Web-Based Document Tracking System for Catanduanes State University with QR-Code Technology: In Alignment with Republic Act No. 11032

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ARTICLE INFO	ABSTRACT
	Tracing in a university setting is usually beset with inaccuracies, misplaced files, and delay retrieval. This research is, therefore, designed to develop a web-based document tracking system that integrates QR-code technology specifically tailored for Catanduanes State University (CatSU). It shall be designed to further enhance efficiency in document tracking to complement administrative processes and purport compliance with Republic Act No. 11032, otherwise known as the Ease of Doing Business and Efficient Government Service Delivery Act of 2018. Through document tracking, the system reduces the risk of human error and allows transparency of both sent and received documents. Developed using HTML, CSS, JavaScript, and PHP, along with a centralized database implemented on an Apache server, QR codes uniquely identify each document for real-time status tracking. The system evaluation, performed on ISO/IEC 25010 software quality criteria, gave it a rating of "Excellent." Overall, the mean score of critical parameters of Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability are in the range of 4.94. This high rating signifies that the system can further document management and administrative procedures at CatSU. Other recommendations include expanding the system's capabilities, training the users, and the development of mobile access. Overall, the DTS provides an effective solution for the document tracking needs of CatSU, which enables transparency, accuracy, and compliance with RA 11032, besides the potential of the backbone toward scalability and further improvements. **Keywords:** document tracking system; QR-code integration; ISO/IEC 25010; government sector efficiency; information systems

1.   INTRODUCTION:

Documentation is crucial for the functioning of every organization, especially in a university environment. Effective administration and monitoring of documents are crucial, yet, despite the incorporation of information and communication technology (ICT) in universities, the procedures for document tracking continue to be predominantly conventional. Logbooks remain predominantly employed for the purpose of locating and monitoring the progress of documents. However, these manual approaches entail a significant likelihood of errors, misplaced files, and delays. Systematically monitoring documents has been met with particular difficulty in organizations characterized by many departments and a large volume of transactions, therefore rendering the procedure tedious and prone to human-error **[1]**. In correspondence, document tracking systems (DTS) have emerged as a viable technology to tackle these

issues. DTSs enables accurate monitoring of documents, determining the most recent access and tracing their whole transaction history **[2]**. Furthermore, the integration of Quick Response (QR) codes amplifies these systems by facilitating rapid, precise scanning and efficient storage of substantial volumes of data **[3]**.

Government agencies in the Philippines are required by the Republic Act No. 11032 or the Ease of Doing Business and Efficient Government Service Delivery Act of 2018 to deliver fundamental services that are tailored to meet the demands of their constituents. According to Section 2 of the aforementioned legislation, it is stipulated to:

"... establish effective practices, aimed at efficient turnaround of the delivery of government services and the prevention of graft and corruption in government, which shall encompass a program for the adoption of simplified requirements and procedures that will reduce red tape and expedite business and non-business related transactions in government **[4]**.*"*

With the intention of improving the effectiveness and clarity of document tracking at CatSU, considering these specific needs, the authors have investigated the development of a web-based document tracking system (DTS) for Catanduanes State University (CatSU) as alignment with the Ease of Doing Business Act 2018, which aims government services to streamline its current systems and procedures. In order to guarantee prompt processing and minimize mistakes, the system will automate the document tracking procedure. This study will focus on two main objectives: (1) develop a web-based DTS with QR-code technology for CatSU, and (2) assess the system using ISO/IEC 25010 standards. This study aims to optimize document tracing in response to ARTA procedures, therefore enhancing efficiency in the administrative activities of the university.

