Development of a Comprehensive Scholarship and Grants Management System (Schogms) for State Universities and Colleges

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DOI: https://dx.doi.org/10.47772/IJRISS.2025.90400261

Received: 29 April 2025; Accepted: 04 May 2025; Published: 09 May 2025

ABSTRACT

Scholarship administration in State Universities and Colleges (SUCs) in the Philippines often encounters delays, redundancies, and security gaps due to manual and decentralized processes. This study addresses these issues through the development of the Scholarship and Grants Management System (SchoGMS), a web-based platform designed to automate workflows, ensure Commission on Higher Education (CHED)-compliant reporting, and enhance scholarship operations. Anchored in Agile methodology and guided by the PIECES framework for requirements analysis, SchoGMS was developed and implemented across multiple campuses of Sultan Kudarat State University (SKSU) in Region XII. The study aimed to evaluate system effectiveness and user acceptance in improving scholarship management. Administrative personnel, including registrars, scholarship coordinators, deans, directors, and program chairs, served as participants, selected through purposive sampling. The Technology Acceptance Model (TAM) guided the evaluation, focusing on Perceived Ease of Use (PEU), Perceived Usefulness (PU), Attitude Toward Use (AT), and Behavioral Intention (BI). Quantitative data were collected through structured descriptive surveys and analyzed using mean and standard deviation. Functional and non-functional testing further validated system security, usability, and performance. Findings revealed that TAM constructs were rated as "very high," with an overall mean of 4.89, indicating strong user satisfaction, system reliability, and a high likelihood of sustained institutional use. Notable features such as Two-Factor Authentication (2FA), automated role-based access, real-time dashboards, and Progressive Web Application (PWA) architecture contributed to data security, operational efficiency, and offline accessibility. A strategic phased implementation plan was developed to ensure sustainable deployment across all campuses. The study concludes that SchoGMS significantly improves scholarship administration and recommends the integration of AI-driven analytics and blockchain technologies to enhance future scalability and fund security.

Keywords: scholarship management system, Agile, progressive web application, technology acceptance model, educational technology

INTRODUCTION

A Scholarship and financial aid programs serve as vital instruments for promoting equitable access to higher education, particularly within state universities and colleges (SUCs) in the Philippines. However, the management of these programs remains fraught with operational inefficiencies, redundant workflows, and delayed fund disbursements due to predominantly manual and decentralized processes [1]. Despite global advancements in scholarship management systems, challenges such as fragmented digital infrastructure, inadequate training, and poor usability persist, particularly in resource-constrained environments [2]-,[4]. These systemic gaps call for contextually appropriate technological solutions that not only automate administrative tasks but also enhance accessibility and accountability.

In international contexts, countries such as Indonesia, China, and Mexico have reported persistent difficulties in implementing integrated scholarship management systems, often citing complexity, poor digital literacy, and insufficient infrastructure as key barriers [2]-[3]. In the Philippines, scholarship programs such as the Tertiary Education Subsidy (TES) and the Tulong Dunong Program (TDP) face similar obstacles, with financial aid processes hampered by lengthy validation cycles, miscommunication, and inadequate system support across

multiple campuses [5]-[6]. These challenges are particularly evident in decentralized universities, where administrative tasks are duplicated and verification procedures prolong fund release schedules, thus adversely impacting student welfare and academic continuity.

At a higher education state university in the Philippines, the absence of a centralized scholarship management platform has contributed to significant inefficiencies, with coordinators manually verifying enrollment records and preparing billing documents across several campuses. Delays in financial aid disbursement, redundant validations, and fragmented communication further exacerbate operational burdens (Romero, 2020). In response to these challenges, a need arises for a unified, scalable, and adaptive scholarship management system capable of streamlining operations while addressing local constraints, such as intermittent internet connectivity.

This study addresses these gaps through the design and development of the Scholarship and Grants Management System (SchoGMS), a Progressive Web Application (PWA)-based platform developed using Agile methodology and guided by the PIECES framework for systems analysis [7]-[8]. SchoGMS automates enrollment verification, billing generation, and CHED compliance reporting while supporting offline functionality through PWA technologies, ensuring continuity even in areas with limited infrastructure. Moreover, to ensure the system's relevance and usability, this study adopts the Technology Acceptance Model (TAM) as a theoretical framework to evaluate user acceptance in terms of perceived ease of use, perceived usefulness, attitude toward system use, and behavioral intention [9]-[10].

