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DEVELOPING A RESPONSIVE DIGITAL FINANCIAL SYSTEM TO IMPROVE TRANSPARENCY IN COMMUNITY-BASED FOREST INSTITUTIONS

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ABSTRACT
The digitalization of community-based institutions is crucial for improving transparency and accountability in financial governance in rural areas. However, institutions such as the Village Forest Management Institution (LPHD) still rely on manual, non-standardized, and error-prone record-keeping. This study developed a responsive and simple digital financial system to address the limited digital literacy and technical conditions of the Darunu Village LPHD. The study used a qualitative approach and participatory design to ensure the application's suitability to user needs, through needs analysis, prototype development, and field trials. The results showed that the application was able to improve record-keeping, clarify cash flow, and strengthen the institution's financial transparency. The novelty of this research lies in the development of a digital financial application specifically designed for LPHDs, taking into account the socio-technical context of forest villages, unlike village financial applications that are generally oriented towards formal government apparatus. The contribution of this research is to present a replicable, lightweight financial system model for community-based forest institutions and provide a participatory design framework for digitizing village administration. These findings confirm that contextual digital solutions can be an effective approach to strengthening financial governance in forest village communities.

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INTRODUCTION

Digital transformation in village governance continues to emerge as a key strategy for improving transparency, accountability, and the quality of public services, particularly in developing countries (Djatmiko et al., 2025). In Indonesia, the application of information technology in village governance has been proven to facilitate administrative processes, financial record-keeping, and data-driven decision-making (Normawati et al., 2025). The growing need for transparent governance is also driven by demands from communities and supporting institutions for villages to provide accurate and accessible financial reports (Mawansyah, 2024). However, the digital divide remains a crucial issue in implementing

technology at the grassroots level, particularly among community-based institutions with limited technical capacity (Anuyah et al., 2023).

One institution facing this challenge is the Village Forest Management Institution (LPHD), which has a crucial mandate for community-based forest resource management and forest village economic development (Christmas et al., 2021). Various studies have shown that most LPHDs still use manual recording methods in the form of notebooks or unstructured records, making them prone to errors, difficult to audit, and unable to produce standardized financial reports (Yuniarto & Siregar, 2025). This reliance on traditional methods not only hinders financial accountability but also limits the capacity of LPHDs to access funding, technical support, and institutional collaboration, which often require formal reporting (Diokno-Sicat et al., 2020).

Furthermore, LPHDs have distinct institutional characteristics from formal village government structures. LPHDs are established as community-based institutions that collectively manage village forest areas. Therefore, their organizational structure, work patterns, and administrative capacity are highly dependent on community participation. Unlike village governments or Village-Owned Enterprises (BUMDes), which receive regular assistance regarding financial management, LPHDs often lack administrative staff with accounting competencies or adequate record-keeping skills. This situation results in financial recording processes not only being manual but also lacking clear operational standards and often relying on the initiative of specific individuals within the management. This unstable managerial system increases the risk of errors, data loss, inconsistent reporting, and weak internal controls.

Various studies on community-based natural resource management show that community-based forest management institutions in developing countries often face similar administrative challenges: low institutional capacity, a documentation burden that is disproportionate to human resource capacity, and a lack of technological tools to support systematic data management. In the context of LPHDs, the burden of administrative responsibility is even greater because these institutions manage ecological resources that have broad environmental and social consequences. However, despite the LPHD's significant responsibilities, its record-keeping capabilities have not evolved in line with increasing accountability demands from supporting institutions such as the Ministry of Environment and Forestry, donor agencies, and conservation partner organizations.

One of the biggest challenges is the lack of a digital system specifically designed for LPHD. Existing systems, such as village finance applications, village-owned enterprise

(BUMDes) applications, or government administration platforms, are unsuitable because they fail to consider the LPHD's semi-formal, flexible, and field-based workflow. LPHDs require a record-keeping system that can operate even with simple devices, limited internet connections, and involves users with varying digital literacy. Therefore, a digital approach that is adaptive, responsive, and easy to operate is a critical need to ensure the sustainability of LPHD governance.

From an academic perspective, there is a clear research gap. The majority of research on the digitalization of village governance focuses on village governments and BUMDes, while studies on the digitalization of village forest institutions are either almost non-existent or very limited. This is despite the unique characteristics of LPHDs that require a different approach than other village institutions. This misalignment underscores the need for research that explicitly examines how digital systems can be designed based on the work needs of LPHDs, rather than simply adapting existing applications for different contexts. In other words, the research gap lies in the absence of digital system models specifically designed for village forest institutions with limited administrative and technological capacity.

