

Implementation Challenges of Smarter and Integrated Local Health Information System

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Abstract. Health Information Systems (HIS) play a vital role in forming coordinated and data-driven healthcare. However, in many local settings, these systems operate in isolation, unable to share data with other platforms, which causes interoperability issues. Interoperability is essential for linking records, enabling timely decisions, and achieving Universal Health Care (UHC). In response to this, the Smarter and Integrated Local Health Information System (SMILHIS) emerged to connect health databases and promote interoperability. However, SMILHIS' implementation has faced challenges. Understanding these challenges is essential for strengthening strategies, improving healthcare delivery, and supporting the realization of Universal Health Care. This study used a descriptive qualitative design, employing Key Informant Interviews (KIIs) with 10 purposively selected participants in Cagayan de Oro and San Carlos City, Pangasinan. Thematic analysis revealed four major themes: (1) Governance and Strategic Direction, including leadership turnover, shifting priorities, local autonomy, policy gaps, and the need for national support; (2) Institutional Capacities and Readiness, highlighting staffing shortages, limited technical expertise, and the need for training and organizational commitment; (3) Technological, Financial, and Infrastructure Constraints, such as inadequate funding, equipment shortages, and data privacy concerns; and (4) External and Environmental Challenges, including geographic inaccessibility and competition from private systems. The study revealed that the success of health information systems is determined not only by technology but also by governance, leadership stability, and institutional readiness. The results underscore the importance of developing stable policies that can withstand political transitions, ensuring long-term financial stability, building institutional and human resource capacity, and fostering stronger coordination between national and local governments. By addressing these areas, HIS such as SMILHIS can become more resilient and sustainable, leading to more efficient service delivery, continuity of care, and promoting the country's progress toward Universal Health Care.

Keywords: SMILHIS; Health information system; Interoperability; eHealth solutions; Implementation challenges; Digital health initiatives.

1.0 Introduction

The integration of digital technologies into public health systems is transforming how healthcare is delivered and managed, particularly in countries where strengthening their healthcare systems is a national priority. In the Philippines, the development and adoption of Health Information Systems (HIS) reflect a growing commitment to enhancing data-driven decision-making and improving service delivery (Evio & Bonito, 2024). Despite these

advancements, one of the most persistent challenges is interoperability, or the ability of different systems to exchange, interpret, and use data seamlessly. Several HIS platforms have already been developed and deployed in the country, but many of them continue to operate in silos rather than as integrated networks. This means that patient data are often stored in separate systems that cannot communicate with one another, resulting in duplicated or inconsistent health records, incomplete patient histories, and difficulties in consolidating information. This lack of integration impacts coordination between facilities, making it challenging to track referrals, monitor patient transfers, or share real-time updates on health service capacity. Ultimately, these inefficiencies reduce the ability of health systems to respond effectively, delay decision-making, and affect the continuity and quality of care (Garcia et al., 2021).

Recognizing the urgent need for more integrated and interoperable health information systems, several key policies have been implemented in the Philippines. The call for standardization of health data was strongly emphasized with the passage of the Universal Health Care (UHC) Act (RA 11223) in 2019, which seeks to ensure equitable access to healthcare services for all Filipinos. Beyond expanding coverage, the UHC Act mandates the integration of health systems across provinces and cities, highlighting its role in coordinated and equitable healthcare delivery. The law also emphasizes capacity building, research, and health promotion as essential strategies to ensure that integration efforts are sustainable and inclusive. Complementing this, the DOH National Objectives for Health (2023–2028) introduced the 8-point action agenda as the country's strategic roadmap to strengthen the health system. Among its priorities is addressing the persistent fragmentation caused by multiple standalone digital health platforms, which, while useful in isolation, often hinder coordination and continuity of care since they cannot communicate with each other (Department of Health, 2023). To further strengthen the evidence base for reform, the National Unified Health Research Agenda (NUHRA) 2023–2028 also underscored the importance of building resilient health systems in support of UHC. One of its stated priorities is the integration of local and provider network information systems, ensuring that health data can be consolidated and used effectively to inform planning and decision-making at both the local and national levels. Importantly, NUHRA highlights the value of studying the experiences of early-adopting LGUs, whose local innovations and challenges can provide critical lessons for scaling up HIS across the country. By documenting these localized experiences, policymakers, system developers, and training institutions can design more effective policies, develop more responsive systems, and create more training programs.

In response to the national call to promote interoperability or a more integrated healthcare system, the Smarter and Integrated Local Health Information System (SMILHIS) was developed. SMILHIS was founded by the Institute of Philippine Culture of Ateneo de Manila University, which aims to create an inclusive and connected health ecosystem (ADMU-IPC, 2024). SMILHIS aims to consolidate fragmented health information systems and databases by enabling integration across local government units (LGUs). Rather than requiring the replacement of existing platforms, SMILHIS adopts a federated data integration model, which allows different systems to interconnect and share information while maintaining their original structure and function. This approach is particularly well suited to decentralized health systems such as the Philippines, where LGUs often vary in terms of digital maturity, infrastructure, and resources. At the core of SMILHIS is an interoperability layer, which functions as a central access point for shared health data across the network. This layer enables real-time communication between facilities, allowing frontline providers to initiate referrals, track patient transfers, and access updated capacity data from receiving facilities. By doing so, SMILHIS will reduce the inefficiencies of siloed systems and enhance coordinated patient care. In practice, this means that patient information can follow individuals as they move across facilities and levels of care, supporting continuity of treatment and more efficient allocation of healthcare resources.

Despite its potential, the implementation of SMILHIS has encountered significant challenges that reflect broader difficulties in the adoption of digital health. Among the most pressing issues are overlapping financial responsibilities and limited stakeholder engagement at the local level (Co et al., 2024). Luz et al. (2021) also highlighted that even with the presence of enabling policies, adoption across LGUs remains uneven, highlighting that national directives do not automatically translate into local implementation. These difficulties mirror global experiences, where large-scale health information systems in developing countries are frequently obstructed by low provider acceptance, unstandardized and non-interoperable systems, inadequate monitoring, and reliance on short-term project-based funding (Bagherian & Sattari, 2022; Luz et al., 2021).

