Enhancing Administrative Accountability in Resource-Constrained Settings: A Case Study of Automated Membership Verification

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ABSTRACT

Accurate membership verification is essential for public-sector union governance and compliance with the Human Resource Management and Information System (HRMIS), yet many unions still rely on slow manual processes. The Sabah Medical Services Union (SMSU) case examines an automated verification system introduced to address processing delays, duplicate entries, and data vulnerabilities. Guided by a Design and Development Research (DDR) framework, a web-based system was built using low-code architecture, combining a modular front end with a secure cloud backend to enable real-time verification and automatic annual expiry. A baseline of 2,600 legacy records was migrated, followed by usability testing (n=30) and performance monitoring of 400 new requests. Data were analysed descriptively using SPSS version 27. Certificate issuance time fell from as long as 28 days to immediate real-time retrieval. The automated expiry function ensured annual validity without requiring manual administrative checks. Usability scores indicated high acceptance (Mean=4.43/5.00; 90% satisfaction), and all 400 new requests were processed without recorded verification errors. The SMSU experience shows that low-cost digital innovation can close administrative gaps in resource constrained organisations and offers a practical model for improving governance and accountability without major infrastructure investment.

Keywords: Digital Transformation, Membership Verification, E-Certificate System, Union Governance, Sabah Medical Services Union.

INTRODUCTION

Membership verification is a core administrative function in Malaysian public sector unions because it determines eligibility for employment-related processes, including submissions to the Human Resource Management and Information System (HRMIS). Despite its importance, many unions still rely on manual or partially digital workflows that struggle to meet rising expectations for accuracy, consistency, and accountability. These weaknesses become more visible as membership expands and as documentation is increasingly scrutinized by employers and regulatory systems.

Over the past decade, Malaysia's policy direction has increasingly emphasised digital accountability in public services. National initiatives such as the Twelfth Malaysia Plan and the Health Digital Transformation Blueprint reflect a clear expectation that public sector organizations maintain records that are timely, auditable, and protected against misuse (Economic Planning Unit, 2021; Ministry of Health Malaysia, 2021). While these policies signal readiness for digital transformation at the national level, their implementation at the organizational level remains uneven. Smaller and resource constrained bodies often lack the infrastructure, expertise, and systems needed to translate policy goals into operational reality (Wahyudin et al., 2024).

The Sabah Medical Services Union (SMSU) represents a large and geographically dispersed workforce within the health sector. For many years, the union relied on physical membership cards to verify eligibility. As membership numbers increased, this approach became difficult to sustain and exposed the organization to risks related to data loss, outdated information, and inconsistent renewal practices. The union later moved to a semi-digital workflow using online forms and spreadsheet-generated certificates, which improved efficiency but still left major limitations. Processing times were long, expiry updates required manual intervention, and outdated certificates could continue to circulate without effective control. Similar patterns have been observed in other public service settings where interim digital solutions fail to address deeper governance weaknesses (Djatmiko et al., 2025).

Recognizing these challenges, the SMSU initiated the development of a web based automated membership verification and e certificate system. The system allows real-time verification, automatically enforces annual expiry, and reduces reliance on manual administrative steps. A modular front-end interface was integrated with a secure cloud-based backend to balance accessibility for members with controlled validation for administrators.

Rather than remaining at the level of conceptual discussion, the SMSU case shows how governance principles can be put into practice through a low-cost, deployable system used in a working public sector union. The work presented here documents the development and early evaluation of the automated verification system using a design and development research approach (Herrington et al., 2013). It examines how a low cost and governance oriented digital solution can improve administrative efficiency, reduce documentation risks, and support accountability within a public sector union. The case offers practical insight into how meaningful digital transformation can be achieved in organizations operating under resource constraints.

Within healthcare-linked unions such as SMSU, verification delays carry operational implications beyond administrative inconvenience. Membership status is often required for salary deduction validation, employment-related documentation, and union representation eligibility. When verification systems are slow or inconsistent, delays can affect payroll deductions, institutional reporting, and administrative trust. Despite increasing documentation demands in healthcare organisations, small unions frequently operate with limited digital infrastructure. This mismatch between governance expectations and operational capacity highlights the need for scalable, low-cost digital solutions that build accountability directly into everyday administrative workflows.

Less attention has been given to how small, resource-constrained membership organisations operationalise governance principles through low-code and frugal digital solutions. In particular, empirical research examining automated verification systems that embed rule-based issuance, expiry governance, and documentation control remains limited. The SMSU case addresses this gap by exploring how governance oriented system logic can be implemented within a healthcare-linked union operating with modest infrastructure.

This study therefore contributes to understanding how digital transformation principles can be translated into practical, scalable solutions in micro-organisational contexts.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

This section reviews literature on digital transformation, public sector governance, and administrative verification systems, with particular focus on membership-based organisations such as SMSU. Studies consistently show that administrative verification processes sit at the centre of organisational accountability, especially in public sector and union settings where documentation determines access to employment-related benefits and institutional representation. As public services increasingly adopt digital systems, verification functions are expected to meet higher standards of accuracy, auditability, and reliability (Economic Planning Unit, 2021; Ministry of Health Malaysia, 2021).

Research on public sector digitalisation highlights that many organisations remain trapped in transitional states, where manual processes are replaced with fragmented digital tools rather than fully integrated systems. Such arrangements often reduce clerical workload but fail to address governance risks related to outdated records, inconsistent renewal practices, and weak validation controls (Djatmiko et al., 2025; Wahyudin et al., 2024).

These findings are particularly relevant to unions such as SMSU, which operate under resource constraints while managing large and dispersed memberships.

