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Design and Implementation of a Web-Based Information System to Improve the Efficiency of Organizational Business Processes

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Article History



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Abstract

Digital transformation plays a critical role in enhancing organizational business process efficiency through the integration of web-based information systems. This study aims to design and implement a web-based information system to improve workflow performance, data accuracy, and managerial oversight within an organizational setting. A design science research approach was applied, incorporating needs assessment, process mapping, system modeling, iterative development, and performance evaluation. Data were collected through interviews, document analysis, observation, and comparative measurement of operational indicators before and after implementation. The findings reveal significant improvements in efficiency following system deployment. Processing time and reporting turnaround were substantially reduced due to automated workflows and centralized data management. Data entry errors and cross-department inconsistencies declined through embedded validation mechanisms and standardized digital records. User feedback further indicates enhanced transparency, improved coordination, and faster decision making. Overall, the study demonstrates that aligning web-based system design with detailed business process analysis generates measurable organizational performance gains and supports sustainable digital transformation initiatives.

Introduction

The rapid advancement of information and communication technologies has fundamentally transformed the way organizations design, execute, and evaluate their business processes. Digital transformation is no longer viewed as an optional strategic initiative but as a critical determinant of organizational competitiveness and sustainability. Contemporary organizations increasingly rely on integrated information systems to enhance operational efficiency, improve data accuracy, and support real-time decision making (Hamdat et al., 2024; Biswas et al., 2024;

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Olayinka, 2021; Saremi, 2025). Prior research has consistently emphasized that the adoption of web-based information systems enables organizations to streamline workflows, reduce redundancy, and facilitate cross-functional coordination. For instance, studies in management information systems highlight that digital platforms enhance process transparency and organizational responsiveness in dynamic environments. As global competition intensifies and stakeholder expectations evolve, organizations are under pressure to modernize their legacy systems and adopt scalable digital solutions that align with strategic objectives (Akanbi, 2023; Chavarnakul et al., 2025; Omerovic Smajlovic, 2024).

Recent literature further underscores the role of web technologies in enabling process automation and information integration across organizational units. Web-based systems offer accessibility, interoperability, and cost-effectiveness compared to traditional desktop-based or manual systems (Biswas et al., 2014). Scholars in the field of enterprise systems argue that web architectures facilitate centralized data management while supporting distributed access, thereby improving collaboration among employees, managers, and external stakeholders. Moreover, research on business process management demonstrates that integrating digital platforms with organizational workflows enhances performance metrics such as cycle time, service quality, and operational consistency. The growing emphasis on data-driven governance and evidence-based management reinforces the need for robust web-based systems capable of collecting, storing, and analyzing large volumes of organizational data in real time (Rahman, 2024; Adepoju & Adepoju, 2025; Hasan & Akter, 2022).

Despite these recognized benefits, many organizations continue to encounter significant inefficiencies in their business processes due to fragmented information flows and reliance on manual procedures. Paper-based documentation, isolated databases, and unstandardized workflows often result in duplication of tasks, delayed reporting, and limited traceability (Sharma et al., 2024; Faruq, 2025). These structural inefficiencies not only increase operational costs but also reduce organizational agility. Empirical studies in small and medium-sized enterprises indicate that inadequate information system integration is associated with higher error rates and reduced productivity. Furthermore, the absence of centralized digital platforms can hinder managerial oversight and compromise strategic alignment across departments. Consequently, addressing process inefficiencies through systematic information system design has emerged as a pressing research and practical concern.

In response to these challenges, scholars and practitioners advocate the implementation of web-based information systems that are specifically designed to align with organizational process structures. A general solution proposed in the literature involves adopting a structured system development life cycle that incorporates needs assessment, system modeling, iterative prototyping, and user evaluation (Hossain, 2023; Yas et al., 2023). Frameworks such as agile development and object-oriented design have been recommended to ensure adaptability and user-centered functionality. Additionally, business process reengineering approaches emphasize the importance of analyzing existing workflows before implementing technological interventions. The integration of system design methodologies with process optimization strategies is widely recognized as essential to achieving meaningful efficiency gains rather than merely digitizing inefficient procedures.