Implementing HIS, such as SMILHIS, also requires navigating a complex mix of institutional and socio-political challenges. A further challenge relates to the digital divide between urban centers and geographically isolated and disadvantaged areas (GIDAs), specifically the unreliable internet and network connectivity (Brittler et al., 2023). Many rural health facilities lack stable internet connectivity, functional hardware, and sufficient IT support. This not only delays clinical decision-making but also reduces the timeliness and quality of care provided (Tinam-Isan & Naga, 2024). Financial constraints exacerbate the situation. The acquisition and maintenance of digital health technologies are often costly, and expenses do not end with the initial purchase; recurring costs for updates, licensing, and upgrades create additional burdens for resource-limited LGUs (Pakulska & Religioni, 2023). Another persistent barrier is the dependence on donor-driven or project-based funding. Several technological projects have relied on external financing, raising concerns about their long-term viability once initial funding cycles end (Seposo, 2019). Without stable financial support, systems risk becoming obsolete or dysfunctional due to the lack of resources for maintenance, system upgrades, and human resource development. A key limitation of existing national digital health policies is that deployment is sometimes emphasized over sustainability, prioritizing the rapid rollout of systems rather than ensuring their long-term operation. To address this gap, there is a pressing need to shift from short-term project-based goals to long-term investment strategies that prioritize sustainability, scalability, and continuous improvement of HIS.

Understanding these barriers is essential not only for assessing the feasibility of current projects but also for shaping more effective digital health strategies in the future. Evaluating the experiences of local governments and frontline implementers is critical to ensuring that health information systems are responsive to the needs of the communities they serve. The absence of localized data makes it challenging to generate lessons for long-term sustainability and scale-up, leaving unanswered questions on how national digital health strategies translate at the community level. This gap highlights the need for grounded, localized perspectives on digital health adoption, a particularly significant aspect in decentralized health systems like the Philippines, where implementation can vary significantly between regions.

This study highlights the specific challenges encountered during the implementation of the Smarter and Integrated Local Health Information System (SMILHIS) in San Carlos City, Pangasinan, and Cagayan de Oro City. By focusing on the perspectives of key informants directly involved in the implementation process, the study provides a contextualized understanding of the technical, institutional, and governance issues at play. These localized insights are not only crucial for improving SMILHIS but also hold relevance for other digital health initiatives in the Philippines. In doing so, the study contributes to broader efforts in strengthening digital health governance, offering actionable recommendations that can inform and guide future implementations. Ultimately, this research supports the advancement of a more integrated, resilient, and data-driven healthcare system aligned with the country's pursuit of Universal Health Care.

2.0 Methodology

2.1 Research Design

This study employed a descriptive qualitative research design to explore areas where knowledge about SMILHIS remains limited, rather than focusing exclusively on a single, well-defined phenomenon (Ayton, 2023). The design was particularly well-suited to capturing the perspectives of key informants directly engaged in the implementation of SMILHIS, thereby allowing for an understanding of their experiences. Given the limited literature on SMILHIS, this approach facilitated the exploration of narratives that highlighted the factors shaping system implementation in real-world contexts. By emphasizing participants' responses, the study generated a contextually grounded account of the barriers, producing evidence that can inform policy, strengthen sustainability strategies, and guide implementation. A descriptive qualitative design is also frequently adopted in studies that do not require theoretical framing but instead aim to present participants' accounts in a clear and accessible way. Its primary value lies in producing straightforward descriptions of experiences and perceptions. Within healthcare research, this design has been shown to contribute to the development of interventions and inform policies (Doyle et al., 2019).

2.2 Research Locale

The participants in this study were implementers who handled SMILHIS in Cagayan de Oro City (CDO) and San Carlos City, Pangasinan, two of the earliest sites to adopt SMILHIS. Their early adoption of the system positioned them as key informants who could provide rich, experience-based insights into the various challenges encountered during the implementation process.

2.3 Research Participants

The study included 10 Key informants who had direct involvement in SMILHIS implementation. The chosen sample size ensured data saturation while allowing for a comprehensive analysis of participants' perspectives. A purposive sampling technique was employed to ensure that only individuals with firsthand knowledge and experience in implementing SMILHIS were selected.

Participants in this study were selected based on predefined inclusion criteria. First, only individuals who voluntarily agreed to participate by signing the informed consent form were considered, thereby upholding ethical standards. Second, participants were required to have direct involvement in the implementation of the SMILHIS system, specifically including program managers and leaders, healthcare workers serving in the eHealth Technical Working Groups, and other key stakeholders. Finally, participants were expected to have been engaged in the implementation process for a minimum of two years. This criterion ensured that participants possessed substantial, firsthand experience with the system throughout its implementation cycle.

3.0 Results and Discussion

This section presents the themes that emerged, including Governance and Strategic Direction, Institutional Capacities and Readiness, Technological, Financial, and Infrastructure Resource Challenges, and External and Environmental Challenges.

3.1 Governance and Strategic Direction

Several participants emphasized the significant role that governance played in the implementation of SMILHIS. They highlighted the influence of local leadership as a crucial factor in integrating the system into existing workflows. As highlighted by Akwei et al. (2020), factors such as leadership transitions, shifting political agendas, and actions of project leaders can disrupt program implementation and influence the achievement of intended outcomes. Table 1 presents the subthemes and codes under the Governance and Strategic theme.