Administrative workload in healthcare institutions has increased substantially due to expanded documentation requirements, compliance monitoring, and digital reporting obligations. While hospitals and ministries have undergone digital transformation, affiliated professional and union bodies often lag in adopting integrated systems. These organisations still rely on manual verification processes that struggle to support large, geographically dispersed memberships. In such contexts, delays in documentation processing may undermine institutional coordination and service continuity. This situates SMSU as a representative case of healthcare linked administrative organisations facing digital governance gaps.

Digital Transformation in Public Sector Organisation

Digital transformation literature emphasises that meaningful change involves more than simply adopting digital tools. It also requires processes to be structurally integrated, governance logic to be clear, and systems to align with organisational goals (Vial, 2019). Studies examining public sector organizations show that digital initiatives frequently stall when they rely on isolated platforms or depend heavily on individual administrators rather than embedded system rules (Hunitie & Akhorshaideh, 2025). Platform-based governance models offer a different way forward. Lean and modular digital systems have been shown to improve administrative oversight while reducing operational complexity, particularly in environments with limited financial and technical capacity (Janssen & Estevez, 2013; Saeed, 2025). These models shift control from manual enforcement to automated logic, supporting consistency and reducing the risk of discretionary errors (Muhammad Imran Sarwar, 2023). For organizations like SMSU, such approaches provide a pathway to modernize administrative functions without requiring large scale infrastructure investment.

Digital Governance, Accountability, and Verification Systems

Public sector digital governance theory identifies accountability, transparency, and reliability as foundational principles for administrative systems (Cordella & Paletti, 2019). Verification systems without automated controls are more exposed to misuse, duplication, and the continued circulation of outdated documentation. Prior studies on digital identity and governance mechanisms show that time bound validity, audit trails, and rule-based issuance are critical for maintaining institutional trust (Giannopoulou et al., 2023; Sanina et al., 2024). Design and development research further supports the use of iterative and practice driven approaches in building digital systems for real world organizational contexts (Herrington et al., 2013). Evidence indicates that low-code and modular architectures can support governance objectives effectively when system logic is clearly defined and built in from the start. These principles shaped the development of the SMSU automated membership verification and e-certificate system, which was introduced to address processing delays, expiry management issues, and duplicate record control. Based on the reviewed literature, this study advances the expectation that an automated and governance-oriented verification system will improve administrative efficiency, strengthen documentation integrity, and enhance user acceptance within SMSU.

Study Propositions

Based on the reviewed literature, this study advances three propositions. The first proposition posits that implementation of the automated membership verification system will reduce administrative turnaround time compared to the prior semi-digital workflow. The second proposition suggests that embedding automated governance controls, including expiry logic and duplicate detection, will improve documentation integrity and reduce verification risks. The third proposition proposes that the introduction of a self-service verification mechanism will positively influence user satisfaction and overall system acceptance among members. These propositions are examined using operational performance metrics, system governance indicators, and user satisfaction measures, as detailed in the results section.

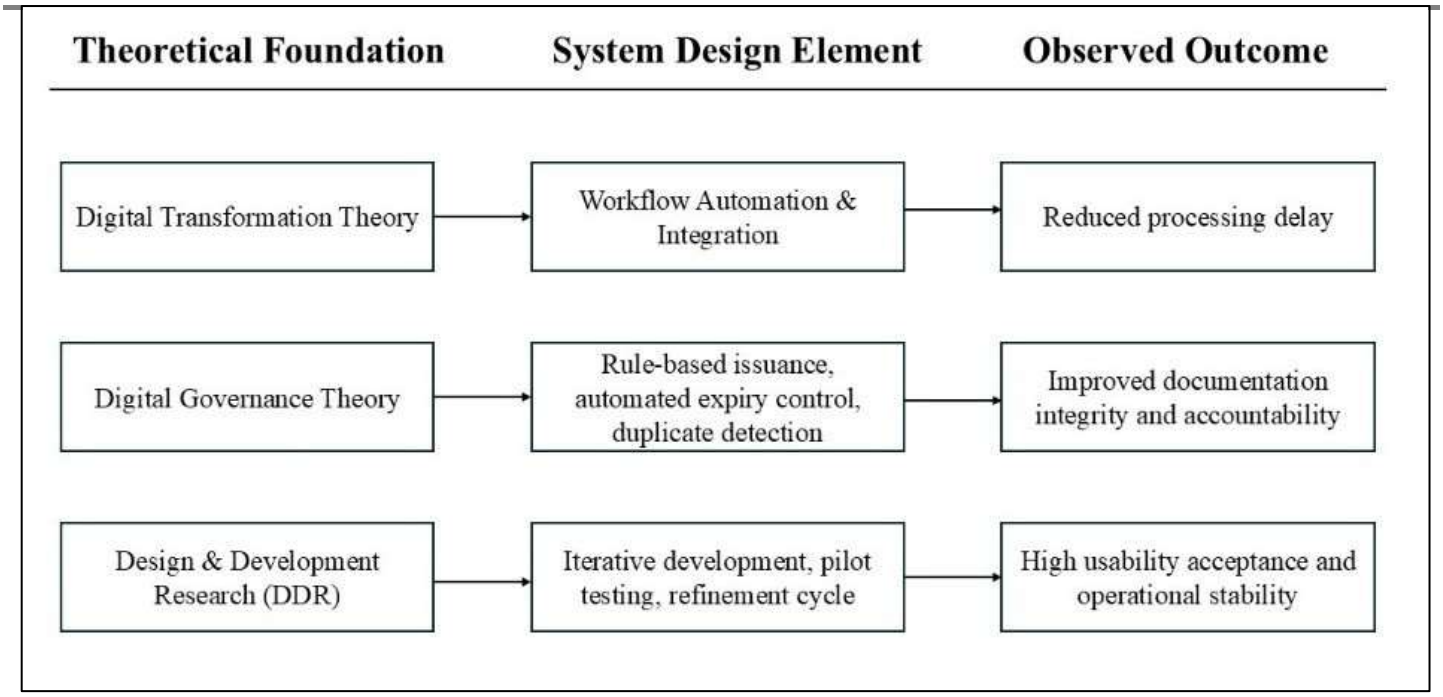

***Figure 1*. Conceptual Framework Linking Theory, System Design, and Outcomes**

Figure 1 illustrates the conceptual framework guiding this study. Digital Transformation Theory explains the shift from fragmented manual workflows to integrated automation. Public Sector Digital Governance theory underpins the embedding of accountability mechanisms such as rule-based issuance and time-bound validity controls. The Design and Development Research framework structures the iterative development and evaluation cycle. Together, these theoretical perspectives shape system architecture and connect directly to the observed outcomes in efficiency, documentation integrity, and user acceptance.