Recognizing that technological innovation alone does not guarantee effective institutional adoption, this research further proposes a strategic implementation plan to guide the system's sustainable deployment, focusing on phased rollout, stakeholder engagement, technical support, and operational integration.

Accordingly, this study seeks to achieve the following objectives: (1) to design and develop the Scholarship and Grants Management System (SchoGMS) suited for decentralized higher education institutions; (2) to determine the level of user acceptance of the developed system using the Technology Acceptance Model (TAM); and (3) to formulate a strategic implementation plan to ensure the effective institutionalization of SchoGMS. Through these objectives, the study aims to contribute a replicable model for improving scholarship administration processes in decentralized and resource-limited higher education settings.

RELATED LITERATURE

Scholarship and Grants Management Systems

Scholarship and Grants Management Systems (SchoGMS) enhance the efficiency, transparency, and timeliness of financial aid processes by automating tasks such as application tracking, fund disbursement, and compliance monitoring [7]-[11]. However, global studies reveal persistent operational inefficiencies due to fragmented workflows, insufficient user training, and limited digital integration [12], [3], [13]. Online platforms and cloud-based solutions have emerged as promising interventions [4], [14], yet they remain constrained by usability issues and infrastructural limitations, especially in rural or decentralized institutions.

In the Philippines, similar challenges are observed in scholarship programs like the Tertiary Education Subsidy (TES) and Tulong Dunong Program (TDP), where manual processes and decentralized operations lead to delays and inefficiencies [1], [15], [6]. Studies emphasize the need for hybrid solutions, such as Progressive Web Applications (PWAs), that provide offline capabilities and scalable system architectures suited for resource-limited environments [8], [16].

Challenges in Financial Aid Management

Operational bottlenecks in financial aid management have been widely documented, including delayed fund disbursements, workflow redundancies, and insufficient technical support [17]-[19]. Decentralized universities face compounded difficulties due to redundant validation procedures and limited communication infrastructures [1]. Internal auditing, role-based access control, and structured automation are among the recommended strategies to enhance transparency and reduce compliance risks [20].

Technological Innovations in Scholarship Systems

Emerging technologies such as blockchain [21], predictive analytics [22], and decision-support systems [23] have shown promise in optimizing scholarship management. However, barriers like high implementation costs and digital divides persist. Studies emphasize the importance of real-time communication, mobile-ready platforms, and offline functionalities in improving accessibility and usability in decentralized settings [16], [24], [8].

Comparative analyses reveal that previous systems often lacked full integration with institutional management platforms, suffered from connectivity limitations, and offered limited post-application support [25], [26], [11]. The design of SchoGMS addresses these gaps by incorporating centralized databases, automated workflows, email notification systems, and flexible deployment across multi-campus operations.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), developed by Davis [9], provides a theoretical lens for understanding user acceptance, focusing on perceived ease of use (PEU), perceived usefulness (PU), attitude towards system use, and behavioral intention (BI). Numerous studies confirm that PEU and PU significantly influence system adoption and user satisfaction in educational settings [27], [28], [10], [29]. Positive user attitudes, peer influence, and institutional readiness further strengthen behavioral intentions to adopt new technologies [30], [31],

In designing SchoGMS, the integration of TAM constructs ensured that system usability, functional relevance, and user engagement were prioritized, thereby increasing the likelihood of successful adoption in decentralized educational environments.

METHODOLOGY

Research Design

This study employed a descriptive-quantitative research design to systematically develop and evaluate the Scholarship and Grants Management System (SchoGMS). A quantitative approach enabled the collection and analysis of objective numerical data related to user acceptance, system usability, and operational efficiency. Specifically, structured surveys grounded in the Technology Acceptance Model (TAM) were used to measure constructs such as perceived ease of use (PEU), perceived usefulness (PU), attitude toward system use (AT), and behavioral intention to use (BI) [9], [32]. Furthermore, operational performance indicators, including reductions in scholarship processing time and improvements in compliance reporting rates, were assessed to evaluate the tangible impact of the system. This design was selected to ensure systematic and evidence-based conclusions regarding SchoGMS's effectiveness and to provide actionable insights for system improvement and scalability.

System Design and Development

The development of SchoGMS followed the Agile methodology, which emphasizes iterative design, stakeholder feedback, and adaptive system evolution. At the beginning of the development process, the PIECES framework was applied to identify and prioritize system requirements, focusing on performance, information flow, economic impact, control mechanisms, efficiency, and service delivery [12]. This guided the identification of critical operational bottlenecks in the institution’s existing scholarship management practices.