More specifically, prior research suggests that effective web-based information systems should incorporate modular architecture, role-based access control, and database normalization to ensure scalability and data integrity. Studies on enterprise resource planning and custom web applications demonstrate that aligning system features with clearly defined user requirements significantly improves system acceptance and utilization. User-centered design principles, including usability testing and interface prototyping, have been shown to enhance system

effectiveness by reducing learning curves and minimizing resistance to change. Furthermore, literature on human–computer interaction highlights that intuitive interface design contributes to higher task completion rates and improved employee satisfaction. These findings indicate that technical robustness must be complemented by consideration of organizational behavior and user engagement.

Another strand of research emphasizes the importance of integrating monitoring and evaluation mechanisms within web-based systems to support continuous process improvement. Performance dashboards, automated reporting tools, and real-time analytics modules enable managers to track key performance indicators and identify bottlenecks. Studies in operations management confirm that organizations employing integrated monitoring systems exhibit better control over resource allocation and service delivery outcomes. Security and data protection are also critical considerations, particularly in contexts where sensitive organizational information is processed online. Contemporary cybersecurity research stresses the necessity of encryption protocols, authentication mechanisms, and regular vulnerability assessments to safeguard system integrity. Thus, an effective web-based information system must balance functionality, usability, and security within a coherent architectural framework.

Although extensive research has addressed enterprise systems, business process management, and digital transformation, gaps remain in understanding how customized web-based information systems can be systematically designed and implemented to improve efficiency within specific organizational contexts. Many studies focus on large-scale enterprise platforms or theoretical models without providing detailed insights into the practical integration of system architecture with localized process requirements. Moreover, empirical evaluations often emphasize adoption rates rather than measurable improvements in process efficiency. There is therefore a need for research that bridges the conceptual frameworks of information system design with applied implementation strategies tailored to organizational needs. Such research should not only describe system features but also examine how design decisions influence workflow optimization and performance outcomes.

This study aims to design and implement a web-based information system intended to improve the efficiency of organizational business processes through a structured and context-sensitive approach. The novelty of this research lies in integrating systematic process analysis with iterative web-based system development, thereby ensuring that technological solutions directly address identified inefficiencies. By combining principles from business process management, user-centered design, and web engineering, the study proposes a comprehensive framework that links organizational requirements with system functionality. The scope of the study encompasses requirement analysis, system modeling, implementation, and evaluation of efficiency outcomes within the target organization. Through this approach, the research seeks to contribute both theoretically, by enriching the discourse on applied information system design, and practically, by offering a replicable model for organizations seeking to enhance operational efficiency through web-based solutions.

Methods

This study adopted a design science research approach to develop and evaluate a web-based information system intended to improve the efficiency of organizational business processes. Design science is widely recognized in information systems research as an appropriate methodology for creating and assessing technological artifacts that address identified organizational problems. The research was conducted within a single organizational context characterized by fragmented workflows, semi-manual data processing, and limited integration

across departments. The methodological framework followed a structured system development life cycle consisting of needs assessment, system design, implementation, and evaluation. This structured approach ensured that the resulting system was grounded in empirical organizational requirements while aligning with established principles of information systems development and business process management.

The first phase involved a comprehensive needs assessment to identify process inefficiencies and define functional and non-functional system requirements. Data were collected through semi-structured interviews with managerial and operational staff, direct observation of workflow practices, and analysis of internal documents such as reporting templates and procedural guidelines. Triangulation of these data sources enhanced the validity of findings and enabled detailed mapping of existing business processes. Process modeling techniques were applied to visualize bottlenecks, redundancies, and delays in information flow. Based on this analysis, system requirements were formulated, emphasizing automation of routine tasks, centralized data management, role-based access control, and real-time reporting capabilities. These requirements guided the subsequent system architecture design, which employed a three-tier web-based model integrating presentation, application, and database layers to ensure scalability, security, and data integrity.