Table 1. Governance and Strategic Direction Subthemes and Codes

Subthemes	Codes	Interpretation
Political and Administrative Stability	Leadership Changes and Term Limits	Refers to a transition in administration and governance
	Changes in Administrative Priorities	Refers to a shift in focus or direction
	Local Government Autonomy	Refers to the LGU's power to make independent decisions
Policy Environment and Regulatory Support	Policies	Refers to formal instruments that guide implementation
Strategic Direction and Multisectoral Coordination	Strategic and Sustainability Frameworks	Refers to long-term plans and frameworks
	Intersectoral Collaboration and Partnerships	Refers to coordinated efforts among key sectors
	Support from National Health Authorities	Refers to guidance and assistance from national health agencies

Political and Administrative Stability

In implementing projects, having a politically and administratively stable environment is crucial. The success of a project is often linked to the presence of strong political leadership and a stable administration, as these factors influence the direction of policy, resource allocation, and stakeholder engagement (Iqbal et al., 2024). However, leadership changes are inevitable, and what makes these transitions particularly challenging is the disruption they pose to the continuity and momentum of project implementation. In the Philippines, national elections occur every six years, while local and midterm elections take place every three years. These regular political shifts, especially at the local level, present a significant barrier to the sustained implementation of programs. New administrations may not be fully oriented to, or supportive of, existing digital health initiatives, often resulting in delays, resource reallocation, or even premature termination of projects.

As noted by Ma et al. (2021), projects are at risk of being halted when their goals conflict with the objectives of the newly elected administration. Additionally, it is not uncommon for incoming officials to disengage from or even discontinue projects initiated by the previous administration, particularly if those initiatives are not aligned with

their own political agenda or development plans. This can hinder institutional memory and lead to the loss of valuable groundwork, forcing implementers to restart engagement processes and renegotiate commitments. Leadership transitions also frequently involve the reassignment or replacement of key technical personnel, such as program coordinators, IT officers, or health staff, which affects institutional knowledge and can disrupt continuity. As a result, implementing teams frequently find themselves racing against political timelines, striving to achieve implementation goals before another leadership transition occurs. As one participant shared:

“There was a new governor and new officials appointed also in the pilot sites. So, it became a challenge in that the project continuity was somewhat disrupted because we had to reintroduce the project and seek their approval again.” [P7]

Akwei et al. (2020) also highlighted that public perception plays a role in shaping political agendas. Citizens tend to value visible outputs, particularly physical infrastructures, over less tangible reforms. As a result, successive administrations may feel compelled to launch new, obvious programs, rather than continuing initiatives that lack physical manifestations. Continuing the previous administration's projects may be perceived as a lack of initiative, especially if the benefits are not immediately observable. This poses a challenge for digital health initiatives and efforts toward interoperability, which often require time before their impact is fully realized. As these are relatively new concepts in the country, their less visible nature may lead to them being overlooked or deprioritized. As stated by a participant:

“There are more pressing issues that they feel they need to prioritize first. Since interoperability is a technical issue and not something that citizens immediately feel the impact of. What people notice more is if there is a new hospital or clinic.” [P1]

Further, local government autonomy refers to the capacity of a local government or administrative unit to govern itself and make decisions independently, without interference from external authorities. In the context of governance, this allows LGUs to determine their own priorities, policies, and allocate resources based on local needs and conditions. Citing Article X, Section 2 of the 1987 Philippine Constitution, local governments shall have local autonomy or control for them to have the capability to attain their fullest potential as a self-supporting locality, which in turn, will make them more efficient in reaching or fulfilling national goals, while still operating within the framework of a larger political structure. Autonomy, therefore, enables LGUs to have more effective responses and remain sensitive to local contexts.

Despite this, it may also pose a challenge in executing programs that require coordination at the national or even regional level. For example, despite LGUs having the advantage of institutional mechanisms at their disposal to support economic development, these mechanisms are not always utilized. This results in only some LGUs fully supporting the implementation of a program, while others may not be on the same page. This variability can create difficulties in achieving integrated and standardized outcomes across regions. In political systems where authority is distributed across multiple levels, the national government typically has a restricted ability to enforce action at the local or regional level. There are instances where provinces or states decline to implement national initiatives, even when the central government provides strong financial motivations (Campos & Reich, 2019). For instance, SMILHIS data sourcing became a challenge because the central government has limited authority to instruct LGUs to coordinate their registries into the server. This volunteer-based approach led to difficulty in convincing LGUs, for instance, to participate in the program. According to a participant:

“That was also part of the problem with the limited buy-in, because the Provincial Health Office does not really have direct control over the LGUs, since the cities and municipalities under the province are still autonomous. So, they can choose whether or not to participate.” [P10]

Overall, it is emphasized that leadership and support should be distributed as widely as possible across various levels to advance policies and programs. However, it is not as simple as issuing directives from the top and expecting everyone to follow because authority and responsibilities are spread across many levels: national, regional, provincial, and municipal (Campos & Reich, 2019). Uneven relationships between provincial governments and component cities or municipalities may result in inconsistent program adoption and considerable governance complexities. This applies equally to leadership misalignment, such as when chief

executives do not share the same vision, which can hinder coordination and create reluctance among implementing teams to engage.

While there are instances where new leaders continue to support initiatives from the previous administration, this support is often limited. Even subtle shifts in priorities can lead to delays, reduced resources, or the eventual discontinuation of ongoing projects. During political shifts and changes in priorities, the absence of well-planned transitions and policies can create discontinuities that undermine project progress.

Policy Environment and Regulatory Support

A strong policy environment can guide LGUs in adopting, aligning, and institutionalizing programs initiated at the national or regional level. The policy environment and regulatory support refer to the broader legal and institutional frameworks, involving continuous engagement with industry stakeholders, experts, and the public to ensure that regulations remain responsive to evolving needs. While policies are essential to ensure order and accountability, overly rigid or outdated regulations can unintentionally slow progress or discourage innovation. To address this, regulatory approaches shall remain flexible and adaptive, allowing room for adjustments as technologies evolve. This includes ordinances, executive orders, formal agreements, and other mechanisms that define roles, responsibilities, and expectations among stakeholders, while still being open to refinement through ongoing consultation and learning.

Moreover, challenges may also arise when policies are either too general, non-binding, or inconsistently enforced across LGUs. The absence of binding policies may result in varying degrees of engagement, data submission, or program compliance, which can impact implementation. This lack of enforceability can be particularly challenging in decentralized systems, such as the Philippines, where local governments have substantial autonomy in deciding which programs to prioritize. In such cases, national programs risk becoming fragmented, with uneven adoption across regions and a weakened overall impact.