METHODOLOGY

Study Design

The study followed a Design and Development Research (DDR) framework, which provides a structured way to create, test, and refine digital interventions in real organisational settings. This approach was chosen to address administrative workflow challenges within SMSU while also generating empirical data on system efficiency and usability. The study utilized a mixed-methods approach, combining quantitative metrics (processing time, uptake rates) with qualitative feedback from early user testing to drive iterative improvements.

Operationalisation of the Design and Development Research (DDR) Framework

The DDR framework guided the study through four structured stages adapted from Herrington et al., 2013 as shown in Table 1 below.

***Table 1.* DDR Framework of this study**

Stage	Description
Stage 1: Analysis of Practical Problem	This stage involved examination of the legacy verification workflow, identification of bottlenecks, duplicate-entry risks, and governance gaps associated with manual expiry control.
Stage 2: Solution Design	Based on digital transformation and governance principles, system architecture was designed to embed rule-based issuance, automated expiry, and duplicate detection logic.

Stage 3: Iterative Development and Refinement	The prototype was developed using low-code architecture and subjected to pilot testing. Feedback informed interface adjustments and logic refinement.
Stage 4: Evaluation	System performance was assessed using processing metrics, monitoring of new verification requests, and usability assessment among pilot users.

Theoretical Foundations Guiding System Design

Digital Transformation Theory helped frame the shift from fragmented manual workflows to an integrated automated verification process. This perspective emphasises process integration, system-level automation, and reduction of reliance on individual administrative intervention. Public Sector Digital Governance theory informed the embedding of accountability mechanisms within system architecture, particularly rule-based certificate issuance, automated expiry control, and duplicate-entry prevention. These theoretical perspectives directly guided system design decisions and logic configuration, rather than serving solely as conceptual background.

Development Process

System development took place between May and November 2025 and progressed through nine distinct phases, ranging from needs assessment to full deployment. The primary goal was to replace the fragmented legacy workflow with an automated ecosystem capable of real-time verification and dependable expiry control. A key baseline was established during migration, where 2,600 manually verified records were transferred to the new backend to ensure immediate service continuity for existing members. The progression of these nine phases, including specific milestones for framework selection, prototyping, and data migration, is detailed in Table 2.

Table 2. **System Development and Implementation Flow of the SMSU automated verification e-certificate System**

Phases	Description
Phase 1: Needs Assessment	This commenced in May 2025 including reviewing of manual workflow, delays and governance risks associated with Google Forms, spreadsheets and Autocrat generated certificates. Identified limitations in accuracy, turnaround time and scalability.
Phase 2: Framework Selection & System Planning	Adopted Digital Transformation Theory and Public-Sector Digital Governance principles to guide system design, emphasising efficiency, accountability and data integrity.
Phase 3: Portal Development Using Canva Code	Developed a customised Canva-based portal with admin, member and new-request modules. Constructed the front-end interface using Canva Code with embedded logic.
Phase 4: Backend Database Setup (Google Sheets)	Established a secure backend with restricted access. Enabled auto sorting alphabetically for duplicate detection. Linked the portal to the backend to support real-time certificate retrieval.
Phase 5: Data Migration (n = 2,600)	Transferred all existing manually verified membership records into the new system to allow immediate certificate access for current members.
Phase 6: Pilot Testing	This phase began in June to July 2025, tested by 30 members to assess clarity, usability, membership-display accuracy and certificate logic. Feedback informed interface adjustments.

Phase 7: Refinement & Bug Fixing	Improved navigation, optimised search functions and strengthened certificate display rules based on pilot feedback.
Phase 8: Full Implementation	Portal disseminated across SMSU EXCO, areas and branches in October 2025. Members gained direct access to automated verification and certificate generation.
Phase 9: Monitoring & Evaluation	From October to November 2025, processed 400 new requests. Evaluated system performance, administrative workload reduction, turnaround time and user satisfaction.

System Architecture and Functional Features

The system architecture followed a low-code development model, chosen to keep costs manageable while supporting scalability in a resource-constrained environment. The front-end interface was constructed using a web-based modular design platform (Canva Code), a framework selected for its capacity to support embedded logic and user-friendly navigation without requiring complex custom coding. Complementing this interface, the backend was anchored on a cloud-native spreadsheet database (Google Sheets), which facilitated real-time data synchronization, controlled administrative access, and the execution of automated sorting algorithms. Functionally, the architecture is divided into operational components designed for different user roles. The administrative interface enables authorized personnel to validate membership status by cross-referencing entries against national salary-deduction records (Angkasa). Conversely, the member interface is designed for self-service accessibility, allowing individuals to query their membership status using their identification number and instantly retrieve e-certificates upon validation. To strengthen institutional accountability, the system includes three layers of automated governance logic. First, a conditional issuance rule ensures that certificates are generated only after specific validation fields are completed, effectively preventing premature or unauthorized access. Second, data quality is maintained through backend auto sorting algorithms that index entries alphabetically, facilitating the immediate identification and removal of duplicate records. Finally, an auto-expiry mechanism enforces temporal validity; a time-based rule limits certificate validity to 31 December of the current year and automatically advances the date on 1 January, thereby eliminating the governance risk associated with outdated documentation. The automated membership workflow is presented in Figure 2.

