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A Strategic Framework for Implementing E-Services in Higher Educational Institutions of Ethiopia

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Abstract

Higher education e-services constitute a paradigm change in this age of rapid technology. Modernization and efficiency depend on E-services in Ethiopian colleges. This change demands a strategic framework that balances technical developments with Ethiopia's unique socio-cultural and infrastructural setting. This research presents an Ethiopian-contextualized strategic framework for higher education E-service integration. The framework model for implementing electronic services in higher education institutions was developed using the Design Science research approach (DSR), enhanced by integrating systemic-holistic and socio-technical perspectives, including the soft systems methodology (SSM), and visualized using Visual Paradigm version 17, a prototyping tool, to create an attractive and user-friendly representation. The result shows a comprehensive Ethiopian higher education E-services implementation framework. Before implementation, institutional framework, operational standards, workflow processes, network infrastructure, human capabilities, and information flow are evaluated. Addressing significant issues aligns policy and prepares for future stages improvement-focused implementation research. Electronic service efficiency, performance, and usefulness improve with complete checks. Steps include modification identification, prioritizing, requirement analysis, design and development, rigorous testing, smooth deployment, user training, and continual monitoring and assessment. Completeness guarantees the electronic service satisfies user needs, improving efficiency and satisfaction. After implementation, the software application undergoes operation, system performance monitoring, problem resolution, post-modification testing, and system fine-tuning. This process continues until the system is shut down. Research emphasizes ongoing assessment and monitoring to identify development areas and demonstrate technology integration. Research suggests periodic legal, fitness for purpose, and policy and procedure compliance reviews, monitoring, and evaluations.

INTRODUCTION

E-services in higher education have altered the area in this age of rapid technological advancement. Digital education is replacing classrooms. ESI promotes globalisation and innovation today. This dynamic feature drives innovation and improves organisational service delivery. Its revolutionary potential impacts all goal achievement and customer pleasure. ESI coordinated a change from old to modern delivery methods, changing the service paradigm. Faster, more accurate service drives e-service implementation, improving efficiency and customer satisfaction (Rahman & Ahmed, 2014).

Ethiopian universities' e-services are an important modernising and efficiency step. Ethiopia's higher education industry values e-services and uses cutting-edge digital solutions to solve educational problems and meet the evolving needs of students, faculty, and administrative staff. This transition is part of digitising administrative activities, integrating innovative e-learning platforms, optimising online registration systems, and providing real-time, global communication channels. This strategy democratises education and encourages lifelong learning by expanding educational resources, removing classroom borders, and permitting remote learning (Saidhbi, 2012).

Ethiopia, with a rich culture and a growing youth population, is at a vital development point. E-services in higher education will improve accessibility, quality, and relevance, moving the nation towards a knowledge-driven future. This shift requires a well-defined strategic framework that matches technical advancements with Ethiopia's specific socio-cultural and infrastructural environments (Hiran et al., 2018). This research is important in academia and Ethiopia's socioeconomic background. By providing a personalized strategic framework, it fills a major information gap and guides higher education policymakers, administrators, and stakeholders. Thus, the main goal of this research is to provide an Ethiopian-specific strategic framework to integrate e-services into higher education institutions.

LITERATURE REVIEW

2.1. Electronic Service

Services are organised by the government or a private corporation to meet public requirements, whereas E-services are delivered via internet-based applications. Scholars define e-service as interactional, content-centered, and electronically-based services across electronic networks supported by ICT. This principle is applicable across fields. Scupola et al. (2009) define E-service as technical, internet-based, and integrated with other information systems, emphasising the importance of user accessibility and usability (Askari et al., 2016).

