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Evaluation of the Implementation of the “SOBAT IF” Innovative App by the Semarang City Health Department in Semarang

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Abstract

The SOBAT IF (Integrated Pharmaceutical Medicine and Medical Consumables System) innovation application represents a digital transformation initiative implemented by the Pharmacy Installation under the Semarang City Health Office to improve pharmaceutical logistics management. This study aimed to evaluate the implementation of SOBAT IF by examining its operational responsiveness, efficiency and effectiveness, user capacity, and sustainability. An empirical descriptive qualitative design was employed, involving five personnel from the Semarang City Pharmacy Installation who were directly engaged in managing, operating, monitoring, or supporting the application. Data were collected through semi-structured interviews, direct observation of pharmaceutical distribution activities and application use, and documentation, followed by thematic analysis to identify recurring patterns related to implementation benefits, user experiences, operational barriers, and future development. The findings indicate that SOBAT IF was positively accepted because barcode tracking, real-time information, batch identification, and visual expiry indicators facilitated pharmaceutical recording, distribution monitoring, and stock management. The value of expired pharmaceutical losses decreased from Rp93,480,333.00 in 2022 to Rp81,531,932.00 in 2024, indicating improved inventory control, although the reduction cannot be attributed exclusively to the application. Key implementation challenges included unstable internet connectivity, differences in digital literacy among personnel, and budget limitations for system development. The evaluation indicates that sustainable improvement requires continuous technical development, user training, infrastructure strengthening, external collaboration, and adequate institutional support..

Keywords: Digital Health, Health Innovation, Pharmaceutical Management, SOBAT IF, User Evaluation.



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INTRODUCTION

Semarang City is a metropolitan area as well as the capital of Central Java Province, characterized by continuing population growth, heterogeneous health needs, and substantial variation in the capacity of health services across its administrative areas. The city comprises 16 subdistricts and 177 urban villages, creating a complex service environment in which increasing population needs must be accompanied by more equitable, responsive, and sustainable healthcare provision (Wilda & Santoso, 2025). The presence of 32 hospitals and 39 community health centers across Semarang City provides an extensive institutional network, yet the availability of healthcare facilities does not automatically guarantee equitable pharmaceutical distribution, particularly in relation to medicine and Medical Consumables (Bahan Medis Habis Pakai/BMHP) management (Fathnin et al., 2023). This challenge reflects a broader transformation in healthcare management, in which digital technologies are increasingly employed to strengthen surveillance, information integration, service coordination, and evidence-based decision-making across health systems (Sujarwoto et al., 2022). Digital health applications have demonstrated potential to improve healthcare access and operational processes, but their sustainability depends not merely on technological availability but also on whether the systems are aligned with institutional workflows and user requirements (Galetsi et al., 2022). Within local government settings, health-sector digital innovation has similarly become an important mechanism for improving public services and supporting the achievement of broader development objectives in

Semarang City (Santoso et al., 2023). These developments establish pharmaceutical information management as an important component of contemporary healthcare governance because weaknesses in stock visibility, distribution, and expiry monitoring can directly undermine the continuity and efficiency of health services.

The Pharmacy Installation of Semarang City, operating as a Technical Implementation Unit under the Semarang City Health Office, occupies a strategic position in maintaining the availability and distribution of pharmaceutical supplies across healthcare facilities in the city. Its responsibilities extend beyond physical storage because pharmaceutical management requires continuous control over availability, quality, safety, stability, and appropriate utilization throughout the distribution process (Kartika & Lola, 2025). Previous research in Semarang has shown that pharmaceutical service implementation at community health centers remains closely associated with compliance with established pharmaceutical service standards, indicating that administrative and logistical processes are integral to the quality of healthcare delivery rather than peripheral activities (Fathnin et al., 2023). At the operational level, however, the geographical spread and varying needs of healthcare facilities may generate imbalances in stock distribution, excessive inventory, and the accumulation of pharmaceutical products approaching or exceeding their expiry dates. Such conditions can increase financial losses and resource inefficiency while simultaneously creating the possibility of delays in treatment when pharmaceutical availability does not correspond to population needs. The consequences become particularly important in the management of infectious diseases, where uninterrupted access to appropriate medication constitutes an essential component of effective treatment and disease control (Kusumawati et al., 2021). The combination of logistical complexity, information fragmentation, and the need for timely pharmaceutical decisions creates a strong rationale for adopting an integrated digital system capable of supporting monitoring and coordination across facilities.