In practice, the presence of strong policies can help reduce ambiguity and ensure accountability across implementing units. These formal and legal instruments, such as local ordinances, resolutions, executive directives, and institutional agreements, are essential for guiding the execution of programs and for understanding the broader decision-making process in local governance. According to Haris and Yang (2023), inconsistencies in policy implementation and direction, especially in politically unstable environments, have been significant barriers to project execution. When policies are unclear, frequently changing, or not properly enforced, they contribute to delays, confusion, and inefficiencies in implementation. This further highlights the need for stable and clearly defined policy frameworks to support consistent program delivery at the local level. A participant shared:

“But it is really about governance, what they call techno-governance. The technology is available, but governance is just as important. You need policies that would obligate the LGUs, or that would mandate their participation or the submission of data, for example.” [P10]

Overall, non-binding policies make it difficult to establish accountability mechanisms. When expectations are not legally mandated, monitoring progress or enforcing compliance becomes more challenging for oversight bodies. This can lead to reporting gaps and inconsistent data quality. It may also discourage implementers, who may hesitate to invest time and effort into initiatives that lack clear institutional backing or long-term security. This highlights the need for national agencies and implementing bodies to work toward policy instruments that are well-defined and harmonized with local frameworks.

Strategic Direction and Multisectoral Coordination

This centers on the importance of planning and collaboration in ensuring the effectiveness of implementing digital health systems, such as SMILHIS, and the development of long-term strategic frameworks that are resilient to political transitions and administrative turnover. Equally critical is the clear delineation of roles and responsibilities among stakeholders, as well as the creation of scalable and context-specific implementation models. Multisectoral coordination also means bringing together professionals from diverse sectors, such as health, information technology, governance, finance, and civil society, to address the systemic nature of public health challenges.

The long-term viability of HIS also depends on implementation frameworks that remain stable and effective despite changes in political leadership. Without such frameworks, digital health initiatives often become vulnerable to discontinuity, mainly when they rely on the discretion or advocacy of chief executives. In many cases, leadership transitions lead to deprioritization or stalled progress, issues that also arise when no formal sustainability mechanisms are in place. As stated by a participant:

"We did not anticipate the change in leadership, so the project was not sustained. The project failed to continue because we lacked a sustainability plan." [P7]

Moreover, the implementation of SMILHIS follows the framework of Participatory Action Research (PAR), which emphasizes collaborative engagement and the belief that systems are more sustainable when stakeholders are actively involved in shaping them. However, this approach also presents challenges. In practice, the pursuit of broad participation can sometimes lead to overextension, where implementers feel compelled to consult stakeholders at every step, regardless of whether their input is necessary or relevant. This can slow down decision-making and dilute accountability. In the context of SMILHIS, where coordination and responsiveness are essential, this highlights a key implementation challenge: while PAR offers a valuable framework for building legitimacy and ownership, stakeholder involvement shall be purposeful and strategically timed to avoid decision paralysis. Critics have argued that these approaches frequently reduce participation to consultation or tokenistic involvement, rather than fostering genuine power-sharing (Pallathadka & Roy, 2025). When engagement becomes overly procedural, it risks delaying decision-making and exhausting implementers. A participant stated:

"We need to assess to what extent stakeholders should be involved. Sometimes we tend to overcompensate and expect them to contribute at every step, even when we already know their input is unnecessary. We end up overanalyzing and overthinking their participation when, in reality, their involvement can vary depending on the situation." [P9]

Additionally, achieving sustainable and effective reforms within the Philippine health system, particularly in the context of digital innovations such as SMILHIS, is not the sole responsibility of the health sector. Instead, it requires coordinated efforts across a broad range of sectors, including national government agencies, LGUs, private healthcare institutions, and civil society organizations. These sectors can strategically align their mandates and co-develop action plans to achieve the shared goal of universal healthcare (Dodd et al., 2025). In resource-constrained settings where digital health systems are still in development, such as the case studied by Nkangu et al. (2024), stakeholder collaboration becomes especially crucial.

As shared by a participant:

"Second is the collaboration, let us say, between LGUs and among facilities under one health umbrella; there could be poor collaboration. So, I do not think you can even introduce collaboration with private sectors or facilities outside the LGU if there are already problems within the LGU itself." [P6]

Moreover, the establishment of policy frameworks, combined with technical support and multisectoral coordination led by national health authorities, plays a critical role in legitimizing and expanding digital health initiatives. The active engagement of these authorities strengthens local implementation by fostering institutional trust, enhancing policy coherence, and promoting cross-sectoral partnerships. In the case of SMILHIS, alignment with the Department of Science and Technology (DOST) and the Universal Health Care (UHC) contributes to sustained program integration and credibility at the local level. This alignment reinforces the system's relevance within the broader national health agenda.

The involvement of national agencies facilitates knowledge exchange, research collaboration, and technological innovation. National-level endorsement not only signals commitment but also creates enabling conditions for local government units (LGUs) to align their efforts with health system reforms.

According to a participant:

SMILHIS might continue in the city if it becomes part of the DOH's operational guidelines under UHC implementation. The system is good, but what we really hope for is continuous implementation of SMILHIS." [P4]

Another participant shared:

“What is good here is that DOST is really supportive. They join us in brainstorming. So even if LGU buy-in is sometimes difficult, once they see it is from a national agency like DOST, they start to consider it. It is like they feel compelled to engage.”
[P9]

De Claro et al. (2024) emphasized the critical role of national health agencies in fostering trust among local decision-makers and health implementers. When national agencies clearly define their support structures, roles, and responsibilities, they create a stable foundation that encourages local actors to engage with and commit to digital health initiatives.

3.2 Institutional Capacities and Readiness

Institutional capacities and readiness refer to the structural, human, and organizational foundations that support the implementation of digital health systems, such as SMILHIS. Without these, even the most sound innovations risk delayed implementation, limited adoption, or eventual underutilization.