2.   METHODS AND METHODOLOGY:

As means of optimizing the document tracking processes of CatSU administration, software development methodology is employed throughout the study. Software development methodology, or Systems Development Life Cycle defines it as a technique or method that revolves in the phases of design, development, and testing in developing software **[5]**. Having considered the specific requirements and output for this study, the Rapid Application Development (RAD) has been found to be the most suitable methodology for this project due to its iterative and flexible approach. Rapid Application Development (RAD) underscores the need of swift prototyping, incremental development, and active user participation, rendering it well-suited for projects characterized by changing needs and stringent time constraints **[6]**. RAD has been adequate in the development and eventual deployment of the system. Figure 1 displays the phases and activities undertaken for this study.
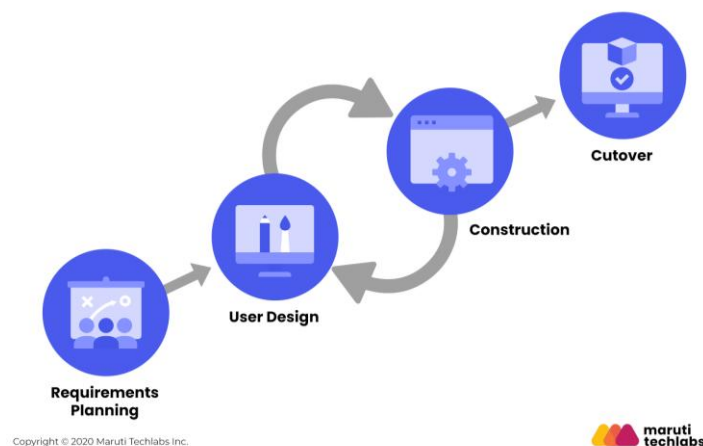

Figure 1 Rapid Application Development Methodology[7]

From figure 1, the RAD phases have been used as follows: (1) ***Requirements Planning*** - The RAD process commences by prioritizing the collection of main requirements and establishing the general objectives of the system. In this research, this phase entailed conducting informal interviews with the selected departments of the CatSU institution as means of determining the top-level process of how documents are transferred from one department to another. The authors have determined that the institution has *incoming* and *outgoing* documents that is being received or released by a department's clerk, respectively. Sample spreadsheet documents and manual tracking logbooks have also been gathered to further understand the details of tracking process; (2) ***User Design*** - The RAD methodology prioritizes fast prototyping to efficiently construct and evaluate a functional prototype once the requirements have been determined. During this phase, a swim lane diagram depicting the design and process of the

system on two users (Clerks and Admin Side) were determined. This has also been the foundation of creating the *prototype* for the system, showing that the system is capable of tracking documents in a timely manner. This prototype is distributed to clerks of different departments for testing in order to obtain early input and validation, which will enable iterative improvement and development of the system architecture (*test and refine*); (3) **Construction** - Following the phase of developing partial components of the system, the focus shifts towards integrating these elements into a unified and operational entity. The front-end and back-end components of the system are identified and all modules were finalized. In this phase, the QR-code technology has also been integrated to capture a document's information for tagging. Pilot testing was also done to five (5) CatSU staff to verify that the system operates in accordance with the institution's document monitoring processes; and (4) **Cutover** - This phase signifies the final stage of the development process such that it shifts from development to deployment. Clerks of departments were also subjected to *user training* to ensure their awareness and adeptness with all modules of the system. The same users were also requested to assess the system based on ISO/IEC 25010 software quality model for the parameters of a) Functional Suitability, b) Performance Efficiency, c) Compatibility, d) Usability, e) Reliability, f) Security, g) Maintainability, and h) Portability. This part of the study was deemed crucial to ensure the success of the initial implementation and locate possible bugs and errors encountered during the pilot testing.

Meanwhile, sources of data and data collecting instruments used for this study were informal interviews, observations, document details, and document tracking information. A software assessment was performed to evaluate the system according to ISO/IEC 25010 criteria. User assessment of the system was conducted using a survey questionnaire comprising two sections: (1) profile of the respondents; and (2) survey evaluation including questions aligned with the parameters of the software quality model described. The system internally processes both document specification and document tracking information. The quantitative and qualitative interpretations of the respondent's answers were established by employing the five-point Likert scale and its associated value range.