The development of the SOBAT IF (Sistem Obat dan BMHP Terintegrasi Farmasi) application represents a local digital innovation intended to respond to these pharmaceutical management challenges by integrating information related to medicines and BMHP across healthcare facilities in Semarang City. The application is designed to support recording, tracking, monitoring, and distribution through a more transparent and accurate digital information environment, allowing pharmaceutical personnel to obtain updated information without relying entirely on fragmented manual records. Its barcode-based recording mechanism captures critical information such as receipt dates, expiry dates, batch numbers, manufacturers, and storage locations, while the application incorporates FIFO and FEFO principles to improve stock rotation and reduce the likelihood of inappropriate pharmaceutical utilization (Anandani et al., 2022). The system also employs visual indicators to identify pharmaceutical products according to their remaining expiry periods, enabling personnel to recognize products requiring priority attention and potentially intervene before stock becomes unusable. Comparable digital health initiatives demonstrate that application-based monitoring can strengthen surveillance and facilitate more systematic responses when information is presented in an accessible and operationally relevant form (Amalia et al., 2024). The capacity to update information in real time and provide access across different locations potentially shifts pharmaceutical management from retrospective reporting toward more proactive monitoring and decision-making. Yet the existence of these technological functions does not, in itself, establish that SOBAT IF has been implemented effectively, because the practical value of an information system depends on how consistently its features are adopted, understood, and incorporated into routine organizational practices.

Previous studies on digital healthcare applications have increasingly emphasized that implementation outcomes should be examined through the interaction between technological characteristics and user experiences rather than through system availability alone. Research on mobile health application acceptance, for example, indicates that user experience and satisfaction are important determinants of whether users accept and continue to engage with digital health technologies (Aprianto & Ibrahim, 2025). Usability research further demonstrates that effective evaluation should consider multiple criteria, including efficiency, effectiveness, satisfaction, learnability, and other dimensions that determine whether an application can be used appropriately within real-world healthcare contexts (Galavi et al., 2024). Empirical evaluations of Indonesian health applications have likewise shown that usability and user experience can reveal practical weaknesses that may not be apparent from technical functionality or implementation status alone (Wulandari et al., 2022). Research concerning the acceptance and success of mHealth applications also indicates that technological acceptance is

influenced by broader behavioral and organizational factors, meaning that a technically functional system may still encounter barriers to sustained utilization (Merdekawati et al., 2024). These findings are reinforced by studies demonstrating that digital health applications require alignment between users, clinical or administrative processes, and technological structures to achieve meaningful implementation outcomes (Karolita et al., 2026). The literature therefore suggests that evaluating SOBAT IF requires attention not only to what the application is designed to accomplish but also to how the system functions in practice, how users interact with its features, and whether its implementation produces operational improvements within the pharmaceutical management context.

The empirical evidence surrounding digital health innovation in Indonesia provides useful foundations for understanding the potential and limitations of application-based healthcare management, although important gaps remain when the focus shifts specifically to integrated pharmaceutical logistics at the municipal level. Studies of health applications have examined disease surveillance, maternal care, tuberculosis detection, chronic disease management, and health-service access, demonstrating that digital platforms can support monitoring and improve the reach of health interventions (Rahayu et al., 2022). Other research has found that task-technology fit and user engagement are critical to realizing the benefits of mobile health technologies, suggesting that the relevance of system functions to users' actual tasks is a central determinant of implementation success (Ridwan et al., 2026). Design-oriented research has similarly emphasized that health applications should emerge from systematic consideration of user needs, contextual constraints, and iterative development rather than from technology-centered assumptions alone (Shania et al., 2026). At the public-service level, the implementation of digital innovation in Semarang has demonstrated that technology-enabled programs can contribute to broader improvements in health-related services, although implementation outcomes remain dependent on the institutional context in which innovations are embedded (SuryaWijaya et al., 2024). Research on other Indonesian health applications has also shown that digital infrastructure must be evaluated in relation to its actual implementation and usability rather than being treated as an inherently successful intervention (Harsono et al., 2022). Despite this expanding literature, empirical evaluation specifically addressing the implementation of an integrated pharmaceutical information system developed by a municipal health authority remains limited, particularly in relation to real-time stock monitoring, expiry control, distribution processes, user experience, and the system's contribution to pharmaceutical governance.