The development and implementation phase utilized an iterative prototyping strategy consistent with user-centered design principles. Unified Modeling Language diagrams were employed to conceptualize system structure and align functionalities with user roles. The web-based system was developed using technologies compatible with the organization's digital infrastructure to ensure seamless integration. During development, prototypes were periodically tested by representative users to assess usability and functionality. Feedback from these sessions informed refinements in interface design, workflow automation features, and data processing mechanisms. After completion of development, the system was deployed within the organizational environment and integrated into daily operational activities, replacing several manual and semi-digital procedures.

The evaluation phase combined quantitative and qualitative assessment techniques to measure system effectiveness. Performance indicators such as processing time, reporting turnaround, error frequency, and data retrieval efficiency were collected before and after implementation. Descriptive statistical analysis was conducted to summarize changes in operational performance, and comparative analysis was used to identify measurable improvements. In addition, user perceptions regarding system usability and its impact on workflow efficiency were gathered through structured questionnaires and follow-up interviews. The integration of objective performance metrics with subjective user feedback provided a comprehensive evaluation of system impact. Ethical considerations, including informed consent and data confidentiality, were maintained throughout the study to ensure responsible research practice and methodological integrity.

Results and Discussion

Needs Assessment and Identification of Process Inefficiencies

The needs assessment phase revealed significant structural inefficiencies in the organization's existing business processes. Interview data collected from managers, administrative personnel, and operational staff confirmed that information processing was largely dependent on semi-manual procedures and disconnected digital files. One administrative officer explained that,

“data must be entered repeatedly in different formats for different departments, and sometimes the numbers do not match,”

indicating duplication and inconsistency in records. A managerial respondent similarly noted that

“retrieving consolidated reports requires checking several documents from different units, which takes time and often delays decision making.”

These qualitative accounts corroborate observational findings that reporting processes were prolonged due to fragmented data storage and manual verification steps.

Direct observation further revealed that approval workflows required sequential physical validation, often resulting in documents being temporarily stalled when signatories were unavailable. An operational staff member described this bottleneck by stating that

“if one person is not in the office, the document cannot move forward.”

Such statements illustrate the rigidity of manual workflows and their vulnerability to delay. Document analysis confirmed inconsistencies in reporting formats across departments, reinforcing interview claims regarding lack of standardization. These findings are consistent with established literature in business process management, which indicates that fragmented systems contribute to inefficiencies and reduced organizational responsiveness. Collectively, the qualitative and observational data validated the necessity for an integrated web-based information system capable of centralizing data and automating workflow transitions.

System Design and Architectural Outcomes

The translation of identified requirements into system architecture was informed by insights derived from interviews and process mapping. Stakeholders emphasized the need for a centralized database, automated approval routing, and real-time status monitoring. During the design validation sessions, a department head remarked that

“what we really need is one platform where all data can be accessed without asking other units.”

This expectation directly influenced the development of a unified dashboard interface tailored to user roles. The presentation layer was therefore designed to display personalized task queues and summary indicators reflecting current workflow status.

The application layer incorporated automated validation rules to address previously reported inconsistencies in data entry. During prototype testing, users confirmed that automated alerts reduced the likelihood of incomplete submissions. One staff member observed that

“the system immediately shows if something is missing, so we do not need to recheck manually.”

The database structure, designed with normalization principles, ensured consistency across records and minimized redundancy. Security features such as role-based authentication were positively received during testing sessions, particularly by managerial staff concerned with data confidentiality. These iterative design discussions demonstrate how qualitative input directly shaped system configuration, ensuring alignment between technological solutions and organizational needs.

Implementation, Training, and User Adaptation

The implementation phase involved gradual system deployment accompanied by structured training sessions. Interview responses collected during early adoption indicated initial

hesitation among some employees unfamiliar with web-based platforms. A senior administrative staff member commented that

“at first it felt complicated because we were used to paper files.”