The Agile process was divided into multiple sprint cycles, with each sprint delivering a working module that was tested, validated, and improved based on user feedback. Functionalities such as user authentication, enrollment validation, billing workflows, CHED compliance monitoring, and real-time dashboards were developed incrementally. The system architecture utilized a three-tier model: a front-end interface (HTML5, CSS3, JavaScript, jQuery), a PHP back-end managing the system logic, and a MySQL database ensuring structured and secure storage. Security protocols such as Role-Based Access Control (RBAC), Two-Factor Authentication (2FA), and SSL encryption were integrated to ensure the confidentiality and integrity of user data. The final system was deployed using a hybrid infrastructure, combining on-premise hosting for secure data storage and cloud services for enhanced accessibility and automated notifications.

Research Locale and Respondents

The study was conducted at a higher education state university in the Philippines, selected for its decentralized scholarship management structure and its critical reliance on manual processes. This university provided an ideal setting for evaluating the effectiveness of SchoGMS, particularly in addressing issues related to redundant workflows, document verification delays, and compliance tracking inefficiencies.

The research respondents were purposively selected to include administrative personnel directly involved in scholarship processes. A total of 53 participants composed the sample, including scholarship coordinators, registrars, deans, program chairpersons, and Office of Student Affairs and Services (OSAS) staff. Their inclusion was based on their active roles in enrollment verification, billing preparation, scholarship validation, and compliance reporting. Additionally, a specialized group of 14 system testers, composed of scholarship officers and IT experts, was involved in system validation during pilot implementation. This diverse respondent pool ensured that feedback was comprehensive, capturing the operational realities of scholarship administration across decentralized campuses.

Research Instrument

Data were gathered using a structured survey questionnaire grounded in the Technology Acceptance Model (TAM). The instrument, adapted from Ghani et al. [33], assessed user perceptions across four core constructs: perceived ease of use (PEU), perceived usefulness (PU), attitude toward use (AT), and behavioral intention to use (BI). Each item was rated on a five-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree." The survey underwent expert validation to ensure relevance, clarity, and contextual appropriateness. Following a pilot test, reliability testing using Cronbach's alpha resulted in a value of 0.891, indicating excellent internal consistency and confirming the instrument's suitability for evaluating user acceptance of SchoGMS.

Data Gathering Procedure

Data collection commenced following ethical clearance from the University Research Ethics Committee (Protocol No. GS-ER-01-25-0154) and institutional permission from university authorities. Respondents were provided with informed consent forms that clearly outlined the study's objectives, data protection measures, and participants' rights, including the right to withdraw at any time. Surveys were distributed using both online and face-to-face methods, allowing respondents flexibility according to their availability and preferences.

During system validation, respondents interacted directly with SchoGMS, performing core tasks such as enrollment record uploading, document verification, billing approval tracking, and CHED form generation. Their operational experience with the system informed their survey responses, thereby enhancing the relevance and accuracy of collected data. Strict compliance with the Philippine Data Privacy Act (RA 10173) was observed, ensuring the confidentiality and security of all participant data.

Statistical Tools

Descriptive statistics were utilized to analyze the survey data, offering a comprehensive summary of central tendencies, variations, and frequency distributions. The data analysis was performed using Jamovi, an open-source statistical software known for its user-friendly interface and robust analytical capabilities [34]. Mean scores were interpreted based on a structured range to categorize levels of user acceptance across the TAM constructs. Visual representations, including tables and graphs, were generated to enhance the clarity and accessibility of the results. The application of these statistical tools ensured a systematic and transparent interpretation of findings.

Ethical Considerations

Throughout the study, rigorous ethical standards were maintained to protect the rights, privacy, and welfare of all participants. Informed consent was obtained prior to participation, emphasizing the voluntary nature of involvement and the right to withdraw without penalty. Data confidentiality was safeguarded through encryption, secure access protocols, and anonymized reporting.

The system's security measures, including AES-256 encryption, RBAC, and SSL-protected data exchanges, were aligned with the Philippine Data Privacy Act (RA 10173) to ensure the protection of personal and scholarship-related information. Furthermore, no vulnerable populations were involved in the study. Transparency was reinforced by regularly updating participants regarding the research process and by formally disseminating research findings to institutional stakeholders. The researcher declared no conflicts of interest, further ensuring the credibility and impartiality of the study.