By broadening our understanding of the institutional challenges, work dynamics, and socio-technical conditions of LPHDs, this research seeks to develop an effective digital approach based on real needs in the field. This also strengthens the argument that digital solutions for community-based institutions cannot be generic but must be tailored to the social, ecological, and technical context of the organization.

Furthermore, LPHDs generally operate in rural areas with low digital literacy, limited device availability, and unstable internet access. Therefore, digitalization efforts require a more contextual and user-friendly approach (Rahman & Jyoti, 2022). The complexity of these issues highlights the need for digital solutions that address LPHDs' unique needs and can function effectively despite technical and administrative limitations. Therefore, this research aims to formulate and answer the main question: how can developing a responsive, simple, and contextual digital financial application improve the transparency and effectiveness of LPHD cash management in forest villages?

The research objectives include:

1. developing a digital financial application based on the needs of the Village Forest Management Institution (LPHD)
2. testing the application's implementation and usability in low-digital literacy environments,
3. evaluating its impact on transparency and accuracy of financial records.

The main contribution of this research is to offer a replicable digital system model for other village forest institutions, while also expanding the academic discourse on the digitalization of community-based institutions.

LITERATURE REVIEW

Literature reviews on village digitalization show that information technology can strengthen financial governance, reduce human error, and increase the accountability of public institutions at the local level (Omweri, 2024). Various studies emphasize that digital systems help accelerate report preparation, provide clearer transaction records, and facilitate audit processes (Islam et al., 2022)(Friday et al., 2024). In the village context, administrative digitalization has been widely implemented through village information systems and government financial applications, but most of these studies focus on formal village officials, rather than community-based institutions such as the Village Forest Management Agency (LPHD) (Ikbal et al., 2025).

Studies on LPHDs themselves have focused more on ecological aspects, such as community empowerment, forest conservation, and ecosystem sustainability (Massiri et al., 2025)(Insani et al., 2023). Meanwhile, the financial management aspect of LPHDs has been relatively rarely addressed by previous research. Yet, transparent and accurate financial capacity is a crucial foundation for the sustainability of village forest institutions and their access to funding and partnerships (Anggareka, 2024). The alignment between forest governance and financial governance is a critical aspect that has not been widely addressed by previous research (Schaefer et al., 2021).

In addition to the limited attention to financial aspects, several studies have also highlighted that the administrative capacity of LPHDs lags far behind that of other village institutions. This is due to limited human resources, a workload dominated by field activities, and limited access to technology-based financial management training (Nyongesa & Westhuizen, 2025). In the context of forest-based program management, LPHDs are often required to prepare detailed financial reports, from recording forest product revenues and the use of operational funds to reporting on grants or external support. However, without a standardized and user-friendly recording system, this reporting burden has the potential to hamper the institution's effectiveness and erode stakeholder trust. This situation reinforces the urgency of research into how digitalization can support LPHD management, not just ecological aspects.

Research on the digitalization of village institutions has largely focused on the implementation of technology within the context of formal village governance, such as village administration systems, development planning applications, and accounting platforms for Village-Owned Enterprises (BUMDes) (Umar et al., 2025). These systems are generally designed for organizations with hierarchical structures, more stable staff capacity, and strong regulatory support. This differs fundamentally from LPHDs, which operate more flexibly, have lower digital capacity, and rely on participatory mechanisms for decision-making. Therefore, the digital approach applied to LPHDs must take into account the characteristics of the community, fieldwork patterns, and technological limitations that are unique to forest villages. This gap between formal digital models and the needs of community-based institutions opens up research opportunities for developing financial applications that are truly contextual and easy for LPHDs to operate.

Literature on rural digital literacy indicates that the success of technology implementation is greatly influenced by the alignment between application design and user capacity (Mwanza, 2022). Developing community-based systems requires a participatory approach that places users at the center of the design, ensuring that applications function effectively within local social and technical conditions (Geekiyanage & Fernando, 2021). Studies on participatory design also emphasize the importance of simple interfaces, mobile access, and features accessible to users with limited digital skills (Henni et al., 2022).