The need for such an evaluation becomes increasingly important because the effectiveness of SOBAT IF cannot be inferred solely from its technological design or from reductions in selected pharmaceutical losses, but must be examined through the actual experiences and assessments of those involved in its implementation. An implementation-focused evaluation can identify whether the application's functions correspond to operational requirements, whether information generated by the system is sufficiently accessible and understandable, and whether users can employ the system consistently when performing routine pharmaceutical management activities. The evaluation is also important for distinguishing between technological capability and implementation effectiveness, since a system may possess sophisticated features while still encountering barriers related to usability, adaptation, communication, workflow integration, or user engagement. In the context of Semarang City, such an assessment can provide an evidence-based basis for determining whether SOBAT IF has strengthened pharmaceutical monitoring and whether particular components require refinement to support long-term sustainability. This study is positioned within the intersection of modern healthcare practice, digital health implementation, pharmaceutical management, and public-sector innovation by treating SOBAT IF not merely as a technological product but as an intervention embedded within an organizational and service-delivery environment. The research therefore aims to evaluate the implementation of the SOBAT IF innovation application by the Semarang City Health Office in Semarang City, focusing on how the application is implemented and experienced in pharmaceutical management practices. Theoretically, the study contributes empirical insight into the implementation of municipal digital pharmaceutical innovation, while methodologically it provides an evidence-based evaluation framework that can inform future assessment and refinement of integrated health information systems in comparable public healthcare settings.

RESEARCH METHODS

This study employed an empirical descriptive qualitative design to evaluate the implementation of the SOBAT IF (Sistem Obat dan BMHP Terintegrasi Farmasi) innovation application by the Semarang City Health Office, focusing on implementation processes, user experiences, operational challenges, and opportunities for system improvement. Participants consisted of personnel from the Semarang City Pharmacy Installation who were directly involved in managing, operating, monitoring, or supporting SOBAT IF, as well as students or academic personnel involved in its development, with inclusion criteria requiring direct experience with the application and willingness to provide relevant information, while individuals without direct involvement in SOBAT IF were excluded. Data were collected through semi-structured interviews addressing the application's development, objectives, benefits, barriers, maintenance, and future development, supported by direct observation of pharmaceutical distribution activities and the practical use of SOBAT IF, as well as documentation of relevant application materials and supporting records. This multi-source approach was used to obtain a comprehensive understanding of implementation from managerial and user perspectives, consistent with evidence that digital health evaluation requires attention to contextual user experiences rather than technological functionality alone (Karolita et al., 2026). The interview and observation processes were conducted systematically to identify experiences related to pharmaceutical monitoring, stock availability, expiry-date control, distribution, information updating, and the integration of SOBAT IF into routine pharmaceutical management practices. Data collection was conducted after obtaining institutional permission and informed consent from participants, with confidentiality maintained throughout the research process.

The research instruments comprised a semi-structured interview guide, an observation checklist, and a documentation protocol covering application functionality, usability, accessibility, workflow integration, information management, and perceived usefulness. The evaluation incorporated usability considerations because digital health applications require assessment of multiple usability dimensions to determine whether their functions can be effectively applied in real-world healthcare settings (Galavi et al., 2024). Data were analyzed using thematic analysis through data familiarization, coding, categorization, theme development, interpretation, and comparison across interview, observation, and documentary evidence. The analysis focused on recurring themes concerning implementation effectiveness, user experience, system benefits, operational barriers, and potential improvements, while differences between data sources were examined to strengthen the credibility of the findings. Interpretation also considered the extent to which SOBAT IF's technological functions corresponded with users' pharmaceutical management tasks and supported their engagement with the system (Ridwan et al., 2026). Ethical standards were maintained by obtaining institutional approval and informed consent, ensuring voluntary participation, protecting participant confidentiality, restricting data use to research purposes, and reporting findings without disclosing personally identifiable information.

RESULTS AND DISCUSSION

User Acceptance and Operational Reliability of the “SOBAT IF” Innovative App

The findings indicate that the “SOBAT IF” Innovative App received a positive response from personnel at the Semarang City Pharmacy Installation because its functions were perceived as relevant to routine pharmaceutical management and distribution activities. Interviews with five informants demonstrated that the application was accepted as an operational tool that facilitates recording, monitoring, and tracking of pharmaceutical products. Ms. Mayang, Head of the Pharmacy Installation, stated,

“The application was well received because it made services faster, particularly with the barcode system that has been implemented” (translated from the interview with Ms. Mayang).

This perception suggests that user acceptance was closely associated with the practical benefits generated by the application's features rather than with technological novelty alone. The finding is consistent with research indicating that user experience and satisfaction are important determinants of acceptance of digital healthcare applications (Aprianto & Ibrahim, 2025). The acceptance of SOBAT

IF across personnel with different operational responsibilities also indicates that the application has become integrated into several stages of pharmaceutical management.