RESULT AND DISCUSSION

System Design and Development Using the PIECES Framework

The development of the Scholarship and Grants Management System (SchoGMS) was guided by the PIECES Framework to address existing operational inefficiencies in scholarship management. Through structured analysis, critical system gaps were identified across performance, information management, economic costs, control, efficiency, and service delivery. Table 1 illustrates the measurable improvements achieved through the implementation of SchoGMS. Notably, the automated CHED masterlist validation reduced processing time from seven days to one hour, aligning with [26], who emphasized the significance of real-time verification in administrative systems. Furthermore, centralized information management improved document retrieval by 70%, supporting the findings of [24] regarding the value of standardized data storage systems.

Economically, SchoGMS generated ₱50,000 in annual cost savings by transitioning to paperless workflows, in agreement with the observations of [36]. Control enhancements, including role-based access control (RBAC) and automated audit trails, improved transparency by 90%, consistent with the governance principles outlined by [20]. The system also delivered operational efficiencies, as reflected in a 60% reduction in coordinator workload, and improved service delivery by ensuring offline dashboard access through PWA technology—critical for decentralized and resource-limited settings, as underscored by [8], [18] .

Thus, SchoGMS demonstrated significant advancements in performance, data management, and service provision, addressing long-standing administrative challenges.

Table I Pieces Framework of Schogms Here's your data converted into a well-formatted table:

Category	Problems	Opportunities	Measurable Outcome
Performance	Manual verification delays, redundant processes, lack of real-time visualization.	Automate CHED masterlist comparison; centralized database; real-time dashboards.	CHED validation time reduced from 7 days to 1 hour.
Information	Difficulty retrieving data, inconsistent eligibility records, lack of historical access.	Centralized database with role-based access; standardized validation formats; digital repository.	Document retrieval time reduced by 70%.
Economics	High paper-based costs, redundant administrative tasks.	Paperless workflow; centralized dashboard for coordinators and deans.	₱50,000 annual savings in operational costs.
Control	Lack of transparency, missing audit trails, compliance difficulties.	Role-based access; audit tracking; automated CHED reports.	Audit transparency improved by 90%.
Efficiency	Slow manual handling, redundant processes, poor coordination.	Automated validation; real-time notifications; improved coordination.	Coordinator workload reduced by 60%.
Service	Poor status tracking, inefficient communication, limited offline access.	Real-time dashboards; automated notifications; offline monitoring through PWA.	80% improvement in scholarship decision-making response time; dashboards accessible offline.

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System Interfaces and User Role Integration

The development of user interfaces within SchoGMS followed an iterative Agile methodology, ensuring stakeholder-driven enhancements and adaptability throughout the development cycle. The system architecture adopted a three-tier model integrating a secure front-end, dynamic back-end, and structured database management as shown in Figure 1.