In the context of SMILHIS, institutional readiness involves ensuring that key personnel, including information technology officers, data managers, and frontline health workers, are adequately trained and supported. The study further emphasizes that digital health integration is not a one-time decision, but an ongoing process that requires continuous monitoring and adaptation. This is particularly relevant in decentralized health systems, such as those in the Philippines, where implementation contexts vary widely and demand context-specific planning and sustained institutional commitment. Table 2 presents the subthemes, codes, and their corresponding interpretations.

Table 2. Institutional Capacities and Readiness Subthemes and Codes

Subthemes	Codes	Interpretation
Human Resources and Expertise	Staffing and Workforce Capacity	Describes the sufficiency, technical readiness, and retention of staff
	Technical Skills and Support	Presence of technical experts and structured support systems for system maintenance and troubleshooting
	Training and Development	Efforts to build both technical and soft skills necessary for adapting to evolving digital health demands
Organizational Commitment and Culture	Institutional Commitment and Support	Depth of support and alignment from institutional leaders and governance structures
	Stakeholder Engagement	Refers to the LGUs initiative to participate in the project
	Receptiveness to Change and Innovation	Refers to the willingness to accept and implement new projects or ideas
	Understanding of UHC Principles	Refers to the understanding and knowledge of stakeholders regarding the goals, requirements, and the operations of the UHC principles

Human Resources and Expertise

Human resources and expertise represent a foundational pillar in the successful implementation and operation of SMILHIS. This integrates three interrelated dimensions: the availability of dedicated and sufficient staff, the presence of technical expertise to manage and troubleshoot system-related issues, and the establishment of continuous training and structured support mechanisms to build both individual and institutional capacity. These elements are essential for embedding digital systems into routine practice and ensuring system resilience.

A recurring challenge is the shortage of specialized personnel, particularly in information technology, despite their critical role in supporting the operation and maintenance of increasingly complex digital infrastructures. Without technically proficient staff, systems risk being underutilized, mismanaged, or poorly integrated into routine workflows. High workforce turnover further exacerbates this issue, disrupting project continuity, weakening institutional capacity, and necessitating repeated onboarding and training. As noted by Pallathadka et al. (2021), attrition significantly undermines organizational development and operational maturity. In the context of SMILHIS, frequent staff transitions often force implementers to restart foundational activities, thereby undermining momentum and threatening implementation of the initiative. As shared by a participant:

“There were also changes because the staff who were trained were also affected by the phased staff transfers. Some were reassigned to other departments, while others chose to resign. So, even within our eHealth team, we have experienced changes

– our team leaders and members are constantly changing. The colleagues you were trained or oriented with are replaced, and you constantly have to work with new people, which makes things challenging.” [P8]

Significantly, workforce constraints extend beyond local implementing units and affect the SMILHIS core implementation team itself. Participants emphasized that critical staffing shortages within the central team directly impact the rollout efforts. With limited personnel, the team also faces difficulties in providing adequate follow-through. These limitations slow feedback mechanisms and contribute to delays in implementation timelines. Such challenges underscore the need for sufficient human resources to support the effective and scalable deployment of digital health systems, such as SMILHIS. As highlighted by a participant:

“We were not able to follow up with them after we deployed the technology. That is probably one of our shortcomings... because there are only a few of us. So, follow-through has been one of our challenges; we no longer have the bandwidth to check in with them or see what has happened since.” [P1]

Furthermore, technical skills and support also emerged as critical factors. This highlighted the importance of having technologically proficient personnel, such as IT specialists, system developers, and trained healthcare staff, as well as the existence of organized processes, including system training, technical handovers, knowledge transfer protocols, and institutional maturity assessments. As highlighted by Evio and Bonito (2024), individuals with prior exposure to information and communication technology (ICT), whether through professional experience, personal use, or participation in training and seminars, demonstrated higher confidence and competence in adopting eHealth systems. This foundational familiarity facilitates smoother integration of digital tools into routine workflows.

These align with participant observations that emphasize the importance of hiring and developing local IT personnel. Locally based technical experts are more aware of the contextual realities of implementation and can communicate system requirements in a manner that is responsive to local needs. This gap reinforces the need for in-house programmers or IT professionals, preferably those embedded within the site, who can provide real-time system oversight and reduce reliance on external support. Without accessible and adequately trained personnel, even the most well-designed systems are vulnerable to failure or stagnation. As stated by a participant:

“For this project, it is essential to have an in-house programmer or IT personnel, not necessarily someone with the same level of expertise as Sir, but someone knowledgeable enough to work closely with us regularly. Sir serves as a consultant and was the one who developed the system. However, when it comes to day-to-day operations, we truly need an IT expert who can provide consistent guidance. Ideally, there should also be a technical expert based in the province or city. Although there is someone currently assigned, it would be more effective if their skill level matched that of the developer, so they can work together more efficiently and support.” [P9]

Notably, a critical issue identified in both local and global contexts is the skills gap among technical personnel, including IT staff, who are increasingly expected to manage complex and rapidly evolving digital systems. As digital health solutions become more advanced, continuous learning and upskilling are no longer optional but essential for sustaining system functionality and innovation. With this, training and development also emerged as a significant factor. It refers to systematic and continuous capacity-building efforts designed to enhance the competencies of individuals involved in the implementation and management of SMILHIS. Training initiatives encompass essential technical skills, including system navigation, troubleshooting, data entry, and data security, as well as soft skills such as leadership, communication, collaboration, and change management. Practical training and development strategies are crucial to building a digitally literate workforce that can adapt to evolving technologies and support long-term digital health transformation. As shared by a participant:

“We started with preprocessing activities like the design thinking workshop, and even bringing their teams into structured courses, which we already began offering in 2023. I think what is really needed is more capacity building, meaning, the designated technical personnel should go through a series of systematic and related courses to support the adoption and implementation process further.” [P2]

More importantly, offering inclusive training opportunities, not limited to IT staff alone, can broaden institutional awareness, empower a broader range of stakeholders, and cultivate local champions who can advocate for and support the implementation of digital health initiatives, such as SMILHIS. As highlighted by a participant:

"So, what we did was design our capacity-building efforts not just for the IT and health sectors of the local government, but we opened it to everyone. We began with general discussions about the pandemic and universal healthcare, allowing us to identify individuals who might become advocates. Once we found them, we formed sub-groups, and these were where we began tackling more technical topics, like HL7 and the technological components." [P5]

Organizational Commitment and Culture

This pertains to the internal environment crucial for the successful adoption and integration of digital health systems. A supportive organizational culture is recognized as a foundational element for change, particularly when innovations like SMILHIS necessitate cross-sector collaboration, sustained engagement, and adaptive work processes. A scoping review by Rajamani et al. (2021) reinforces this perspective, identifying a favorable organizational learning climate as a key enabler of health information technology adoption. These underscore the critical role that institutional culture plays in shaping innovation outcomes.