Table 1. Five-Point Likert Scale

Quantitative Equivalent	Range	Quantitative Equivalent
4.21-5.00	5	Excellent
3.41-4.20	4	Very Satisfactory
2.61-3.40	3	Satisfactory
1.81-2.60	2	Fair
1.00-1.80	1	Poor

Table 1 displays the quantitative assessment scale employed to evaluate performance or replies, which spans from "Excellent" to "Poor." The maximum rating, "Excellent," is associated with a score range of 4.21-5.00, which is comparable to 5 in numerical terms. The rating of "Very Satisfactory" is allocated a score of 4 and falls within the range of 3.41-4.20. A performance deemed "Satisfactory" falls within the range of 2.61-3.40, which is quantitatively comparable to a score of 3. On the other hand, a performance classified as "Fair" represents a score of 2 and a range of 1.81-2.60. The lowest rating, "Poor," is assigned to the range of 1.00-1.80, which is quantitatively equivalent to 1. The utilization of this scale enables a uniform and consistent understanding of performance across several categories.

Furthermore, the outcomes of beta testing and final software evaluation were examined utilizing statistical techniques like Frequency Count, Weighted Mean, and Percentage analyses. The analysis provided the foundation for evaluating the general feedback, suggestions, and user acceptance of the system.

3. RESULTS:

This section outlines the outcome of the investigation of the development of a web-based Document Tracking System (DTS) integrating QR-code technology specifically designed for Catanduanes State University (CatSU). The system was specifically developed to enhance the effectiveness and precision of document tracking as means of adhering to RA 11032. This section would tackle both the inner workings of the system as well as its evaluation.

Development of a web-based DTS with QR-code technology for CatSU

The central focus of this study was the development of a web-based document tracking system with QR-code technology that was customized to meet the unique requirements of Catanduanes State University. The system architecture diagram in Figure 2 illustrates the general structure and organization of the system.
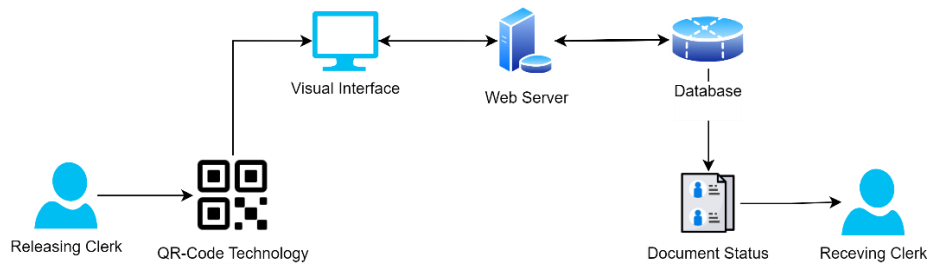