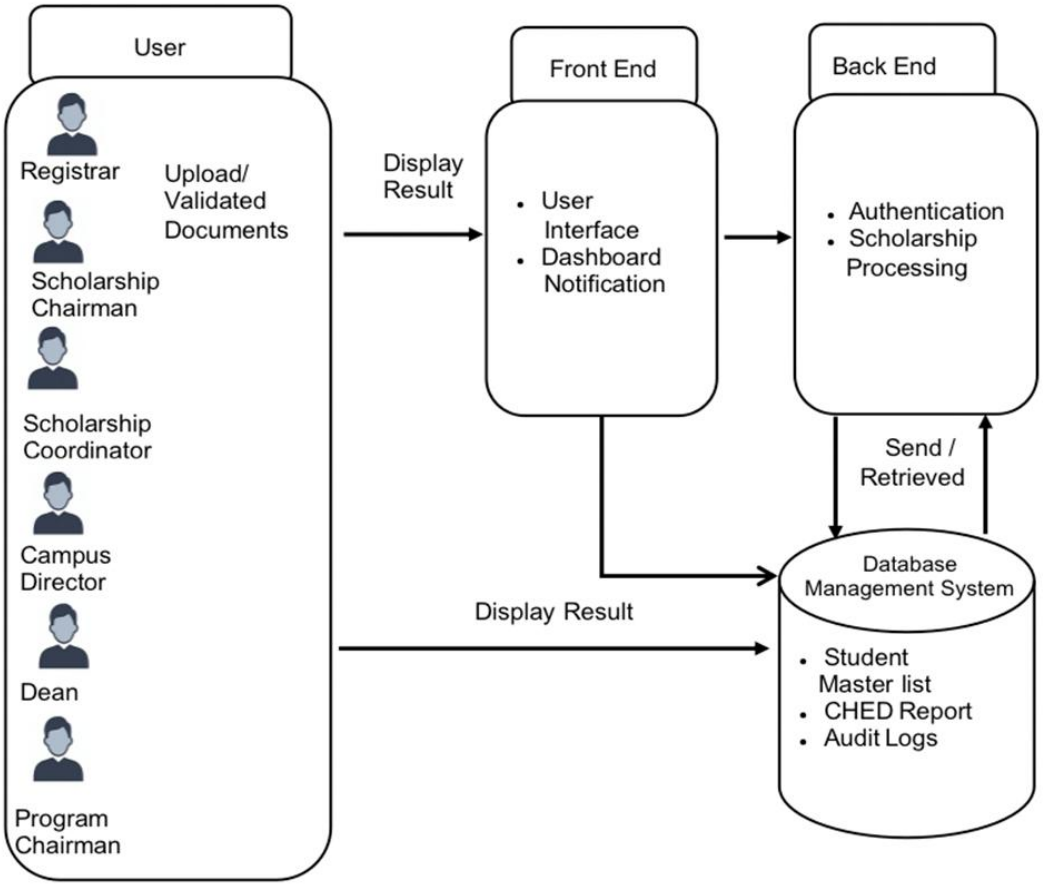

Fig.1 System Architecture

Key interfaces included:

Admin Dashboard: Managing users and overseeing system-wide analytics.

Registrar Interface: Uploading and verifying scholarship documents.

Scholarship Chairman Interface: Validating CHED masterlists and billing forms.

Scholarship Coordinator Interface: Conducting real-time student eligibility validation.

Director, Dean, and Program Chair Dashboards: Monitoring scholarship distribution at program and campus levels.

Each module was designed to facilitate operational efficiency and data transparency, aligning with [33] and [11], who emphasize the importance of user-centered administrative systems. This modular, role-based approach ensured that responsibilities were clearly defined, monitored, and optimized through real-time visualization tools.

Validation of Functional and Non-Functional Requirements

Extensive testing validated the reliability, functionality, and security of SchoGMS. Functional validation confirmed

that key modules, including user authentication (2FA), role-based access control (RBAC), document uploads, CHED billing verification, and dashboard monitoring, operated reliably across user groups.

Authentication and encryption mechanisms adhered to established digital security protocols, supporting the recommendations of [19], [18] regarding safeguarding sensitive institutional data. Document management workflows, especially bulk uploads and auto-verification mechanisms, demonstrated strong operational efficiencies, consistent with [10]. A significant refinement was the integration of the automated delisting mechanism for non-enrolled students, which streamlined CHED compliance reporting and minimized manual administrative tasks, aligning with [22] .

In terms of non-functional testing, SchoGMS maintained high system stability during concurrent operations, although comprehensive stress testing remains a future direction as recommended by [4]. Furthermore, Progressive Web Application (PWA) capabilities ensured offline dashboard access, reinforcing system accessibility in geographically dispersed campuses [8].

Collectively, the validation process confirmed that SchoGMS is secure, efficient, and adaptive for long-term scholarship management.

User Acceptance Based on the Technology Acceptance Model (TAM)

The evaluation of user acceptance using the Technology Acceptance Model (TAM) as shown in Table 2 revealed a very high overall mean score of 4.89, with a standard deviation of 0.150, indicating strong approval among stakeholders.

Across all TAM constructs—Perceived Ease of Use (PEU), Perceived Usefulness (PU), Attitude Toward Use (AT), and Behavioral Intention to Use (BI)—respondents reported strong agreement regarding the system's usability, relevance, and effectiveness. These findings align with [27], [28], [10], who assert that user-centered design and functional relevance drive system adoption.

Specifically, users highlighted the system's intuitive workflows (PEU) and its ability to significantly improve scholarship management productivity (PU). Positive attitudes (AT) and strong intentions for continued use (BI) confirm that SchoGMS meets both operational needs and user expectations, consistent with the behavioral insights provided by [30]-[31].

These results substantiate the scalability and institutional sustainability of SchoGMS as a long-term digital solution for scholarship administration.