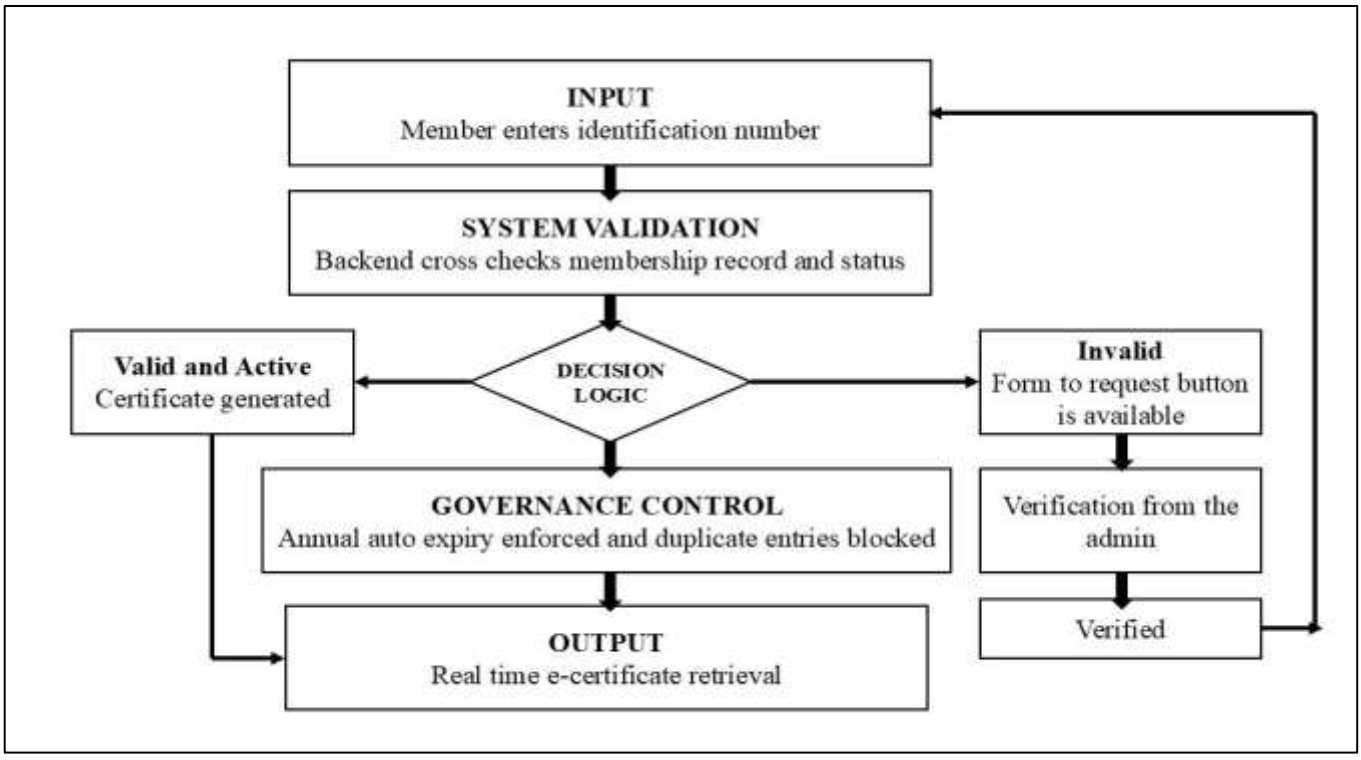

Figure 2. **Automated membership verification workflow and embedded governance logic.**

The workflow illustrates how governance controls are embedded between decision logic and output, ensuring that certificate issuance is conditional, time bound, and auditable.

Pilot Testing

Pilot testing was conducted between June and July 2025 involving 30 SMSU members selected from various healthcare facilities. The aim was to assess system clarity, ease of navigation, and the accuracy of certificate retrieval logic. Feedback collected during this phase was instrumental in refining the interface, specifically leading to improvements in search functionality and instructional clarity for new submissions.

Implementation and monitoring

Following the refinement phase, full implementation was launched in October 2025. The system link was disseminated via the SMSU organizational hierarchy, including EXCO members and branch secretaries. Monitoring took place over a two-month period (October–November 2025), focusing on processing speed, error rates, and system stability. During this window, 400 new verification requests were successfully submitted and processed.

User Satisfaction Assessment

User satisfaction was measured using a five-point Likert scale, ranging from very dissatisfied to very satisfied, a widely accepted instrument for assessing usability and user attitudes in system evaluation studies (Joshi et al., 2021; Likert, 1932). Responses from pilot participants were analysed descriptively using SPSS version 27 to determine mean satisfaction scores and overall acceptance rates.

Ethical Considerations

The project involved development of an internal administrative system using non-clinical data, so formal ethics approval was not required. To ensure data privacy and integrity, access to the backend database was strictly limited to the system developer and authorized administrative personnel, in compliance with SMSU's internal governance protocols.

RESULTS AND DISCUSSION

The system's operational baseline began with migration of 2,600 legacy membership records, covering all previously validated members. This migration created an immediate service baseline, allowing long-standing members to retrieve digital certificates without requiring re-verification. During the two-month monitoring period (October-November 2025), the system processed 400 new verification requests without recorded verification errors or downtime. The move to the automated system resulted in clear efficiency gains compared to the previous semi-digital workflow; as detailed in Table 3, the turnaround time for certificate issuance was reduced from a range of 7–28 days to immediate real-time generation (1–2 minutes) upon verification. Furthermore, the system eliminated the previous processing cap of 100 certificates per day, effectively removing the bottleneck caused by the former Autocrat-based workflow. The governance rules built into the backend worked as intended during the monitoring period. The auto-sorting algorithm indexed new entries alphabetically, allowing immediate identification of duplicate submissions. Crucially, the auto-expiry mechanism was validated during the transition window; all certificates displayed validity until 31 December, and the system successfully executed the automated rollover on 1 January, advancing validity to the subsequent calendar year without administrative intervention. This indicates that governance risks related to outdated certificates were effectively reduced.