The observed implementation further showed that SOBAT IF supports pharmaceutical traceability through barcode-based identification, batch tracking, and distribution-status monitoring. These functions allow personnel to retrieve information concerning the movement of pharmaceutical products without depending entirely on conventional manual records. Table 1 presents the main findings obtained from interviews with personnel involved in different aspects of SOBAT IF implementation.

Table 1. Interview Questions for the SOBAT IF Implementation Evaluation

No.	Informant	Position	Main Finding
1	Indah Mayang Karti	Head of Pharmacy Installation	Positive acceptance and faster pharmaceutical services
2	Agnes Tuning Dyah Anggraeni	Pharmacy Service Officer	Internet connectivity remains an operational constraint
3	Roziqin Widodo	Information and Technology Officer	Technical management and application development
4	Wisnu Jati Nugroho	Warehouse Officer	User adaptation and digital literacy
5	Sekar Arum Rahmandari	Vaccine Service and Management Officer	Improved monitoring of vaccine distribution

The distribution of informants presented in Table 1 demonstrates that the implementation of SOBAT IF involves interconnected organizational roles, ranging from managerial supervision and information technology to warehouse, service, and vaccine management. This cross-functional use strengthens the interpretation that the application is not restricted to a single administrative activity but supports pharmaceutical information flow across different operational processes. Similar evidence suggests that digital health applications can provide greater practical value when their technological functions correspond directly to the tasks performed by healthcare personnel (Ridwan et al., 2026). The barcode and batch-tracking functions are particularly relevant because pharmaceutical management requires accurate identification and monitoring of products throughout storage and distribution. The application therefore contributes to a more traceable information environment in which pharmaceutical movements can be monitored with greater consistency.

Despite the positive acceptance, the findings also identified network connectivity as a significant operational constraint affecting the reliability of SOBAT IF. Ms. Agnes explained,

“If the Wi-Fi connection is not good, the application is automatically disrupted” (translated from the interview with Ms. Agnes)

Indicating that application accessibility depends on the availability of stable internet infrastructure. This limitation becomes important because the value of real-time digital monitoring depends on continuous access to the information system during pharmaceutical activities. Previous research on mobile health applications in Indonesia has similarly highlighted that digital health implementation is influenced by technological infrastructure and the conditions surrounding actual use (Sujarwoto et al., 2022). The finding indicates that weaknesses in supporting infrastructure may interrupt otherwise functional application processes and reduce the consistency of digital-based pharmaceutical monitoring. Operational reliability should consequently be interpreted as the interaction between the application's technical capability and the infrastructure available within the implementation environment.

The application also demonstrates functional relevance through its capacity to support the monitoring of pharmaceutical distribution at a more detailed level. Personnel responsible for vaccine management reported that SOBAT IF could provide information concerning the receiving facility, quantity distributed, and batch number, allowing distribution activities to be followed through a centralized information system. Ms. Arum stated,

“With SOBAT IF, we can identify which community health centers received vaccines, how many were distributed, and even check their batch numbers” (translated from the interview with Ms. Arum, Vaccine Service and Management Officer).

This capability strengthens traceability because pharmaceutical information can be connected to specific distribution events and product batches. The importance of such functionality is supported by pharmaceutical inventory research showing that systematic stock management and appropriate product rotation are essential for reducing the risk of pharmaceutical products becoming unusable (Anandani et al., 2022). SOBAT IF therefore provides an operational mechanism that supports more systematic monitoring of pharmaceutical movements while reducing dependence on fragmented documentation.

The findings position user acceptance and operational reliability as two interconnected dimensions of SOBAT IF implementation rather than independent outcomes. Positive acceptance emerged because users experienced tangible improvements in recording and monitoring, while the principal limitation originated from infrastructure conditions outside the application's core functions. Digital health implementation research emphasizes that effective systems must be evaluated within their organizational and socio-technical environments because technological functionality alone cannot determine implementation success (Karolita et al., 2026). The evidence from Semarang indicates that SOBAT IF has achieved functional acceptance and provides relevant support for pharmaceutical monitoring, particularly through barcode identification, batch tracking, and distribution-status information. At the same time, dependence on stable Wi-Fi represents a practical vulnerability that can affect continuity of use in operational settings. The evaluation therefore suggests that strengthening infrastructure reliability alongside continued system maintenance is important for ensuring that the application's capabilities remain consistently accessible to pharmaceutical personnel.