Table Ii User Acceptance Results Based on Tam

Code	Question	Mean	SD	Interpretation
1	Using SchoGMS easily	4.89	0.312	Very High
2	Learning to use SchoGMS	4.82	0.391	Very High
3	Performing tasks with SchoGMS	4.91	0.292	Very High
4	Understanding SchoGMS components	4.88	0.331	Very High
5	Following SchoGMS processes	4.85	0.364	Very High
6	Finding needed information	4.88	0.331	Very High
Category Mean (PEU)		4.87	0.221	Very High
7	Improving management efficiency	4.92	0.269	Very High
8	Enhancing accuracy	4.88	0.331	Very High
9	Accomplishing tasks faster	4.86	0.348	Very High
10	Improving overall productivity	4.83	0.378	Very High

11	Managing scholarship processes effectively	4.97	0.174	Very High
Category Mean (PU)		4.89	0.197	Very High
12	Maintaining a positive attitude	4.86	0.348	Very High
13	Recognizing SchoGMS's value	4.88	0.331	Very High
14	Liking SchoGMS usage	4.94	0.242	Very High
15	Finding SchoGMS efficient	4.91	0.292	Very High
16	Satisfaction with SchoGMS experience	4.98	0.125	Very High
Category Mean (AT)		4.91	0.142	Very High
17	Intending to continue using SchoGMS	4.86	0.348	Very High
18	Recommending SchoGMS to others	4.80	0.403	Very High
19	Preferring SchoGMS over other methods	4.86	0.348	Very High
20	Committing to regular use	4.95	0.211	Very High
Category Mean (BI)		4.87	0.226	Very High
Overall Mean		4.89	0.150	Very High

Strategic Implementation Plan for SchoGMS Deployment

To ensure a successful transition to automated scholarship management, a structured implementation plan was developed, focusing on infrastructure readiness, user training, controlled deployment, full-scale rollout, and continuous post-implementation monitoring.

The plan commenced with technical assessments and system optimization, followed by user training to facilitate smooth onboarding. Controlled deployment at the ACCESS campus allowed for real-time system evaluation before expanding to all campuses. Full integration with the University Management Information System (UMIS) ensured that billing, scholarship validations, and compliance tracking were seamlessly coordinated.

Post-deployment monitoring and maintenance strategies were implemented to guarantee long-term system resilience and user support. Institutional leadership, including the Office of the Student Affairs (OSA) and the Vice President for Academic Affairs (VPAA), provided full financial and administrative backing, ensuring the sustainability of SchoGMS.

Thus, the strategic implementation framework provided a risk-mitigated, scalable model for digital transformation in decentralized scholarship management, positioning SKSU as a benchmark institution for scholarship modernization in Philippine higher education.

CONCLUSION AND RECOMMENDATIONS

This study successfully designed and developed the Scholarship and Grants Management System (SchoGMS) using Agile methodology, guided by the PIECES framework to address performance, control, efficiency, and service gaps in decentralized scholarship management. Through iterative development and user validation, the system integrated automated workflows, centralized data management, role-based access control, dynamic dashboards, and offline accessibility, effectively streamlining operations across multiple campuses.

Moreover, the assessment of user acceptance through the Technology Acceptance Model (TAM) revealed a very high level of agreement across all constructs, indicating that SchoGMS was perceived as easy to use, useful, satisfactory, and suitable for sustained adoption. The consistently high ratings across Perceived Ease of Use, Perceived Usefulness, Attitude Toward Use, and Behavioral Intention to Use validate the system's usability and relevance within an academic setting.

Furthermore, a strategic implementation plan was formulated to support the phased rollout of SchoGMS, beginning with pilot deployment and scaling toward university-wide adoption. By emphasizing infrastructure optimization, user training, controlled testing, and feedback-driven improvements, the plan ensures a sustainable and replicable model for scholarship administration modernization.

Therefore, it is recommended that university administrators adopt the proposed implementation plan to guide the deployment of SchoGMS across all campuses. Additionally, future system enhancements may consider integrating AI-driven analytics to further optimize enrollment verification, predict scholar retention trends, and enhance the accuracy of scholarship eligibility validation, thereby strengthening the efficiency and impact of scholarship management processes.

ACKNOWLEDGMENT

The researcher extends profound gratitude to the university of the immaculate conception (UIC) for the academic guidance and ethical oversight that shaped the conduct of this study. Special thanks are also extended to the administration of sultan kudarat state university (SKSU) for their unwavering support, permission, and collaboration throughout the development and evaluation of the scholarship and grants management system (SchoGMS). Their invaluable assistance greatly contributed to the successful completion of this research.

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