Usability assessment among the pilot cohort (n=30) indicated strong acceptance of the new interface. As shown in Figure 3 and Table 4, 90% of participants (n=27) reported satisfaction with the system's clarity, ease of navigation, and retrieval speed. The mean satisfaction score was 4.43 ± 1.04, reflecting a generally positive user experience, with only a minority of participants (10%) expressing neutral or dissatisfied responses attributed to unfamiliarity with the digital workflow rather than technical failure. The reduction from a 7–28-day processing window to real-time certificate generation represents a clear efficiency improvement exceeding 95% in average

turnaround delay. Visual confirmation of the interface performance, including real-time status display and certificate generation, is presented in Appendix A and Appendix B.

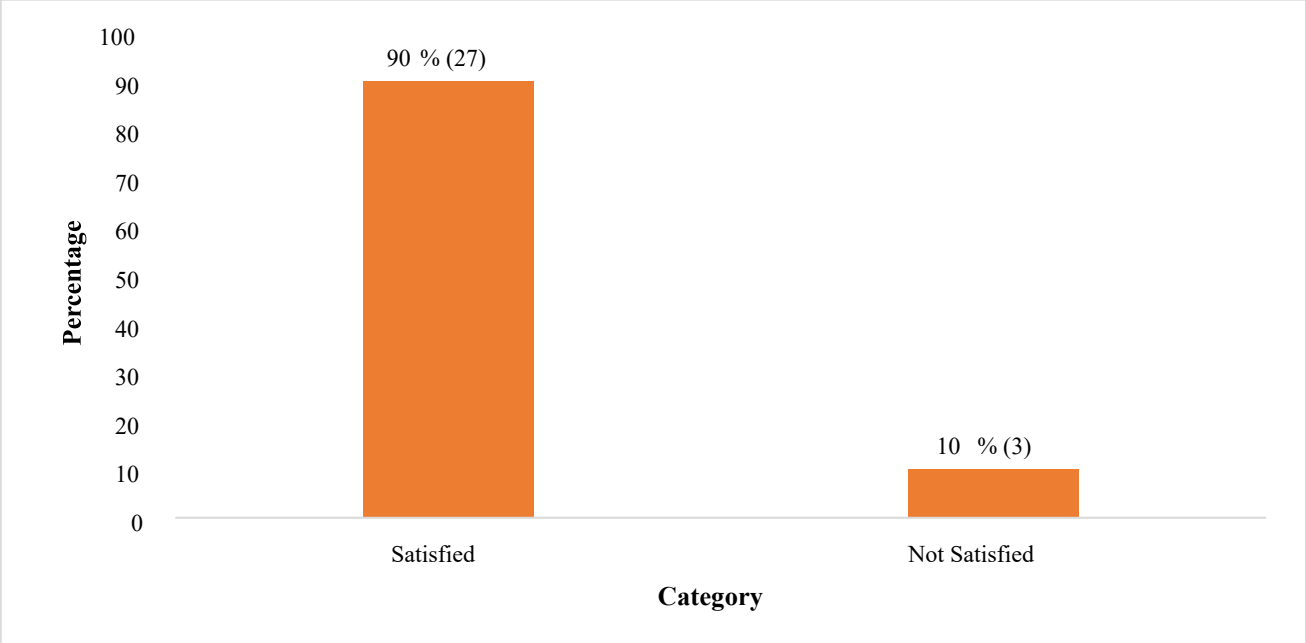

***Figure 3*. User Satisfaction (Satisfied vs Not Satisfied)**

***Table 3.* Comparison of verification workflow before and after implementation**

Parameter	Previous System	Automated System
Verification Time	10 minutes per person	10 minutes per person (same due to admin-dependent)
Certificate Generation	Manually via autocrat (after admin completed verification for all members) 1-4 weeks	Automatic and instant (1-2 minutes)
Daily Output Limit	100 certificate per day (autocrat limit)	No limit
Turnaround Time	7-28 Days	Immediate after verification
Annual Renewal	Fully Manual	Auto-expiry update yearly
Risk of Outdated Certificate	High	Substantially reduced
Duplicate Detection	Manual Checking required	Auto sorting alphabetically with immediate identification

Table 3 summarises the operational differences between the previous semi digital workflow and the automated system, highlighting gains in speed, scalability, and governance control. It also provides a pre–post comparison of workflow performance, illustrating the operational impact of system implementation.

***Table 4.* User Satisfaction Scores for the Automated Verification System (n=30)**

Satisfaction Score	Frequency (n)	Percentage (%)	Interpretation / Statistics	Mean Satisfaction Score (Mean ± SD)
1 = Very dissatisfied	1	3.3	Low satisfaction	4.43 ± 1.04
2 = Dissatisfied	1	3.3	Low satisfaction	
3 = Neutral	1	3.3	Neutral	
4 = Satisfied	13	43.3	Contributes to high satisfaction	
5 = Very satisfied	14	46.7	Contributes to high satisfaction	
TOTAL	**30**	**100**		

System interface performance outputs are shown in Appendix A (portal homepage) and Appendix B (generated e-certificate), illustrating how members view their status and retrieve their certificates in real time. The automated expiry mechanism operated as intended across the monitoring period. All certificates displayed validity until 31 December, and on 1 January, the validity automatically advanced to the next calendar year without requiring administrative updates. This addressed earlier governance concerns about outdated certificates remaining in circulation.