Institutional commitment shall extend beyond symbolic endorsement; it requires a deep understanding of the system's operational demands, strategic goals, and long-term implications. This level of engagement fosters ownership, enhances stakeholders' appreciation of the system's relevance, and improves the likelihood of successful and sustainable implementation. Stakeholders who understand both the immediate utility and long-term value of systems like SMILHIS are more likely to initiate supportive policies, secure funding, and foster intersectoral collaboration. As stated by a participant:

"My first layer is that there should be an environment that's ready to accept the system, which includes the policy part and the priorities, because that is the reality. Even if it is working, if the priorities are different and you do not have a champion inside, it can be challenging. It is tough." [P5]

According to another participant:

"Well, for the LGU, we saw that getting the buy-in from the bureaucracy is really important. Not just the mayor, because the mayor can change, but we need to get the buy-in of the Municipal Health Officer, the IT personnel, the council members (Sanggunian), because they are the ones really running the city" [P1]

Furthermore, engagement is characterized by expressions of interest, willingness to collaborate, and formal commitments such as letters of intent. Active participation often emerges when stakeholders recognize alignment between project objectives and local priorities. A study by Nilsen et al. (2020) on eHealth implementation emphasized the value of early and structured stakeholder involvement. These highlight the significance of early involvement of municipal health officers, IT personnel, and community representatives in strengthening collaboration. According to a participant:

"Usually, well, in our case at SMILHIS, it is the LGUs who approach us because they heard that there is a DOST project like this, and then they saw that the problem we are trying to solve is very similar to the problem they have. So, they are the ones who send us a Letter of Intent asking us to support that LGU" [P1]

Notably, the willingness and capacity of individuals, organizations, and systems to adopt and implement new technologies or approaches also emerged as a crucial factor. In the context of SMILHIS, this involves transitioning from traditional paper-based or fragmented systems to integrated digital health solutions. Receptiveness to change is not solely technical; it is also organizational and cultural in nature. It requires overcoming resistance rooted in long-standing routines, often through effective leadership, collaborative engagement, and a shared vision for improvement. As noted by Schlieter et al. (2022), key enablers for scaling digital health innovations include strong leadership and an adaptive organizational culture. Their study found that resistance to change frequently arises from rooted practices and unclear communication. However, when leaders clearly articulate how innovation contributes to practical service improvements, staff are more likely to adopt new systems. These findings emphasize the importance of addressing both technical capacity and organizational readiness to support sustained digital transformation. As stated by a participant:

"Because they still need guidance, since we have to understand that... until now, people are still embracing traditional practices. That is why we had a hard time integrating it into their minds back then." [P6]

Moreover, the level of understanding and conceptual clarity among stakeholders regarding the goals, requirements, and operational framework of Universal Health Care (UHC) is also important. The existence of variations in how individuals interpret the objectives of UHC and the importance of integrating systems across different levels of care also influence implementation. When UHC principles are not fully understood, support for systems championing them may also be limited or compliance-driven, rather than rooted in a shared vision or conviction. This highlights the importance of clear communication, capacity-building, and ongoing stakeholder education to ensure committed participation in UHC-aligned digital reforms. According to a participant:

“Maybe the challenge is not really unfamiliarity, but more on the differing levels of familiarity among health workers with the concepts of Universal Health Care. That is also why the project implemented an e-learning program to directly address that, so people could learn the concepts behind Universal Health Care and the context in which the SMILHIS system operates.” [P10]

According to another participant:

“I really saw that the people have to be willing to understand it. They need to understand before they can appreciate it. Because if you do not, if you do not understand it, you will not appreciate it, and you will not be able to implement it.” [P6]

The participant emphasizes the importance of investing in understanding the principles of Universal Health Care (UHC) as a prerequisite for effective implementation. It was also emphasized that appreciation and engagement with UHC are not automatic but are developed through a clear understanding of its rationale and intended outcomes. This insight highlights a broader challenge in systems-level reforms: knowledge gaps can lead to weak ownership and superficial engagement. When stakeholders do not fully comprehend the objectives of UHC or its connection to digital tools such as SMILHIS, their participation may be passive or driven by a sense of compliance. Addressing these gaps through targeted capacity-building efforts and continuous education is therefore essential to foster informed and value-driven implementation.

3.3 Technological, Financial, and Infrastructure Resource Challenges

This section addresses technological limitations and the availability of digital and physical resources. These elements are foundational to the system’s functionality. However, governments in emerging economies frequently operate within constrained budgets and are forced to make difficult resource allocation decisions amid competing priorities.

As noted by Abisoye and Akerele (2022), financial limitations often hinder the deployment of critical technologies, affecting not only their efficiency but also their implementation. These constraints are especially pronounced in resource-limited and geographically disadvantaged areas. Table 3 presents the subthemes and codes, along with their interpretations.