Figure 2 Systems Architecture of the CatSU-DTS

The architectural design of the system begins with an authorized Releasing Clerk logging in to the system with the credentials (username and password) provided by the System Administrator. The Releasing Clerk is tasked to enter the details for the *outgoing document* via the Visual Interface built with web technologies such as HTML, CSS, JS, and PHP. Upon creation of the outgoing document post, the Release Clerk can generate a QR-code sticker, quipped with distinct control numbers that function as the identification of the document in the system, that can be affixed to the hard copy document. The details for the *outgoing document* are transmitted to the Server (running on Apache) and stored in the Database. The document details will be updated depending on the current location and status of the document. Finally, the system will respond by providing the authorized Receiving Clerk with the forwarded Document Status of the document. This document could then be flagged as *incoming document* once received by the Receiving Clerk in the system whether via Visual Interface or by scanning the QR-code. Following the RAD cycle, Figure 3 displays the process flow of the system.
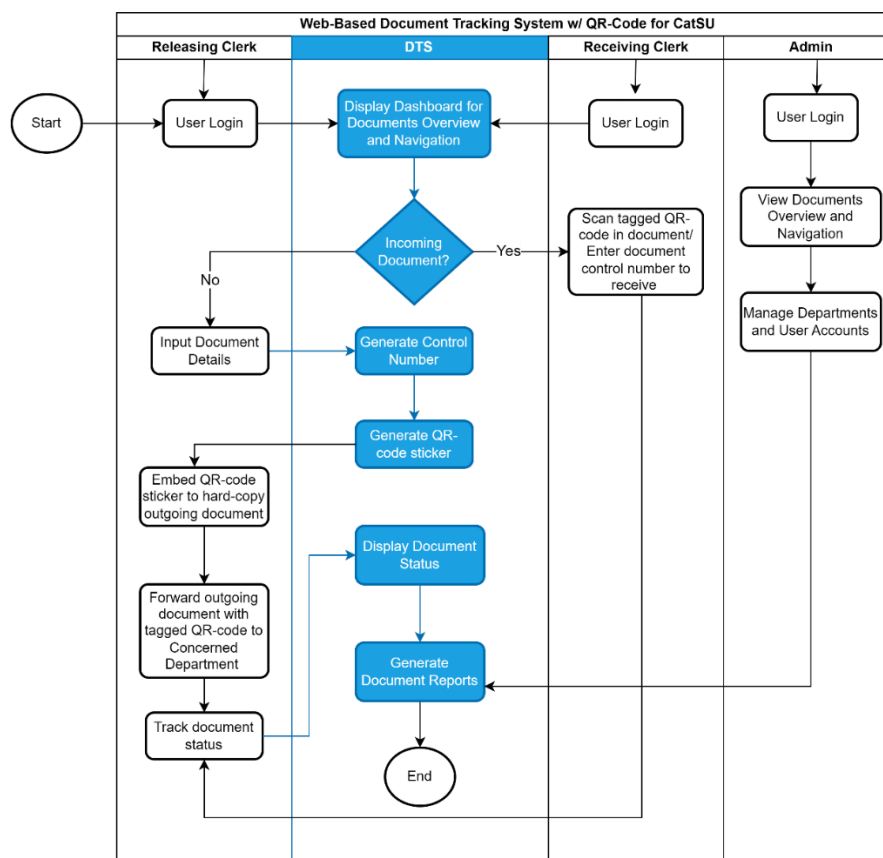

Figure 3 Swimlane Process Model of the CatSU-DTS

The developed system follows the process flow depicted from figure 3. The DTS is divided into four (4) main roles, namely: (1) Releasing Clerk, (2), DTS system, (3) Receiving Clerk, and (4) Admin. The process begins with the

Releasing Clerk logging into the system which directs him into the dashboard of the *DTS*, showing the overview and navigation for the different document tracing modules. If the system detects that an incoming document is pending, the *Receiving Clerk,* logged in to the system, can either scan the tagged QR-code document or enter the document control number for the document to be received. This would then let the Receiving Clerk track the status of the document for which the system would display the document status. Otherwise, the Releasing Clerk must input the document details from which the system would generate a control number that will be also embedded to the QR-code sticker once generated. This control number would serve as the unique identification of the document. The generated QR-code sticker would then be tagged into the outgoing document and is ready to be forwarded to the concerned department. The status of the document is tracked in the system throughout this process.

The *Admin*, on the other hand, logs into the system to oversee document tracing and navigation via managing departments and user accounts. The system consistently updates the status of documents and produces reports for these documents to facilitate tracking. The process is finalized by the production of these reports, which signify the conclusion of the document tracking procedure.

Assessment of the system using ISO/IEC 25010 standards

As planned, the system was evaluated using a survey questionnaire tool devised by the researchers, which includes two parts: 1) the profile of the respondents; and 2) the evaluation proper following the software quality metrics of ISO/IEC 25010 namely the a) Functional Suitability, b) Performance Efficiency, c) Compatibility, d) Usability, e) Reliability, f) Security, g) Maintainability, and h) Portability. This part of the study was deemed crucial to ensure the success of the initial implementation and locate possible bugs and errors encountered during the pilot testing.