The nine-phase development pathway is represented visually in Figure 4, outlining the sequence from needs assessment to full deployment. The full workflow of the automated verification system, including data flow, user interface interactions and backend logic, is illustrated in Figure 5, providing a complete depiction of how the system manages both legacy and new membership records with consistent governance safeguards.

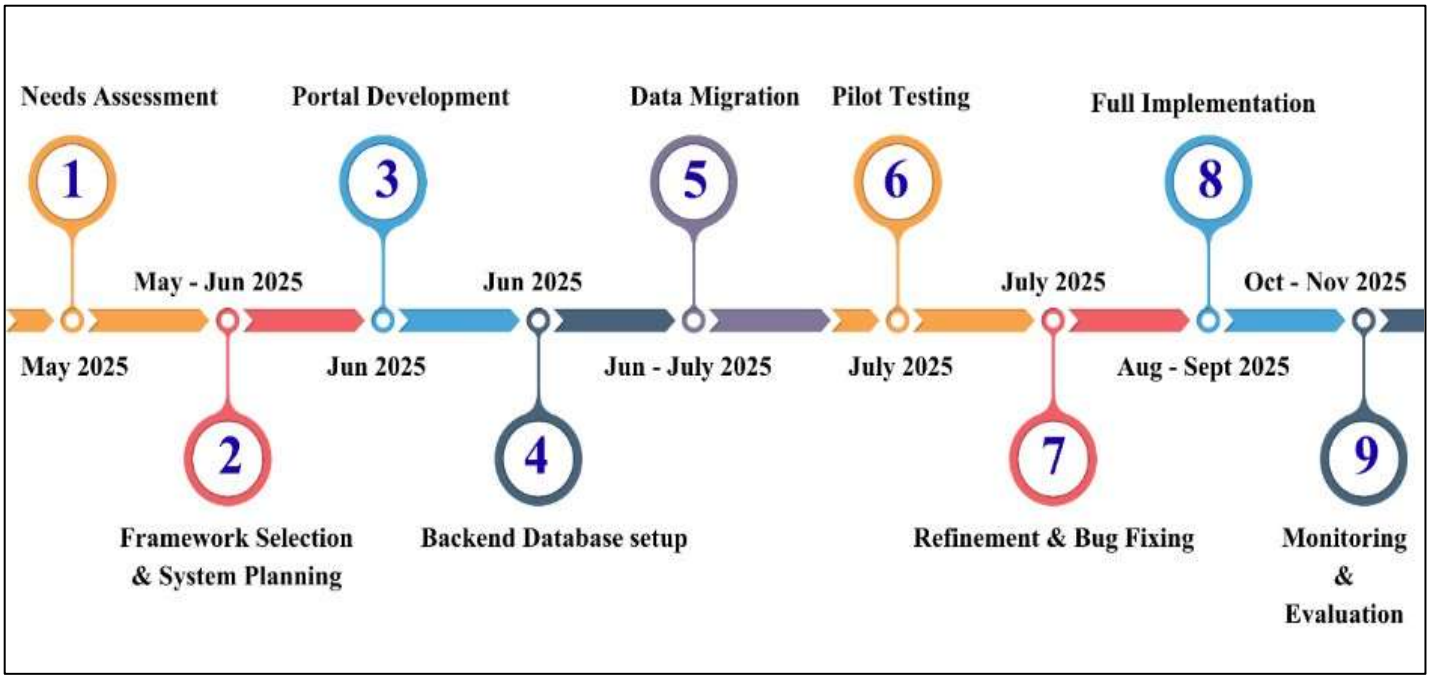

***Figure 4*. Development timeline (phases) for the automated verification system**

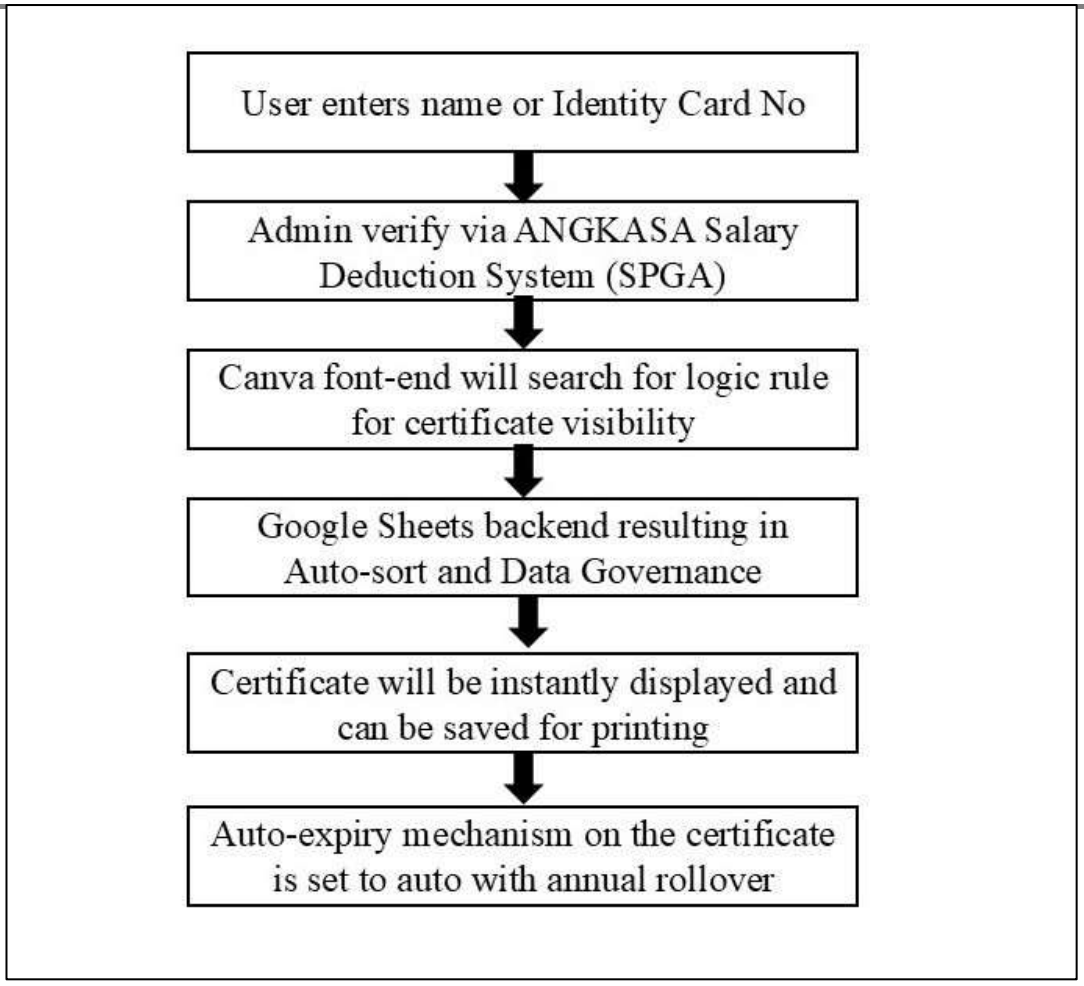

***Figure* 5 System Workflow Architecture**

DISCUSSION

The SMSU experience shows that even a modest digital system can change how a large health union handles verification and documentation. The automated system replaced fragmented manual processes that depended heavily on individual administrators and often led to long waiting times for members. After implementation, certificate access moved from a slow and sometimes unpredictable process to immediate retrieval once verification was completed. This pattern reflects long standing observations in digital transformation research, where integrated automation produces rapid gains in efficiency and reliability (Cordella & Paletti, 2019; Vial, 2019). Improvements observed in SMSU are also consistent with broader public sector digitalization evidence indicating that well designed digital tools reduce administrative strain and shorten processing time when supported by appropriate governance structures (Janssen & Estevez, 2013; Sanina et al., 2024).

The automated expiry logic implemented in this system aligns with findings from digital identity and governance studies showing that time bound validity controls reduce misuse and strengthen institutional credibility (Ayei Ibor et al., 2024; Giannopoulou et al., 2023). These features contribute to a cleaner and more accurate membership registry while reducing risks associated with outdated or inconsistent documentation. The model presented here shows how systems grounded in day-to-day operational realities can strengthen governance even in resource-constrained environments. Automated expiry and self-service access together support a more accountable administrative ecosystem. These principles align with emerging work on secure digital governance and the role of audit trails in maintaining trust and documentation integrity (Marian et al., 2025; Sanina et al., 2024).

User satisfaction results further support the system's acceptability. Most participants reported clear instructions, fast certificate retrieval, and smooth navigation. Similar outcomes appear in evaluations of e-government services, where usability and clarity strongly shape continued use of digital platforms (Chen et al., 2024; Luo et al., 2024). Although a small proportion of users expressed dissatisfaction, this was attributed to misunderstanding

rather than system failure. Transitional challenges of this kind are commonly observed during early phases of digital adoption and tend to improve with clearer communication and ongoing user support (Djatmiko et al., 2025; Joshi et al., 2021).

