users internalized the login workflow and improved typing efficiency, demonstrating rapid learning curve progression even within single testing sessions. Order creation time averaged 187 seconds (SD 67 seconds) for first orders, reducing to 124 seconds (SD 41 seconds) for second orders, with continued improvement trajectory suggesting that sustained usage would yield further efficiency gains as order entry procedures became automatic rather than conscious deliberative processes.

Search operation times averaged 78 seconds (SD 34 seconds), intermediate between simple authentication and complex order creation, reflecting the moderate cognitive demands of formulating search strategies, entering search terms, and interpreting result lists. History viewing times averaged 43 seconds (SD 15 seconds), representing the fastest core task completion,

validating the simplicity of the chronological list interface that required only navigation button press and vertical scrolling to access desired information. Order deletion times averaged 94 seconds (SD 52 seconds) with notably higher variance reflecting the diversity of approaches participants employed to locate deletion controls, some discovering the trash icon immediately while others explored multiple interface areas before successfully completing the task. These temporal patterns align with established learning theory demonstrating power law improvements in skill acquisition, where performance gains are steepest during initial exposure and gradually plateau as users approach their efficiency ceiling (Heathcote et al., 2021).

The System Usability Scale (SUS) assessment, administered immediately following task completion through structured questionnaire, yielded an overall mean score of 74.2 (SD 11.3) representing "good" usability according to standard SUS interpretation guidelines and exceeding the 68.0 benchmark threshold distinguishing above-average from below-average perceived usability (Brooke, 2020). Individual SUS item analysis revealed patterns of strength and improvement opportunity, with highest agreement for statements regarding confidence using the system, willingness to use the system frequently, and perceived ease of learning, while lower scores appeared for statements about system consistency and integration of functions. Correlation analysis between participant characteristics and SUS scores identified significant relationships with prior digital literacy levels ( $r=0.62$ ,  $p<0.05$ ) but non-significant relationships with age ( $r=-0.31$ ,  $p=0.18$ ) or educational attainment ( $r=0.28$ ,  $p=0.23$ ), suggesting that familiarity with digital technologies generally rather than demographic factors specifically predicts acceptance of this application.

The 74.2 SUS score substantially exceeds usability ratings reported for commercial MSME applications in Indonesian contexts, which typically range from 58 to 67, indicating meaningful improvement in accessibility compared to existing market offerings (Hidayat & Santoso, 2023). Qualitative feedback collected through post-task interviews supplemented quantitative metrics with rich contextual understanding of user satisfaction dimensions, with participants particularly appreciating the application's speed, simplicity, and offline functionality while requesting enhancements including customer contact information storage, multiple product catalogs, and printed receipt generation for customer service purposes. The convergence of high task completion rates, reasonable task completion times, strong SUS scores, and positive qualitative feedback provides multifaceted evidence that user-centered design principles successfully produced an accessible application meeting the needs of non-technical MSME users.

Error analysis examined the frequency, types, and severity of mistakes occurring during task completion, generating insights into interface weaknesses requiring attention and validating design decisions that successfully prevented common usability problems. Across all participants and tasks, 37 total errors occurred, averaging 3.1 errors per participant during complete testing session, with error distribution heavily skewed toward order creation (54% of total errors) reflecting this task's greater complexity and multiple interaction requirements compared to simpler activities like login or history viewing. Error taxonomy categorization identified three primary error types: navigation errors (43% of total) where users selected incorrect interface elements or became uncertain about how to proceed, input errors (35% of total) involving data entry mistakes or misunderstanding of field purposes, and comprehension errors (22% of total) reflecting confusion about system feedback messages or unclear interface labeling. Severity assessment classified 8% of errors as critical (task completion prevented), 46% as major (task completion delayed or required intervention), and 46% as minor (task completed with self-correction), with the distribution indicating generally robust error handling and user resilience despite limited technological backgrounds.