2.2. Benefits of Electronic Service

E-services benefit citizens, corporations, and governments. Free access to organisational data improves service quality and lowers operational costs by streamlining operations. Government agencies profit from more efficient and effective public service delivery. E-service also improves government service efficiency, transparency, transactional costs, and citizen services (Solinthone & Rumyantseva, 2016). Alshehri and Drew (2010) further stress that E-service saves time, effort, and money for service seekers and providers. Service delivery, customer happiness, and good governance improve. E-service also promotes new enterprises and improves efficiency by allowing service seekers to share information through a common database.

2.3. Electronic Service Implementation

Since the early 1990s, governments worldwide have implemented E-Services, progressing from web-based communication to interactive transactions with residents and businesses to integrated web presence and e-participation (Ground & Horn, 2014). E-Services development should be gradual and matured, according to Moon (2002) and Layne & Lee (2001). E-Services present diverse organisational and technological difficulties that require re-evaluation and transformation of organisations and its components (Anderson, 2004; Irani et al., 2006). While maturity levels are valuable, they don’t improve the ontology of e-government. Hassan et al. (2011) emphasise the importance of using both qualitative and quantitative measures to differentiate maturity levels,

which may increase citizen adoption of E-Services. The ultimate goal is to integrate electronic services across government systems and departments to give citizens quick online access to government services and information (Sharma & Gupta, 2003). Electronic service researchers and universities have developed unique concepts and models for electronic service stages.

2.4. E-service Implementation Growth Model

Since the early 1990s, governments worldwide have been adopting and implementing E-Services, evolving from basic web-based communication to more interactive transactions with citizens and businesses, culminating in integrated web presence and e-participation (Ground & Horn, 2014). Researchers like Moon (2002) and Layne & Lee (2001) have analyzed E-Services development in stages, emphasizing the need for a phased approach and a shift towards maturity. This involves a re-evaluation and transformation of organizations and their components to address the multifaceted organizational and technological challenges posed by E-Services (Anderson, 2004; Irani et al., 2006). While incorporating maturity levels is valuable, it doesn't enhance the ontology of the e-government concept, and researchers like Hassan et al. (2011) stress the importance of employing both qualitative and quantitative measures to differentiate maturity levels, potentially increasing citizen adoption of E-Services (Olatokun & Adebayo, 2012). The ultimate goal is the integration of electronic services across various government systems and departments, providing citizens with convenient online access to government services and information from a single point (Sharma & Gupta, 2003). Throughout the discipline of electronic services, numerous researchers and institutions have contributed innovative concepts and models for electronic service stages.

2.4.1. Three-stage model

Al-Shafi (2009), Bhatangar (2004), and Howard (2001) developed a three-stage electronic service deployment approach. This tripartite framework outlines the advancement of electronic service integration, synthesising their ideas into a roadmap to help organisations use technology to improve service delivery and customer engagement. For developing nations, "Publish" is crucial because it sets the groundwork for a strong e-government infrastructure. This phase distributes government information via digital platforms, giving the public access to laws, regulations, official

papers, and forms via smartphones. Providing access promotes transparency and informed citizenship, laying the framework for future e-government functions. The next step, "Interact," uses technology to actively involve citizens in policymaking, changing governance dynamics. This level allows citizens to directly communicate with officials, democratising decision-making and allowing them to voice concerns, share insights, and collaborate on policies. Inclusion boosts citizen participation, trust, transparency, and responsiveness in governance in an interactive e-government strategy. Finally, the "Transact" step transforms e-government by creating online venues for user transactions. The online access to government services by people and enterprises may save money, promote accountability, and boost productivity for both parties. This step speeds up operations, making them more easy, accessible, and efficient, lowering in-person transaction time. Digital empowerment peaks at the "Transact" level, when a seamless digital interface connects government and constituents, making governance more nimble, accountable, and service-oriented.