The development pathway adopted in this project reflects broader evidence from design and development research. Iterative refinement and rapid feedback cycles are widely recognised as effective ways to develop sustainable and functional digital systems (Herrington et al., 2013). The structured phases applied in this study enabled early identification of issues and optimization of both interface flow and certificate logic prior to full implementation. Public sector research similarly suggests that iterative approaches contribute to long term system stability and user acceptance (Hallin et al.,2022).

Several considerations are worth noting, as the evaluation covered only the early months of system implementation. Sustainability of digital services depends on continuous monitoring and institutional commitment to system adaptation over time (Kayyali, 2025; Norling, 2024). Although the system relies on Canva and Google Sheets, which are appropriate lightweight platforms for the scale and needs of SMSU, such tools may be insufficient for organizations requiring higher security standards or large volume processing. Governance research indicates that successful digital transformation at larger scales often requires more complex infrastructure and coordinated leadership (Maheshwari, 2025). Despite these constraints, the SMSU case shows that meaningful digital transformation is possible without large budgets or complex technical infrastructure. A modest and well-structured system can reduce administrative burden while improving member experience and reinforcing institutional accountability.

The experience of SMSU highlights a practical pathway that other unions and professional organizations may adopt. A well-structured and accessible digital system can ease administrative load, enhance member experience, and strengthen institutional accountability. Future studies may examine longer term outcomes, integration with national human resource platforms, and the organizational change processes that accompany sustained digital adoption.

The usability assessment involved a modest pilot group, which reflects early-stage system evaluation rather than large-scale behavioural generalisation. The findings therefore indicate system acceptance within the pilot context, while broader adoption patterns warrant further study.

Theoretical and Practical Implications

This work contributes to digital governance research by extending analysis beyond large-scale e-government platforms to micro-organisational contexts operating under resource constraints. While much of the literature focuses on national systems and high-budget digital reforms, this case demonstrates that governance principles such as accountability, auditability, and rule-based control can be operationalised through low-code architectures in small institutional settings. This places the study within the growing discussion on frugal digital innovation, where affordability and scalability are critical design considerations.

From a methodological perspective, the study illustrates how Design and Development Research (DDR) can be applied to administrative governance problems rather than purely educational or technical prototypes. The structured cycle of problem analysis, iterative refinement, and performance evaluation offers a replicable approach for evaluating governance-oriented digital interventions in real-world organisational environments. The findings extend digital governance theory into micro-organisational contexts, contribute to the literature on frugal digital innovation, and indicate the applicability of DDR methodology in public sector administrative system development.