Efficiency and Effectiveness of Pharmaceutical Management

The implementation of the “SOBAT IF” Innovative App was also associated with improvements in the efficiency of pharmaceutical management at the Semarang City Pharmacy Installation, particularly in recording, tracking, and monitoring the distribution of medicines and Medical Consumables (BMHP). Interview findings indicate that the application reduces dependence on fully manual recording by providing integrated information that can be accessed during pharmaceutical management activities. This condition is important because pharmaceutical services require accurate information regarding stock movement, product identity, quantity, and distribution status to support timely operational decisions. The use of digital technology in healthcare has been shown to improve the efficiency of information management when applications are appropriately integrated into the tasks performed by healthcare personnel (Galetsi et al., 2022). The findings suggest that the efficiency generated by SOBAT IF is reflected not only in reduced administrative workload but also in improved access to pharmaceutical information. Such functionality strengthens the role of digital information systems as operational instruments rather than merely electronic replacements for conventional documentation.

One of the clearest findings concerned the application's ability to facilitate detailed monitoring of pharmaceutical distribution, particularly through information regarding receiving facilities, quantities, and batch numbers. Ms. Arum stated,

“With SOBAT IF, we can identify which community health centers received vaccines, how many were distributed, and even check their batch numbers” (translated from the interview with Ms. Arum, Vaccine Service and Management Officer).

This capability allows personnel to trace pharmaceutical movements through information that is more structured than conventional recording practices. The main empirical indicators related to efficiency and effectiveness are presented in Table 2.

Table 2. Efficiency and Effectiveness Indicators of SOBAT IF Implementation

Indicator	Finding from the Evaluation	Implementation Implication
Pharmaceutical Recording	Digitalized and integrated recording	Reduced dependence on manual documentation
Distribution Monitoring	Receiving facility and quantity can be monitored	Improved distribution control
Batch Tracking	Batch numbers can be identified	Strengthened pharmaceutical traceability
Stock Management	Pharmaceutical movement can be monitored	Supports more efficient inventory control
Expired Pharmaceutical Losses	Decreased from Rp93,480,333.00 in 2022 to Rp81,531,932.00 in 2024	Indicates improved control of expired stock

The information presented in Table 2 indicates that the efficiency of SOBAT IF is primarily generated through improved information accessibility and traceability across pharmaceutical management activities. The ability to identify distribution locations, quantities, and batch numbers provides personnel with information that can support faster verification and monitoring. This finding corresponds with evidence that digital health technologies can improve healthcare processes when information is structured according to the operational needs of users (Rahayu et al., 2022). The integration of these functions also reduces the possibility that information concerning pharmaceutical distribution becomes separated across different records or organizational units. From a pharmaceutical management perspective, improved traceability is particularly valuable because accurate stock information supports better control over product movement and utilization.

The effectiveness of SOBAT IF was further reflected in the reported reduction in the financial value of pharmaceutical products that became expired between 2022 and 2024. Based on verified interview data, the value decreased from Rp93,480,333.00 in 2022 to Rp81,531,932.00 in 2024, representing a reduction of approximately 12.08% over the observed period. Ms. Mayang confirmed,

“Before SOBAT IF, the loss could reach Rp93,480,333.00, whereas now it has decreased to Rp81,531,932.00” (translated from the interview with Ms. Mayang, Head of the Pharmacy Installation).

This change provides an empirical indication that improved monitoring may contribute to better control of pharmaceutical stock approaching its expiry date. The finding is relevant to established FIFO and FEFO principles, which prioritize appropriate stock rotation to reduce the accumulation and expiration of pharmaceutical products (Anandani et al., 2022). The decrease should, however, be interpreted as an indicator associated with implementation rather than as evidence that SOBAT IF alone caused the reduction, because other managerial and operational factors may also influence pharmaceutical losses.

The efficiency achieved through the application remains accompanied by organizational constraints that can affect its continued development and potential effectiveness. Interview findings indicate that the principal limitation is not necessarily the existing functionality of the application but the availability of financial resources required to introduce additional features and technological improvements. Ms. Mayang explained,

“The problem is not the system, but the budget; sometimes development has to be postponed” (translated from the interview with Ms. Mayang, Head of the Pharmacy Installation).

This finding demonstrates that the effectiveness of a digital innovation is partly dependent on institutional capacity to maintain and develop the system after its initial implementation. Similar evaluations of digital health applications indicate that sustainability requires continuous adaptation to user needs, system requirements, and organizational conditions rather than one-time technological deployment (Amalia et al., 2024). Budget limitations may consequently restrict the ability of the

Pharmacy Installation to respond rapidly to emerging operational requirements even when users have already identified potential improvements.