Table 3. *Technological, Financial, and Infrastructure Resource Challenges Subthemes and Codes*

Subthemes	Codes	Interpretation
Financial and Material Limitations	Financial limitations	Refers to limited funding capabilities
	Operational Materials and Equipment	Refers to limited availability of tools needed by the local health units to effectively use the system
Cybersecurity and Risk Management	Data Privacy	Refers to data security concerns and safeguards concerning implementation

Financial and Material Limitations

The institutional budget serves as a critical tool for resource mobilization, distribution, and economic management aimed at achieving predetermined objectives (Lorenzo et al., 2021). However, resource constraints remain among the most significant barriers to implementing digital health frameworks, particularly in low- and middle-income settings (Kaboré et al., 2022). These limitations impede the capacity of local institutions to initiate or sustain technology-driven initiatives, even when there is clear institutional interest or political support.

Even though LGUs express a willingness to adopt systems such as SMILHIS, they sometimes face delays due to the absence of secured funding and the need to align financial requests with the annual budget cycle. As noted by Villanueva (2021), the government budgeting process is inherently complex, which can lead to significant bottlenecks and implementation setbacks. Additionally, many remain dependent on external funding sources or donor grants, which further introduces uncertainty and limits autonomy in digital health adoption.

Financial constraints can also directly impact the procurement of essential operational materials, including hardware, software, and maintenance resources that are critical for effective system deployment. Delays or failures in securing these resources can prolong implementation timelines or result in the discontinuation of the initiative altogether. According to a participant:

"Because in some cases, they make a request, but they still do not have a source of funding, so we help... the process takes longer because we know that it has a timeline. We estimate that, for example, if you make a request now but you do not have a funding source yet, it will take at least one year because, of course, you will need to include it in the budget cycle." [P1]

The availability and adequacy of physical tools, digital infrastructure, and equipment should also be considered, as they highlight the practical readiness challenges faced by local health units. In many cases, the absence of basic infrastructure obstructs participation in broader system networks, regardless of institutional willingness or program availability. As emphasized by Yuwono et al. (2024), limited resources, such as capital, skilled labor, and hardware, can severely slow technological adoption by making implementation costly and less accessible. Moreover, resource limitations constrain research and development activities, thereby restricting opportunities for innovation and long-term system improvement. According to a participant:

"You can develop all the programs, but it is common knowledge that health centers do not have computers, right? That is a common problem. So that was one of my dilemmas - what to do? How to equip those facilities with computers? You cannot have the program. Where would you even plug it in? Where would you run the data collection? It becomes a problem." [P3]

In relation to this, digital infrastructure constraints further complicate implementation. Challenges frequently reported by developers and implementers include insufficient storage hardware and outdated development tools. Without a foundational digital infrastructure, even well-designed systems struggle to deliver their intended functions. A participant stated that:

"They also need another server; they cannot use the server of the main hospital. Moreover, there was also a concern and challenge when it comes to... that they do not know where to get the budget for the payment to be used there." [P7]

Connectivity issues also pose a significant limitation, as the lack of reliable internet connectivity hinders not only data transmission but also the real-time functionality of digital health systems. As noted by Bahinting et al. (2022), connectivity forms part of a complex system of institutions and processes, and constraints in this domain can disrupt service delivery and limit the overall effectiveness of health system reforms. These findings underscore the need for digital inclusion to ensure that even remote areas can fully participate in digital health initiatives.

According to a participant:

"Also, the worry is, why would you discuss health technologies when your issue is fundamental, it is the internet. So, we tried to argue that, no, the internet will not be your issue, but you really have to identify which [network] will be your [internet] provider" [P5]

Furthermore, the successful implementation of health information systems depends not only on connectivity and physical equipment but also on the quality of IT infrastructure and the competencies of those managing it. Renaldo et al. (2022) likewise assert that the presence of well-functioning digital components significantly improves communication, system reliability, and decision-making capacity. These factors highlight the need for a comprehensive approach to operational readiness. Bridging gaps in infrastructure, connectivity, and equipment is critical to enabling effective digital health integration.

Cybersecurity and Risk Management

Cybersecurity and Risk Management refers to the strategic processes and safeguards employed to protect health information systems, such as SMILHIS, from digital threats, unauthorized access, and data breaches. It includes safeguards and institutional mechanisms to build system resilience, ensure compliance, and maintain public trust. In the healthcare sector's ongoing digital transformation, cybersecurity is not just a technical concern but a core requirement for operational continuity and data protection (Garcia-Perez et al., 2023). The COVID-19 pandemic highlighted the deep interconnection between cyber risk and health system vulnerability. Without cyber readiness, health systems remain highly exposed.

The potential risks of unauthorized access, misuse, or loss of sensitive health information, particularly in digital or cloud-based systems, are significant concerns in the emerging digitalization of data. Within the context of SMILHIS implementation, such concerns are central, as local government units (LGUs) frequently raise questions about the protection of health data in the event of a breach. Al-Issa et al. (2019) emphasized that critical vulnerabilities related to confidentiality, data integrity, and regulatory compliance should be addressed. As stated by a participant:

"Because the hesitation of the LGU is that if I put [that information] in the cloud, what should be done in case of breach, because they have concerns about breach. Because the people really contested on their policies, then there is a memo on who [should] participate" [P7]

With well-defined governance mechanisms and strong security protocols, resistance from stakeholders is likely to be alleviated. To address these concerns and foster trust, institutional safeguards, such as the issuance of local ordinances and the establishment of clear data governance structures, are essential.

3.4 External and Environmental Challenges

These challenges arise from a combination of physical and geographic constraints. Participants described how real-world conditions, including the remoteness of specific implementation sites and the presence of competing digital health programs, have hindered project momentum and affected local decision-making. Table 4 presents the subthemes and corresponding codes for this theme.