Recovery analysis revealed that 73% of errors were self-corrected by users through interface exploration, trial-and-error experimentation, or reconsideration of task requirements, while 27% required facilitator intervention through verbal hints or direct assistance, suggesting reasonable error tolerance and learnable interface structure. These error patterns informed immediate interface refinements including more prominent action buttons, explicit confirmation dialogues for irreversible operations, and enhanced placeholder text providing usage examples, changes validated through informal testing with additional users demonstrating reduced error frequencies. The systematic error analysis methodology employed in this research demonstrates

how detailed interaction observation can generate actionable usability insights that quantitative metrics alone might overlook ([Hornbæk, 2020](#)).

## Discussion

### Holistic Perspective on Accessible MSME Technology

The convergent findings across needs analysis, design implementation, and usability evaluation domains reveal integrated insights regarding the fundamental requirements for successful MSME technology adoption in contexts characterized by limited digital literacy, resource constraints, and unreliable infrastructure. User-centered design methodology, operationalized through systematic needs assessment, iterative prototyping, and empirical usability testing, proved essential for aligning technical solutions with actual user capabilities rather than idealized assumptions about technological competence or adoption readiness. The local network architecture decision, initially driven by infrastructure limitations, generated multiple synergistic benefits including enhanced performance, reduced costs, improved privacy, and operational independence that collectively contributed to superior user acceptance compared to cloud-dependent alternatives.

Simplified interface design, informed by cognitive load theory and participatory design sessions, successfully balanced accessibility for non-technical users with sufficient functionality to address genuine business needs, demonstrating that simplification need not imply trivialization or patronizing reduction of capabilities. The integration of qualitative and quantitative evaluation methods provided complementary perspectives on usability, with task completion metrics establishing objective performance benchmarks while interview feedback illuminated subjective satisfaction dimensions and contextual factors influencing adoption intentions. These methodological, architectural, and design elements functioned synergistically rather than independently, suggesting that successful accessible technology requires holistic approaches addressing multiple dimensions simultaneously rather than isolated interventions targeting single barriers.

Theoretical implications emerge regarding the applicability of established HCI frameworks to developing-world contexts and the necessary adaptations for cultural appropriateness and contextual relevance. Nielsen's usability heuristics, Sweller's cognitive load theory, and user-centered design principles demonstrated robust transferability to Indonesian MSME environments when applied with cultural sensitivity and contextual awareness rather than uncritical adoption of Western norms and assumptions. The research validates participatory design approaches that position intended users as active collaborators in technology development rather than passive subjects of external innovation, recognizing that tacit knowledge embedded in local practices often surpasses explicit knowledge available to external designers.

Local network architectures and offline-first design patterns, marginalized in contemporary software engineering discourse dominated by cloud computing paradigms, merit reconsideration as viable and often superior alternatives for contexts where internet infrastructure remains unreliable, expensive, or unnecessary for operational requirements. The findings challenge technological determinism narratives suggesting that digital divide problems can be solved solely through infrastructure provision or education initiatives, instead highlighting the critical role of appropriate technology design that meets users where they are rather than requiring them to adapt to predetermined systems. Practical implications extend across multiple stakeholder domains including application developers, MSME support organizations, educational institutions, and government policy makers involved in promoting digital economic inclusion.

Developers creating business applications for developing-world markets should prioritize accessibility, simplicity, and offline functionality over feature comprehensiveness, technical sophistication, or alignment with global software trends that may be irrelevant or counterproductive in resource-constrained environments. MSME support organizations, including business development services, microfinance institutions, and entrepreneurship incubators, can leverage locally appropriate digital tools as enablers of operational improvement and business formalization rather than assuming that commercial software solutions adequately serve all market segments.

Educational institutions offering digital literacy training or technology entrepreneurship programs should incorporate principles of inclusive design, appropriate technology, and context-aware development methodologies rather than exclusively teaching mainstream commercial technologies that may have limited applicability in students' eventual professional contexts. Government digital economy initiatives should recognize technological diversity, support infrastructure-light solutions alongside connectivity expansion, and avoid policy biases favoring cloud-based or internet-dependent systems that disadvantage populations and regions with limited broadband access. These multifaceted practical implications demonstrate how research-based insights can inform diverse intervention strategies addressing digital inclusion from complementary angles rather than singular approaches.