However, subsequent training and hands-on demonstrations improved confidence levels. Follow-up interviews revealed a shift in perception, with the same respondent later acknowledging that

“after using it for several weeks, it actually makes the work faster.”

Operational staff reported that automated notifications significantly improved task coordination. One respondent explained that “now we know immediately when a document needs our approval because the system sends a notification.” Managers highlighted the advantage of accessing consolidated reports without requesting updates from multiple departments. According to one manager,

“I can now see the status of all submissions in one place, which was impossible before.”

These testimonies indicate that usability improvements and visible efficiency gains contributed to increased acceptance and routine integration of the system into daily workflows.

Operational Efficiency and Performance Improvements

Quantitative analysis of operational indicators demonstrated substantial improvements following system implementation. Average processing time for routine administrative approvals decreased significantly compared to the pre-implementation period. Reporting turnaround time improved due to automated data consolidation and validation mechanisms. Error frequency in submitted documents declined as a result of system-generated input controls. These outcomes are summarized in Table 1, which presents comparative efficiency metrics before and after deployment.

Table 1. Comparative Operational Efficiency Indicators Before and After System Implementation

Performance Indicator	Before Implementation	After Implementation	Percentage Improvement
Average processing time per document	4.8 days	2.1 days	56.3% faster
Reporting turnaround time	3.5 days	1.4 days	60.0% faster
Data entry error rate	12.4%	4.1%	66.9% reduction
Document retrieval time	25.6 minutes	6.8 minutes	73.4% faster
Workflow approval delay incidents	18 cases/month	6 cases/month	66.7% reduction
Cross-department data discrepancies	14 cases/month	3 cases/month	78.6% reduction

The improvements reflected in Table 1 correspond with qualitative feedback from employees who reported noticeable reductions in repetitive tasks and waiting periods. An operational staff member stated that “previously we spent much time correcting mistakes, but now the system helps prevent them.” Managers also confirmed that real-time dashboards enhanced monitoring capacity and supported faster decision making. These results align with theoretical expectations that integrated web-based information systems enhance efficiency by reducing manual intervention and standardizing workflows.

User Perceptions and Organizational Impact

Post-implementation interviews revealed strong perceptions of improved transparency and accountability. Employees emphasized that digital workflow tracking allowed them to monitor document progress without direct follow-up communication. One respondent noted that “we can see who is responsible for the next step, so there is less confusion.” Managers similarly observed that the system strengthened oversight by providing objective performance indicators accessible at any time.

Nevertheless, minor challenges were reported. A small number of users indicated the need for ongoing technical assistance, particularly when encountering unfamiliar features. These concerns underscore the importance of continuous support and periodic system updates to maintain performance and user satisfaction. Despite these challenges, the overall sentiment expressed during interviews was positive, with most participants affirming that the web-based system significantly improved coordination, reduced redundancy, and enhanced operational efficiency.

The convergence of quantitative performance data and qualitative interview findings provides comprehensive evidence that the implemented web-based information system effectively addressed previously identified inefficiencies. The integration of structured process analysis with iterative user engagement ensured that technological development translated into measurable organizational benefits. Collectively, the results demonstrate that aligning system design with stakeholder input and empirical workflow assessment can produce sustainable improvements in business process efficiency.

Conclusion

This study confirms that the structured design and implementation of a web-based information system can substantially improve organizational business process efficiency. The empirical findings demonstrate clear reductions in processing time, reporting delays, data inconsistencies, and workflow bottlenecks. The integration of automated approval mechanisms, centralized databases, and real-time dashboards strengthened coordination across departments and enhanced managerial oversight. Importantly, the improvements were not solely technological but organizational, as the system redesign was grounded in detailed process analysis and stakeholder input.

The study contributes to the information systems and business process management literature by providing applied evidence that design science-oriented system development produces measurable operational benefits when aligned with workflow reengineering principles. It reinforces the argument that digital transformation initiatives must be process-driven rather than technology-driven to achieve sustainable outcomes. Future research may examine cross-sector implementation to test scalability and explore integration with advanced analytics for predictive decision support.

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