Literature on technology for rural communities indicates that the successful adoption of digital systems is influenced by the socio-ecological conditions in which the institution operates. In forest villages, barriers such as low digital skills, minimal technological infrastructure, and reliance on low-cost devices are factors that limit the effectiveness of overly complex digital systems (Samsudin et al., 2024). Other studies also emphasize that digital applications developed without considering the local context tend to fail because they are not relevant to the working patterns of community-based institutions (Chowdhury & Alzarrad, 2025). Therefore, a system design approach for LPHDs must consider the institution's flexible working methods, limited user capacity, and unstable network conditions. These contextual needs demonstrate the need for innovative digital financial systems that are not only simple and responsive but also developed based on a deep understanding of LPHD operational dynamics.

This research thus fills a significant gap in the literature: the lack of digital financial systems explicitly designed for LPHDs and tested in the context of forest villages with low digital literacy. This research approach offers both practical and academic contributions by

providing an application model that can serve as a reference for village forest institutions in other regions (Mahmoudi et al., 2023).

METHODS

This research used a qualitative approach with a participatory design to ensure that the developed digital financial application truly aligns with the operational context and user capacities of the LPHD. A qualitative approach was chosen because this research emphasizes an in-depth understanding of the financial recording process, the institution's work patterns, and user perceptions of technology. A participatory design was used because LPHD is a community-based institution with varying levels of digital and administrative literacy, making user involvement crucial to producing a relevant, user-friendly, and sustainable system.

The research design consisted of three main stages: (1) needs analysis, (2) application development, and (3) initial testing. During the needs analysis stage, data was collected through in-depth interviews, observations of work processes, and documentation of previously used financial records. A purposive sampling technique was used to select informants directly involved in financial management, such as village heads, LPHD chairs, secretaries, and treasurers. This selection was based on their direct experience with manual recording, administrative challenges, and the needs of the desired digital system. The information collected included the recording process, the report format used, operational constraints, and features deemed important to users.

The application development phase was conducted using an iterative design approach, where application features were gradually refined based on user feedback. This approach allowed developers and researchers to adapt the application's interface, data structure, and workflow to suit field needs. The application was designed to be lightweight, responsive, and usable on low-spec devices and with unstable network conditions, considering the characteristics of the forest village area where the research took place.

In the initial trial phase, LPHD administrators were asked to use the application to record income and expenditure transactions that occurred over a specific time period. Data collection at this stage was conducted through direct observation, usage logs, and discussions with users regarding the application's comfort, ease of use, and challenges. The data obtained provided an overview of the application's functionality in real-world situations and aspects that needed further improvement.

Data analysis was conducted using thematic analysis techniques to identify patterns in user needs, perceptions of the application, responses to features, and changes that emerged in the financial recording process. Findings from manual recording were then compared with those from the application to assess the extent to which the application improved transparency, accuracy, and efficiency. Data validity is maintained by triangulating the results of interviews, observations, and documentation, while data credibility is strengthened through member checking by involving users in verifying the interpretation of the findings.

RESULT AND DISCUSSION

The research results indicate that the LPHD's financial recording process prior to digitization was still manual, unstructured, and lacked a standard format. Field observations revealed that some transactions were poorly documented, some records were missing, and there were no periodic cash reports accessible to stakeholders. This corroborates previous research findings that community-based institutions in rural areas are vulnerable to administrative lag due to a lack of standardized support systems (Djatmiko et al., 2025) (Yuniarto & Siregar, 2025)(Ikbal et al., 2025). This situation underpins the need for a digitalization model tailored to the LPHD's capacity.

During the financial application trial, LPHD administrators were asked to record daily transactions such as material purchases, mangrove product sales, donations, and operational expenses. The results showed a significant improvement in record keeping. Users could view total income, total expenses, cash balances, and transaction history directly through the dashboard. This finding is consistent with literature suggesting that a simple interface can improve financial management efficiency in communities with low digital literacy (Koskelainen et al., 2023)(Imjai et al., 2025). The use of mobile devices also accelerated access and simplified record-keeping for administrators who frequently worked in the field.

Thematic analysis of interviews following the trial revealed three important changes. First, users stated that the application simplifies the recording process and reduces the risk of errors that were previously common in manual systems. Second, the application clarifies transaction flows, allowing administrators to understand the institution's financial condition more quickly. Third, LPHD managers' confidence in producing more organized and reviewable cash reports has increased. This supports previous studies that found that digital systems can strengthen the transparency and accountability of village institutions (Omweri, 2024)(Friday et al., 2024).

Theoretically, the findings of this study reinforce the view that contextual digital tools are more effective than generic applications because they can adapt to the work structure and capacity of local users. The participatory design process allows applications to be developed based on real-world needs, thereby reducing technology resistance and increasing the potential for continued use. This aligns with the literature on community-based information systems, which emphasizes the importance of responsive design to the socio-technical context of users (Schaefer et al., 2021)(Henni et al., 2022).