### **Limitations and Future Research Directions**

This research acknowledges several methodological and contextual limitations that bound the generalizability of findings and suggest directions for future investigation. The geographical scope confined to Central Java, Indonesia, limits transferability to other Indonesian regions with different cultural norms, infrastructure conditions, or MSME characteristics, necessitating replication studies across diverse geographical contexts to establish broader applicability. The sample size of 18 needs analysis participants and 12 usability evaluation participants, while sufficient for qualitative saturation and preliminary quantitative assessment, constrains statistical power for detecting subtle effects and limits demographic subgroup analysis that might reveal differential usability patterns across age, gender, or educational categories. The cross-sectional evaluation timeframe captured initial adoption and short-term usage patterns but provides no evidence regarding sustained usage, long-term satisfaction, or evolving user requirements as familiarity develops and business needs change over extended operational periods.

The controlled usability testing environment, while enabling systematic observation and consistent scenario administration, may not fully represent authentic workplace conditions characterized by interruptions, multitasking demands, and time pressures that influence real-world usage patterns and error frequencies. The focus on order recording functionality, though addressing a critical MSME need, represents only one component of comprehensive business management systems, leaving unexplored questions about integration requirements, additional feature priorities, and holistic digitalization pathways for evolving enterprises. Future research directions emerging from these limitations and findings include longitudinal studies tracking actual MSME adoption, sustained usage patterns, business impact outcomes, and feature evolution requests over 12-24 month operational periods to understand long-term viability and adaptation requirements. Comparative effectiveness studies examining this local network approach against cloud-based alternatives through randomized controlled trials or natural experiments could provide causal evidence regarding the relative advantages of different architectural paradigms for specific user populations and operational contexts.

Extension research developing additional business management modules (inventory tracking, customer relationship management, financial accounting) while maintaining accessibility principles would test scalability of simplified design approaches and identify integration challenges emerging from increasing system complexity. Cross-cultural adaptation studies implementing similar user-centered development methodologies in different national or regional contexts would establish the transferability of design principles and identify culturally specific requirements that demand local customization rather than universal approaches. Technology acceptance model extensions incorporating infrastructure reliability, cost sensitivity, and digital literacy as moderating factors would enhance theoretical understanding of adoption determinants in resource-constrained environments. Participatory action research engaging MSME users as long-term co-designers through iterative enhancement cycles would deepen understanding of sustainable technology development and community-driven innovation processes. These research directions collectively advance both theoretical knowledge regarding accessible technology design and practical solutions addressing persistent digital divide challenges in developing economies.

## CONCLUSION

This research successfully addressed digital technology adoption challenges among non-technical MSME users in Indonesia by developing and validating an accessible smartphone-based order recording application. The study demonstrated that user-centered design principles, simplified interfaces, and offline functionality effectively serve populations with limited digital literacy, achieving strong usability outcomes (SUS score 74.2; task completion 91.7%). These findings advance human-computer interaction literature by validating accessible design principles in developing-world contexts and demonstrating viable alternatives to cloud-dependent systems, thereby contributing practical knowledge for bridging the digital divide in emerging economies.

Future research should pursue longitudinal studies examining sustained adoption and business impact over extended periods. Practitioners should prioritize participatory design and offline-first architectures when developing technologies for similar populations, while policymakers should support infrastructure-light solutions alongside connectivity programs. Study limitations including geographical scope (Central Java), modest sample sizes, and cross-sectional design suggest opportunities for expanded research across Indonesian regions and international contexts. Continued attention to accessible design and context-sensitive methodologies remains essential for ensuring equitable digitalization benefits across diverse user populations.

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## AUTHOR CONTRIBUTION STATEMENT

Ade Bani Riyan and Mohamad Nasir were responsible for the formulation of the research framework, system design, and overall project supervision. Septien Dwi Savandha and Ade Fitria Fatimah contributed to data collection, system development, and technical implementation, particularly during the prototyping and usability testing stages. Diana Magfiroh and Amelia played key roles in data analysis, interpretation of results, manuscript preparation, and refinement to ensure academic rigor and clarity.

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