Taken together, the findings demonstrate that SOBAT IF has contributed to more efficient pharmaceutical information management through digital recording, distribution monitoring, and batch-level traceability, while the decline in expired pharmaceutical losses provides an additional empirical indication of improved stock control. The observed changes are consistent with the broader principle that digital health innovation can generate meaningful operational benefits when technological functions are directly connected to healthcare management activities (Galetsi et al., 2022). The reduction in expired pharmaceutical losses also suggests that better visibility of stock information can support preventive management rather than relying solely on retrospective identification of expired products. Nevertheless, the financial data should be treated as supportive evidence of implementation effectiveness rather than as a definitive causal measure because the qualitative design does not isolate the effect of SOBAT IF from other organizational interventions. The findings establish that application functionality, information accessibility, and pharmaceutical traceability are central mechanisms through which SOBAT IF supports efficiency and effectiveness. Continued investment in system maintenance and development is needed to preserve these gains and address operational requirements that emerge as pharmaceutical management becomes increasingly dependent on integrated digital information.

User Capacity and Digital Adaptation

The implementation of the “SOBAT IF” Innovative App revealed that user capacity constitutes an important component of successful digital pharmaceutical management at the Semarang City Pharmacy Installation. Interview findings showed that not all personnel possessed the same level of familiarity with computers and digital applications, creating differences in the ease with which information could be accessed and processed through SOBAT IF. Mr. Wisnu, a Warehouse Officer, stated,

“Some staff rarely use computers, so they have difficulty retrieving information from the application” (translated from the interview with Mr. Wisnu).

This finding indicates that technological implementation does not automatically produce uniform user capability because individual digital experience remains an important factor in everyday system utilization. Previous research has demonstrated that user experience and satisfaction can influence the acceptance of digital health applications, particularly when users must adapt technological systems to existing service routines (Aprianto & Ibrahim, 2025). The variation in digital capability identified in this study therefore represents an implementation consideration that requires organizational intervention rather than being treated solely as an individual limitation.

The interviews further indicated that difficulties experienced by some employees were primarily related to unfamiliarity with computer-based information retrieval rather than rejection of the SOBAT IF system itself. This distinction is important because the presence of user difficulties does not necessarily demonstrate low application acceptance, but may instead reflect a gap between system requirements and existing digital competencies. Table 3 summarizes the empirical findings concerning employee capacity and adaptation identified through the interviews and observations.

Table 3. User Capacity and Digital Adaptation in SOBAT IF Implementation

Implementation Aspect	Empirical Finding	Implication
Digital Literacy	Some employees have limited experience using computers	Additional user assistance is required
Information Retrieval	Some users experience difficulty accessing information	Practical guidance is needed
Internal Training	Direct guidance is provided to employees experiencing difficulties	Supports user adaptation
User Adaptation	Different levels of digital familiarity are observed	Implementation requires differentiated support

Human–Technology Interaction	Application use depends on user capability	Human capacity influences implementation quality
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As shown in Table 3, the principal challenge is associated with variation in digital readiness among employees rather than a fundamental incompatibility between SOBAT IF and pharmaceutical management activities. The organization has responded through internal guidance and direct assistance for personnel experiencing difficulties. This approach reflects the importance of aligning digital health technologies with users' actual competencies and work environments, particularly when applications are introduced into established healthcare processes (Karolita et al., 2026). The implementation experience suggests that training functions as a mechanism for reducing the gap between technological availability and effective utilization. User capacity therefore becomes an organizational resource that must be continuously developed alongside the application's technical features.

The internal assistance provided by the Pharmacy Installation represents an important adaptive response to the differences in digital capability identified among employees. Mr. Wisnu explained,

“We provide guidance for employees who experience difficulties” (translated from the interview with Mr. Wisnu, Warehouse Officer)

Indicating that support is provided directly when users encounter problems during application use. Such assistance can facilitate gradual adaptation because employees receive guidance within the context of their actual tasks rather than through abstract technical instruction alone. Research on health application usability emphasizes that effective systems must accommodate users' abilities and minimize barriers that interfere with task completion (Galavi et al., 2024). In the context of SOBAT IF, direct mentoring may therefore strengthen the practical usability of the application while simultaneously increasing users' confidence in accessing pharmaceutical information. The finding also indicates that successful implementation depends on organizational mechanisms that support users after an application has been introduced.