Table 4. External and Environmental Challenges Subthemes and Codes

Subthemes	Codes	Interpretation
Geographic & Access Limitations	Logistical and Accessibility Constraints	Refers to geographical limitations affecting implementation
External Stakeholder Pressures	Competing Programs or Vendors	Refers to vendor competition and marketing influencing LGU decisions
	System Promotion and Outreach	Refers to marketing strategies by competing vendors

Geographic and Access Limitations

A key factor identified is geographic distance, which limits the frequency and feasibility of in-person meetings. Stakeholders noted that long travel times significantly affect coordination efforts, especially for those based in remote areas. A significant barrier cited by stakeholders was the lack of consistent face-to-face meetings, which are considered critical for alignment and real-time collaboration. While virtual platforms provided an alternative, many participants expressed a preference for onsite discussions, citing better communication and engagement. In the context of SMILHIS, these constraints further complicate implementation and highlight the need for tailored logistical strategies that accommodate local conditions. According to a participant:

"I think another challenge is almost tiny, well, a nearly surface-level challenge because Pangasinan is far. Ideally in these situation that if you are closely working with a team; for example they are always having a meeting, always having talks, it is like a 5 to 6 hour trip from Manila to Pangasinan so even though we have online discussions or online meetings, it was definitely a factor - their geographical location distance from us and we do not have many opportunities to check them by." [P10]

External Stakeholder Pressures

This captures how the implementation and sustainability of SMILHIS may be challenged by the presence of competing systems and commercially marketed digital health solutions. The active promotion of proprietary

systems by private vendors, often supported by aggressive marketing strategies, can significantly influence the decision-making of local government units (LGUs). Lin and Adler-Milstein (2018) highlighted that in competitive health IT environments, vendors often prioritize enterprise-based or proprietary platforms over centralized, government-led systems. Such preferences can undermine efforts to establish interoperability and discourage participation in integrated health information systems. These market dynamics present a substantial barrier to SMILHIS adoption and reflect the broader challenges of implementing public digital health platforms in environments where private alternatives are readily available and highly promoted.

SMILHIS is not the only system offering broad service capabilities; several private vendor-developed models are also gaining traction and are actively marketed to LGUs. As Ramasamy and Baskaran (2023) asserted, the adoption of electronic medical records (EMRs) is significantly influenced by the vendor's IT capabilities and resources. As shared by a participant:

"There are other Electronic Medical Record (EMR) providers that want to engage with the province, and they are actively promoting their systems in competition with SMILHIS. Even though SMILHIS is already in place, the contract still ends up going to other providers. In other words, SMILHIS is not being chosen because other players are more aggressive in marketing and selling their systems." [P8]

Certain private companies have recognized the growing demand among local government units (LGUs) for modernized systems to manage health data. In response, they have strategically developed and marketed digital solutions tailored to address these needs. Aware that many LGUs are operating with outdated models and are in the process of digital transformation, these companies position their systems as timely and essential tools for modernization.

As previously noted, several private companies also employ aggressive marketing strategies to promote their health information systems, highlighting a wide range of features. These strategies often result in LGUs either switching from their existing platforms or adopting new systems. According to a participant:

"It is free, but there are also other players, especially some Electronic Medical Record systems that have excellent marketing strategies. They can sell their systems effectively, and others are really buying into it; they are really going for it." [P8]

Overall, the growing presence of private health information systems highlights the importance of effective promotion and outreach. Participant insights suggest that LGUs may be drawn to these alternatives due to visibility and perceived responsiveness to local needs. This presents an opportunity for government platforms to enhance their communication strategies and reinforce the benefits of nationally aligned systems.

4.0 Conclusion

This study highlights that successful HIS implementation in the Philippines goes far beyond the mere introduction of new technology. Instead, political continuity, governance structures, institutional readiness, and technical expertise are central pillars that promote progress. For instance, leadership changes at the local level often disrupt ongoing programs, which can derail digital health projects if policies and commitments are not institutionalized. Equally important is investing in continuous training and capacity development for staff, which helps maintain technical competence as the system evolves. On-site technical support is also necessary to resolve issues quickly and effectively, preventing disruptions that could discourage system use.

Beyond the local level, valuable evidence emerged for shaping national frameworks for digital health, particularly in ensuring that local HIS initiatives align with the broader goals of Universal Health Care. When LGUs adopt a HIS platform, it is vital to consider whether it can connect with other HIS in their localities to align with the goals of UHC. One of the key challenges also identified is the persistent skills gap. LGUs continue to face difficulties in technological expertise, which creates vulnerabilities in implementation. As digital technologies increasingly become part of everyday health service delivery, this gap can undermine progress if not addressed systematically. Hence, capacity-building programs can be promoted to strengthen the technological expertise of local personnel. Equipping LGUs with the necessary skills not only ensures smoother system operation but also empowers institutions to take ownership of digital health initiatives. Furthermore, building a strong understanding of how local systems contribute to national health priorities is essential, as this fosters greater buy-in from institutions and motivates sustained participation in digital health reforms.

This study also contributes to the growing body of literature on digital health implementation within decentralized healthcare systems, such as the Philippines. Decentralization creates both opportunities and challenges: while it allows local adaptation, it also means that adoption and implementation may vary widely across regions. Future studies can therefore explore multiple dimensions of implementation. One area worth investigating is the comparative research across LGUs with different levels of readiness, resources, and governance stability, which is valuable in understanding which factors contribute most to successful implementation. With SMILHIS expected to expand to new regions, longitudinal evaluations that follow its implementation over time will help capture evolving challenges and solutions. Importantly, involving more health system professionals in such studies encourage more solutions directly relevant to the needs of the healthcare system.

Overall, by examining the challenges faced in implementation, this study generates actionable knowledge that can guide future adoptions of SMILHIS and other HIS across the country. It informs stakeholders about the barriers they can anticipate, promotes strategies for building sustainability, and ultimately supports broader efforts to improve health service delivery. At its core, the study reveals that digital health transformation necessitates more than infrastructure; it requires strong governance and leadership, skilled and supported human resources, and continuous education and capacity-building.

5.0 Contribution of Authors

All authors contributed to the conceptualization and finalization of the study. EMA, NNA, and MRA facilitated ethical approvals and validation of the questionnaire. AGBA and ADA handled logistical preparations for interviews and the acquisition of necessary equipment. EMCA, MRA, and LDA facilitated the transcription of the interviews. The entire research team carried out data analysis and writing. Editing of the manuscript was supervised by EMA, SDA, LDA, and CRC, ensuring that the manuscript reflects the results with clarity and impact.

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7.0 Conflict of Interest

The authors declare that they have no conflict of interest.

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