Five (5) designated participants participated in the pilot testing, which comprised the following: a) the Clerk of the VPAA Office; b) two Clerks from the CICT Dean's Office; and c) two Technical Experts from the CICT Faculty. The participants' answers for each parameter were assessed utilizing the Five-Point Likert Scale. The range of responses, along with their corresponding quantitative and qualitative equivalents, are detailed in Table 1. Figure 4 displays the summary of all ratings for the system quality by respondents.
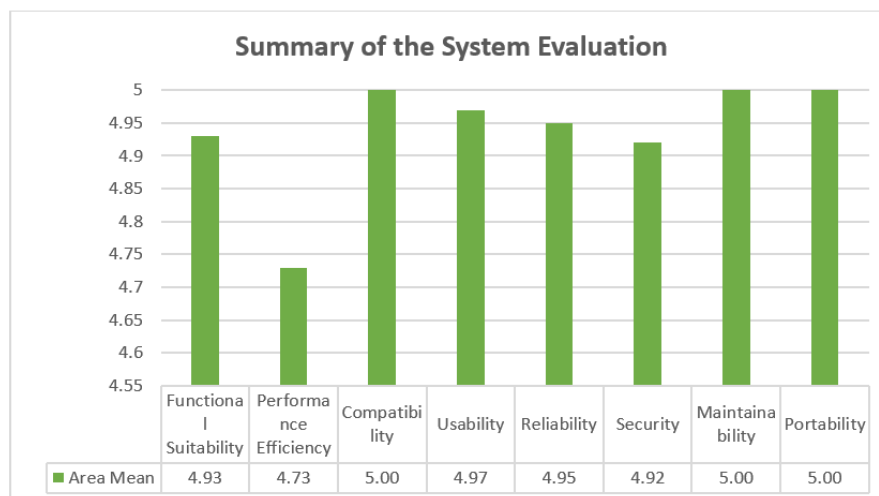

Summary of the System Evaluation

	Functional Suitability	Performance Efficiency	Compatibility	Usability	Reliability	Security	Maintainability	Portability
Area Mean	4.93	4.73	5.00	4.97	4.95	4.92	5.00	5.00

Figure 4 Summary of Evaluation of the CatSU-DTS

From Figure 4, it could be garnered that the eight parameters achieved high ratings from the respondents. The *Functional Suitability* parameter obtained an Area Mean of 4.93, understood as "5" (Excellent), based on the evaluation of the system across eight factors. Most indicators scored 5 except for the first, which obtained a weighted mean of 4.8 but was still regarded as "Excellent." In spite of the significantly lower weighted mean of 4.2 (Very Satisfactory) for the first indication, perhaps due to respondents still acquainting themselves with the system, the *Performance Efficiency* parameter had an Area Mean of 4.73, which is likewise understood as "Excellent." The *Compatibility* parameter achieved a flawless score, with all indications awarded a grade of 5, resulting in an Area Mean of 5. This suggests a smooth integration of the QR code scanner into the system. The system received an Area Mean of 4.97 for *Usability*, with most indications awarded a rating of 5, save for one respondent who rated the system 4 on its capacity to execute required activities, nonetheless resulting in an "Excellent" interpretation. The *Reliability*

parameter obtained an Area Mean of 4.95, with the majority of indicators scoring 5, save for one category which had a weighted mean of 4.8, however still receiving a qualitative assessment of "Excellent." Regarding *Security*, the initial four indications received a score of 5, but the fifth indicator had a weighted mean of 4.6. However, the system as a whole still attained an Area Mean of 5, which is considered "Excellent." Regarding *Maintainability*, a consistent pattern was noted, where indications one through four received a score of 5 and the fifth received a score of 4.6, consistently maintaining an overall "Excellent" grade. Finally, the *Portability* criteria yielded a flawless score of 5 for all indicators, indicating that the system excelled in effectively adjusting to diverse platforms, guaranteeing seamless installation and configuration on different browsers and operating systems. In general, the system exhibited exceptional performance in achieving or surpassing user expectations across all metrics.