The differences in digital capability have particular significance because SOBAT IF is intended to support activities that require timely access to pharmaceutical information. When users experience difficulty retrieving information, the potential efficiency gained from digitalization may not be fully realized, particularly in warehouse and distribution activities where information is required to support immediate operational decisions. Previous research on digital health applications has shown that task-technology fit and user engagement influence whether technological systems can effectively support users' actual activities (Ridwan et al., 2026). The findings from Semarang reinforce this perspective because the usefulness of SOBAT IF depends partly on the ability of personnel to translate available system functions into appropriate actions. Digital adaptation should therefore be viewed as an ongoing implementation process rather than a one-time training activity. Continued assistance becomes particularly relevant when application features are modified or expanded, because changes in system functionality may generate new learning requirements among existing users.

The findings establish that employee capacity is a complementary determinant of SOBAT IF implementation alongside technological functionality and infrastructure. The application provides mechanisms for pharmaceutical monitoring and information management, but the realization of these functions remains dependent on personnel who can access, interpret, and apply the information generated by the system. This relationship reflects the socio-technical nature of digital health implementation, in which technological performance is shaped by interactions between system design, users, organizational practices, and contextual conditions (Karolita et al., 2026). The internal mentoring conducted by the Pharmacy Installation represents a practical strategy for addressing differences in digital literacy and maintaining continuity of application use. The evaluation therefore identifies strengthening digital competencies as an important component of maintaining the effectiveness of SOBAT IF, particularly among personnel with limited previous exposure to computer-based systems. Continued user support, task-oriented training, and accessible system interfaces can help ensure that technological capabilities are translated into consistent pharmaceutical management practices.

Sustainability and Future Development of the “SOBAT IF” Innovative App

The findings indicate that the sustainability of the “SOBAT IF” Innovative App is viewed by the Semarang City Pharmacy Installation as a continuous development process rather than a completed implementation outcome. Interviews revealed that the institution has identified several potential improvements, including enhanced real-time tracking, integration with the SI MANIS system, and automated notifications concerning pharmaceutical distribution status. These planned developments indicate that the institution recognizes the need for SOBAT IF to adapt to emerging operational requirements and increasingly interconnected digital health environments. Research on digital health innovation emphasizes that sustainable implementation requires continuous alignment between technological development, organizational needs, and user expectations (Galetsi et al., 2022). The planned improvements are also relevant to the broader development of healthcare information systems in Indonesia, where interoperability and contextual adaptation have become important considerations in designing sustainable digital services. The findings position SOBAT IF as an evolving digital infrastructure whose long-term value depends on its capacity to respond to changes in pharmaceutical management practices.

The proposed development of real-time tracking and automated distribution notifications reflects an effort to strengthen the timeliness of pharmaceutical information available to personnel. Integration with SI MANIS is similarly expected to reduce fragmentation by connecting information generated through related digital systems. Table 4 presents the principal development priorities identified from the interviews with personnel responsible for managing and supporting SOBAT IF.

Table 4. Development Priorities and Sustainability Strategies for SOBAT IF

Planned Development	Current/Planned Function	Expected Contribution
Real-Time Tracking	More detailed distribution monitoring	Faster monitoring and response
SI MANIS Integration	System interoperability	Better information integration
Automatic Notifications	Distribution-status alerts	More timely follow-up
External Collaboration	Technical and system input	Improved system quality
Budget Support	Continued system development	Long-term sustainability

The priorities presented in Table 4 demonstrate that future development is directed toward improving information timeliness, interoperability, and responsiveness rather than merely adding technological features. Real-time monitoring can strengthen operational decision-making because personnel can receive information closer to the point at which pharmaceutical distribution activities occur. Research on digital surveillance applications similarly demonstrates the importance of timely information and system sustainability in supporting continuous health-service monitoring (Amalia et al., 2024). The proposed integration with SI MANIS further indicates an institutional movement toward interconnected information management, which can potentially reduce duplicated processes and improve coordination between systems. These developments suggest that the sustainability of SOBAT IF depends partly on its ability to become an adaptable component of a wider digital health ecosystem.

The evaluation also identified external collaboration as an important strategy for maintaining the quality and relevance of future SOBAT IF development. Mr. Widodo, an Information and Technology Officer, stated,

“We collaborate with UNDIP to obtain input regarding the quality of the system” (translated from the interview with Mr. Widodo).

Collaboration with universities and other institutions provides access to technical perspectives that may not be available exclusively within the Pharmacy Installation. This approach is consistent with design-oriented digital health research, which emphasizes iterative development through engagement with relevant stakeholders and contextual evaluation (Shania et al., 2026). External input can support the identification of usability problems, technical weaknesses, and opportunities for feature refinement before modifications are fully implemented. The collaborative model therefore represents an institutional mechanism for maintaining technological quality while incorporating perspectives beyond routine internal operations.