From a comparative analysis between manual recording, the use of SIAPIK as a transitional tool, and the new application, it can be concluded that the developed application has advantages in terms of simplicity, real-time data visualization, and flexibility of use on low-spec devices. This demonstrates that small innovations designed with the limitations of village officials in mind can have a significant impact on improving cash management effectiveness.

Overall, the results of this study not only provide an empirical overview of the digital capacity enhancement of LPHDs through the use of applications, but also confirm the theoretical contribution that digitalizing community-based institutions requires a contextual, participatory, and technically light approach. Therefore, the research proposition that can be concluded is:

The results of this study also indicate that strengthening the digital capacity of LPHDs is determined not only by the availability of new technology, but also by how it integrates with existing work processes at the community level. In other words, the effectiveness of digitalization is not determined solely by application features, but by the alignment between system design, management work patterns, and the institution's socio-ecological context. Field observations show that when applications are tailored to LPHD operational needs—from transaction types and organizational structure to management record-keeping styles—the level of application acceptance and use is significantly higher. This finding aligns with the literature on technology adoption in community-based institutions, which emphasizes that technology fit with local capacity is a critical determinant of successful digital system implementation.

This study reveals that digitalization has a broader impact on LPHD internal governance. Access to more structured and transparent financial data encourages more open internal discussions about the institution's cash flow, fund usage, and long-term planning needs. This demonstrates that digital applications can be a catalyst for changes in managerial behavior and increased accountability among members, rather than simply an administrative tool used

to record transactions. These findings strengthen the argument that digitalization in forest village institutions is not only instrumental but also transformative in shaping an organizational culture based on transparency and collaboration.

Furthermore, this study demonstrates that the successful implementation of financial applications in community-based forest institutions (LPHD) has the potential to fill a gap in the literature regarding the digitalization of community-based forest institutions. To date, research has focused more on the digitalization of village governments or Village-Owned Enterprises (BUMDes), while LPHDs have very different structures, capacities, and needs. Thus, this study expands academic contributions by demonstrating that a simple and participatory digital model can be an effective approach for institutions with technical limitations but high accountability requirements. This underscores the urgency of developing digital systems that are truly based on local contexts, rather than simply adapting existing formal village administration platforms.

Overall, these findings reinforce the understanding that LPHD digitalization requires an approach that encompasses not only technical but also social and institutional elements. A responsive and lightweight digital financial system should be positioned as part of a long-term strategy to strengthen village forest governance, increase community trust, and open up opportunities for collaboration with external parties. Therefore, before formulating the final research proposition, it is important to emphasize that successful digitalization in LPHD depends on a combination of participatory design, technological suitability, community support, and an understanding of the institution's operational conditions.

"A digital financial application designed in a participatory manner and tailored to the capacities of LPHD users can improve the transparency, accuracy, and efficiency of financial management of village forest institutions."

This proposition can be further developed in future studies by testing it on LPHDs in other regions or by conducting a long-term evaluation of changes in financial management behavior following application adoption.

CONCLUSION AND SUGGESTION

This study concludes that a digital financial application developed in a participatory manner and adapted to the operational context of the Village Fund Management Institution (LPHD) can effectively increase transparency, accuracy, and efficiency in financial management. The responsive, simple, and easily accessible application via mobile devices has been shown to improve daily recording processes, reduce error rates, and clarify the

institution's cash flow, addressing the key issues of limited manual recording and low digital literacy. These findings suggest that a digital system designed to meet the needs of forest village users can be a practical solution for LPHDs in strengthening financial governance.

This study has several limitations that should be considered when interpreting the results. The application trial was conducted in only one LPHD (Regional Village Fund Management Institution) for a relatively short period, making it impossible to observe long-term changes in financial behavior. Digital infrastructure limitations and variations in user capabilities were also not thoroughly analyzed in a broader context. Furthermore, this study did not evaluate the application's effectiveness when integrated with a larger village information system. These factors allow for further testing in different locations and operating conditions.

Future research is recommended to expand the application's implementation to other LPHD areas to test the consistency of findings and conduct long-term evaluations of changes in financial management behavior. Developing additional features such as automated reporting, audit trails, or integration with village information systems could also be considered to enhance the application's usability. Support for local stakeholders in the form of training, digital tools, and network infrastructure is essential for sustainable application adoption and greater benefits for village forest management communities.

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