With the shown user feedback and acceptability, the developed web-based DTS with QR-code technology for Catanduanes State University demonstrates alignment with the provisions of RA 11032, which requires the optimization of services to offer expedited and more effective delivery of public services to government constituents. The system's effective automation of document tracking and production of QR codes for simplicity of identification and status monitoring guarantees the timely processing of transactions, minimizes human errors, and promotes transparency. The system's adherence to the standards for streamlined processing, as confirmed by both the system architecture and the ISO/IEC 25010 evaluation, enables the institution to achieve its goals of promoting public sector efficiency and optimizing the user experience.

4.   DISCUSSION

This section outlines the results' interpretation obtained from the study, highlighting the significance of the developed web-based Document Tracking System (DTS) with QR-code for Catanduanes State University (CatSU). This section would delve into the system's impact on optimizing document tracking, such that it reduces human-prone errors and faster turnaround times as response to RA 11032.

Development of a web-based DTS with QR-code technology for CatSU

The system architecture and process flow are designed to maximize the existing manual procedures in monitoring documents, which is more often than not pretty much bound by inefficiency and inaccuracies, as shown in Figures 2 and 3. The DTS allowed users, especially the *Releasing and Receiving Clerks*, to access a centralized, web-based interface that captures the needed information of the documents and generates control numbers together with QR codes. The system also enables users to trace the right documents as they make their way across different departments. This optimized workflow, using QR-code technology for accelerating document identification and scanning, ensures remarkable improvement in traceability, accuracy, and speed of retrieval of documents.

The technologies used (HTML, CSS, JavaScript, and PHP) also provided a seamless and user-friendly GUI. The QR code generation and tagging worked out very nicely because each document was assigned a unique control number, hence reducing the chances of misplaced documents during transfer to a degree. Embedded QR codes allowed tracking of the documents with ease in the process. This increased traceability could satisfy the timely processing requirement of RA 11032 because any user would be in a position to know exactly where a particular document was, who handled it last, and at what stage it was.

The Apache server used for managing the movement of document information within the database scales the DTS where large volumes are being managed at any one time without slowing down. The home page dedicated in providing users with the overview of received and pending incoming and outgoing documents give less involvement from the clerical staff in handling the documents, hence freeing the time of the staff for other administrative tasks. The reporting features also allowed the clerks to come up with details of document transactions, meeting the system objective of accountability and efficiency in the administrative processes of the university. The web-based DTS using QR code technology, therefore, in its entirety has successfully come up with an alternative to the frailties of the traditional DTS, which is more dependable, fast, and user-friendly.

Assessment of the system using ISO/IEC 25010 standards

The assessment of the system, according to standards set out in ISO/IEC 25010, provided an evaluation focused on determining the functional suitability, performance efficiency, compatibility, usability, reliability, security and maintainability of its overall software quality. From the extracted response of the determined participants, it showed

that in all eight (8) criteria, the DTS performed exceptionally well, indicative of the fact that most user expectations were met or surpassed by the system.

From the Figure 4, it is noted that the Area Mean of every respective area is in the range 4.73 to 5.00; all areas have been rated quantitatively "5" as well as qualitatively "Excellent." To receive a Grand Mean of 4.94 falls within a quantitative rating of "5," which further agrees with the qualitative appraisal of "Excellent," meaning the rated areas have achieved the highest possible ranking. A rating that is high and continuous would indicate a great extent in quality or success of the pilot implementation of the system. This would somehow mean that the respondents view this implementation as one that enhances the general quality and efficiency in document tracking among the offices within CatSU. For instance, this system in moving documents from one office to another shall make document tracking easy and fast. Most of these advantages will result in better document tracking and a speedier process, which in turn will result in higher productivity and smooth operation.

Findings from the ISO/IEC 25010 assessment has proven that the web-based DTS using QR-code technology is an appropriate and highly efficient solution for tracking documents within CatSU. The very high ratings across all quality characteristics justify that the system exceeds what the university needs at present and gives room for further scalability in the future. The improvements may be had in the narrow areas of performance efficiency and advanced security features, which future releases could attend to, such that the system keeps on delivering a reliable and effective service. In summary, the performance of the system is promising enough to be used and effective in rationalizing administrative procedures and ensuring the enforcement of the Ease of Doing Business Act of 2018.