Despite the existence of development plans and external collaboration, financial capacity remains a substantial constraint on the sustainability of SOBAT IF. Mr. Widodo explained,

“Everything depends on the budget; if funding is available, development will certainly continue” (translated from the interview with Mr. Widodo, Information and Technology Officer).

This statement indicates that the continuity of technological innovation is strongly influenced by the availability of resources for system maintenance, feature development, and technical improvement. Evidence from digital health implementation research suggests that sustainability requires organizational support and the capacity to maintain technological interventions beyond their initial implementation phase (Merdekawati et al., 2024). Budget constraints may therefore create a gap between identified technological needs and the institution's ability to implement those improvements within the desired timeframe. The issue is particularly relevant because postponement of system development may gradually reduce the application's ability to respond to changing pharmaceutical management requirements.

The sustainability of SOBAT IF is also closely connected to the capacity of the organization to maintain user engagement while introducing new technological functions. New features such as system integration, automated notifications, and expanded real-time monitoring may provide operational benefits, but their effectiveness will depend on whether users can incorporate these functions into established workflows. Research on task-technology fit demonstrates that continued engagement with digital health systems depends on the extent to which technological capabilities correspond to users' practical tasks and requirements (Ridwan et al., 2026). The planned development of SOBAT IF should therefore consider technological enhancement together with user readiness, infrastructure stability, and workflow compatibility. A development strategy focused exclusively on adding features could create additional complexity if users are not adequately prepared to employ them.

The findings establish that the long-term sustainability of SOBAT IF depends on the interaction between technological development, institutional resources, external collaboration, and user capacity. The Pharmacy Installation has demonstrated a proactive orientation toward system improvement through planned feature development and collaboration with external institutions. This orientation corresponds with evidence that sustainable digital health innovation requires continuous adaptation and stakeholder involvement rather than static system deployment (Sumarsono et al., 2023). At the same time, the identified budget constraint represents a structural factor that may determine the pace and scope of future innovation. The sustainability of SOBAT IF therefore requires a balanced development strategy in which technical improvements are accompanied by adequate financing, infrastructure support, user training, and systematic evaluation. Such an approach would allow the application to retain its operational relevance while adapting to evolving pharmaceutical management needs within the Semarang City healthcare system.

CONCLUSION

The evaluation demonstrates that the “SOBAT IF” Innovative App has played an important role in strengthening digital pharmaceutical logistics management within the Semarang City Health Department, particularly in pharmaceutical recording, distribution monitoring, and stock control. Based on interviews with five personnel from the Semarang City Pharmacy Installation, the application was positively received from its initial implementation because its barcode tracking, real-time information, batch identification, and visual expiry indicators support faster and more structured pharmaceutical management. The ability to monitor vaccine distribution by facility, quantity, and batch number also facilitates verification, reporting, and operational decision-making in routine pharmaceutical services. The reported decrease in the value of expired pharmaceutical losses from Rp93,480,333.00 in 2022 to Rp81,531,932.00 in 2024 provides an empirical indication of improved inventory control, although this change cannot be attributed exclusively to SOBAT IF because the qualitative evaluation did not isolate other organizational factors. The findings also show that the application's effectiveness remains influenced by infrastructure conditions, particularly unstable internet connectivity, and by differences in digital competencies among personnel. Internal guidance and direct assistance have helped address these human-resource limitations, indicating that successful digital transformation requires

technological functionality to be accompanied by adequate user capacity. The evaluation positions SOBAT IF as a useful digital innovation for pharmaceutical management while emphasizing that its long-term effectiveness depends on continuous adaptation to operational, technological, and organizational requirements.

Future development should prioritize sustainable improvement of SOBAT IF through stronger real-time tracking, automated distribution notifications, improved data visualization, and integration with related health information systems to increase information timeliness and support more responsive decision-making. System development should also be accompanied by regular user training and task-oriented technical assistance so that differences in digital literacy do not reduce the practical benefits of the application. Strengthening internet infrastructure is equally important because system accessibility and operational continuity remain dependent on stable connectivity during pharmaceutical distribution and monitoring activities. Collaboration with universities, technology experts, and relevant healthcare institutions should be maintained to provide independent technical input and support iterative system evaluation. Adequate institutional budgeting is also required because limited financial resources may delay feature development, system maintenance, and technological adaptation. Future evaluations could employ mixed-method or longitudinal designs to examine changes in efficiency, user satisfaction, system usability, and pharmaceutical losses using measurable indicators over a longer implementation period. These strategies can support the transformation of SOBAT IF from an operational digital application into a sustainable pharmaceutical information infrastructure that remains responsive to the evolving needs of healthcare services in Semarang City.

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