Practically, the findings show that building governance rules directly into the system architecture can reduce documentation risks, processing delays, and administrative burden without requiring complex infrastructure. This suggests that similar professional associations, unions, and small public-sector bodies may adopt modular, low-cost systems to improve verification reliability while maintaining organisational control. The SMSU case therefore offers a transferable model for digital accountability in institutions that lack largescale IT resources.

CONCLUSION AND FUTURE RESEARCH

The SMSU automated verification system shows that governance principles can be built directly into everyday administrative work using modest, low-cost digital infrastructure. What started as a local response to verification delays and documentation risks offers wider insight into how frugal digital innovation can strengthen accountability in institutions operating under resource constraints. The combination of Design and Development Research with governance-informed system logic illustrates how small organisations can modernise verification processes without relying on complex or expensive technical environments. Beyond operational gains, the study offers a practical and transferable model for embedding accountability into administrative systems. Future research may examine longer-term sustainability, potential integration with national human resource platforms, and how similar governance-embedded approaches perform across different organisational settings.

Author Contributions

The corresponding author led the conceptualisation, system design, data analysis, and manuscript preparation. All co-authors from SMSU contributed to pilot testing, system monitoring, and provided critical operational feedback

Funding Statement

This research received no external funding.

Informed Consent Statement

Not applicable. The study evaluated an administrative system and did not involve clinical, personal health, or sensitive human data.

Data Availability Statement

Aggregated system performance and usability data are available from the corresponding author upon reasonable request. Raw membership records are not publicly available due to organisational confidentiality policies.

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Conflict of Interest

The authors declare no conflict of interest.

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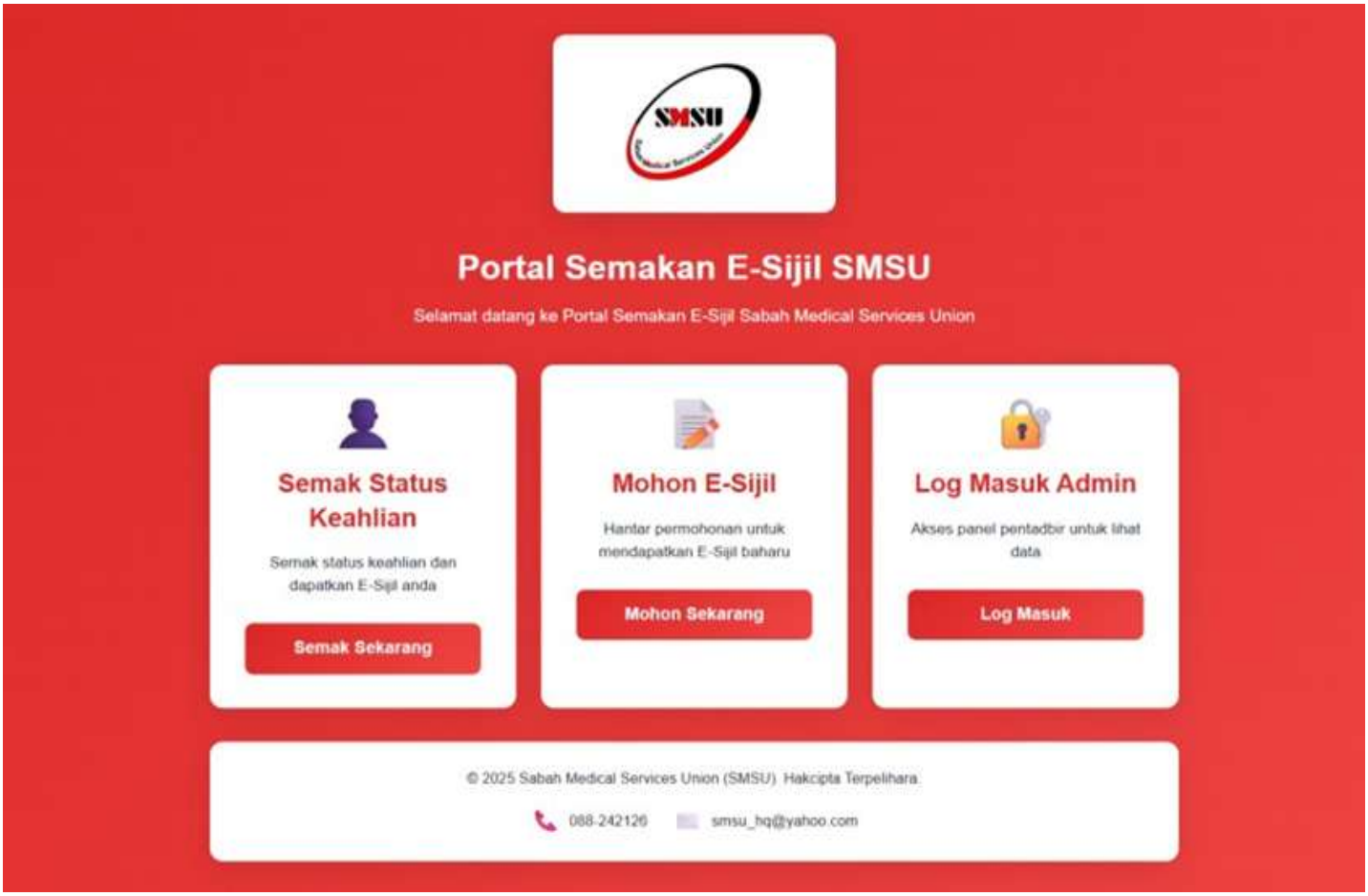
APPENDICES



Appendix A : The portal homepage view

Appendix B : Sample of Generated E-certificate