The study implies that using QR-code technology in designing and evaluating a web-based DTS for CatSU has really taken giant steps up in upgrading document handling at the institution. Flaws in manual tracking prompted an effective automation of the workflow, facilitating increased traceability of documents with minimal errors, which also reduced retrieval time. The system also used QR codes to identify documents correctly, which could fall on the requirements in realizing RA 11032. The technologies at the system framework and user interfaces have been developed on solid grounds of access and extensibility in the present and possibly in the future needs of CatSU. Furthermore, the system is strong in all quality attributes, therefore suitable and effective for CatSU based on the quality standard of ISO/IEC 25010 re-emphasized. Although a few minor points for improvement have been noticed, mainly connected with performance efficiency and security issues, the overall result of the pilot implementation shows that the system is well-positioned to contribute to administrative processes and help the university become more compliant with government regulations.

5.   CONCLUSION

This study concludes that a viable document-tracking system at the Catanduanes State University that improved the efficiency and precision of the administration has been successfully be pilot implemented. The system was purposefully developed to manage the sequential generation and transfer of documents, providing the administrative personnel with an efficient process that guarantees easy retrieval and documentation. This development is in line with Republic Act No. 11032, otherwise known as the Ease of Doing Business and Efficient Government Service Delivery Act of 2018, which allows the streamlining processes within government agencies to cut red tape and accelerate the delivery of government services. Integrating QR-code technology into the system enhances the intents of the Act, particularly transparency and reduced human error to facilitate timely processing.

The authors of this study were successful in developing a web-based document tracking system that will allow users, especially clerical staff at CatSU, to access and work with the system through a web browser. Such availability renders even more transparency and accuracy in keeping track of the documents being issued and received; it also serves as a repository for documents since it allows attachment of scanned or digital copies. Integration with QR-code technology allows real-time tracking of the status of documents in need of updating and allows tracking through an easy QR-code scanning mechanism, allowing better effectiveness of the system.

The system obtained a rating of "Excellent" from the technical experts and users, which depicted confidence that the system has potential to improve service delivery in the university. Its overall feature of facilitating ease of access, keeping records, and transparency were also highly appreciated; this proved that the aims of the study have been addressed. An evaluation done based on ISO/IEC 25010 standards verified that the system passed all the quality measures, which means it will be efficient and reliable for use in the administrative services of CatSU.

The study, therefore, affords CatSU a way in which documentation can be properly maintained, administrative processes facilitated, and productivity and efficiency improved to conform to the goals laid down by RA 11032. In addition, the viability of system development and assessment of a developed system for positive remarks ensures a stable platform for its actual implementation while yielding ways for further improvements toward areas that need improvement. Scaling ensures that when the institution grows, it will be handling many documents and users.

These findings then form the basis of the following recommendations on further development and implementation: (1) enhance the existing system to include the feature that will attach related documents to the original receipt and release of the document and thus manage the related transactions process; (2) set up a Document Management system tailored to the specific and organizational needs of different colleges within the university; (3) conduct user training and the provision of technical support to the staff for effective integration of the system; (4) enhance mobility for the personnel to track and manage documents at their convenience via a mobile application; (5) extending this system to external agencies such as Municipal LGUs, with a view to enabling more seamless document handling processes within public service and building efficiency in public service thereof; and (6) improve the system such that it would provide notifications and real-time updates in conjunction to the 3-7-20 rule of ARTA Memorandum Circular No. 2020-02.

Overall, this document tracking system developed for and in consonance with the stipulation of Section 2 of RA 11032 has been a proper vehicle toward not only speeding up administrative functions but also institutionalizing further the delivery of public service. It will not only address current expectations at the university but will go further in providing a robust base for improvement measures that would place CatSU as a clear model for effective public service-consonant to the commitment of the government by reducing bureaucratic inefficiency and raising transparency.

8.   DATA AVAILABILITY:

No new data were created or analyzed in this study. Data sharing is not applicable to this article.

9.   CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest.

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