2.4.2. Four-stage model

The thorough research of Gatner (2003) and Baum and Di Maio (2000) produced a four-stage electronic service implementation model. This paradigm, based on their ideas, organises electronic service integration. From these varied views, a clear roadmap guides organisations through crucial stages to improve service delivery, streamline operations, and involve citizens. In the first stage, "Web Presence," a basic, passive website like a brochure is created. The second level, "Interaction," includes digital communication and information change beyond information dissemination. Online transactions and back-office connectivity mark the third stage, "Transaction," which is more advanced. The "Transformation" step is the culmination, using technology to transform government functions. Its strong customer relationship management features enable easy handling of varied enquiries and issues, promoting unfettered information flow and stakeholder collaboration. Online two-way conversations allow citizens to participate 24/7, regardless of time or location. The "transformation" stage of E-Service implementation is when technology transforms governance and service delivery.

2.4.3. Five-stage model

The five-stage model, designed to overcome limitations in the Layne and Lee (2001) framework and enhance citizen participation, encompasses key initiatives such as bridging the digital divide, encouraging engagement, and building trust in e-government services, particularly in the context of concerns like corruption. Introducing an additional "interaction" stage after the cataloguing phase, the model mandates prerequisites including political commitment, robust IT infrastructure, legal framework, citizen-centric approach, and government guidance. The stages are as follows: The "Cataloguing Stage" establishes an informational website for accessing government-catalogued information, forming the foundation for online transactions and e-literacy training. The "Interaction Stage" emphasizes citizen participation and awareness, calling for a reevaluation of governance processes to simplify access and minimize corruption opportunities. Overcoming the digital divide and incentivizing engagement are paramount challenges. In the "Communication Stage," electronic channels are set up for one-way and, in some cases, two-way communication, with a focus on user feedback for service improvement. The "Transactional Stage" facilitates comprehensive electronic transactions with government agencies, reducing time and costs for stakeholders. Finally, the "Integration Stage" unifies all government agencies into a single portal, enabling seamless access to all services online, marking the pinnacle of e-government evolution and propelling the nation into a new era of digital governance.

2.4.4. Six-stage model

The "Six Stage Model" for electronic service implementation, originating from foundational works by Deloitte and Touche (2001) and contributions by Irani et al. (2006), offers a comprehensive framework delineating the stages of electronic service evolution. These stages, collectively serving as a roadmap for institutions and governments, encompass vital progressions in digital governance. Beginning with Information Publishing/Dissemination, where transparency and accessibility are emphasized, the model advances to Official Two-way Transaction, integrating secure tools like digital signatures for trustworthy interactions. Multi-purpose Portals usher in a new era, consolidating services under one accessible hub, followed by Portal Personalization, empowering users to customize their digital experiences. Clustering of Common Services streamlines and harmonizes service delivery, reducing redundancy and bureaucratic hurdles. Finally, Full

Integration represents the pinnacle of digital governance, offering advanced, personalized services that transcend transactional models, showcasing a government's dedication to pushing the boundaries of digital service provision. This tailored five-stage model provides a focused framework for analyzing electronic service delivery's evolution in the specific research domain, aligning seamlessly with the study's objectives.

Research Methodology

3.1. Source of Data

A comprehensive array of "both primary and secondary data was meticulously gathered" from diverse sources, all strategically aligned to fulfill the study's overarching objectives. The primary source of data for this study comprises a diverse range of essential stakeholders within the higher educational landscape of Ethiopia. This encompasses a broad spectrum of individuals, including esteemed university administrators who hold pivotal roles in shaping the direction and policies of these institutions. Additionally, faculty members, who constitute the backbone of academic delivery and curriculum development, are integral contributors to this study.

Furthermore, the inclusion of IT professionals, who possess specialized expertise in technological infrastructure and digital systems, is crucial in understanding the intricacies of E-Services implementation. Students, the primary beneficiaries of E-Services, represent a significant stakeholder group, providing invaluable perspectives on their experiences and expectations. Finally, government officials engaged in education policy-making form an essential part of this population, as their decisions and directives play a central role in influencing the adoption and integration of E-Services within higher education institutions across Ethiopia. By encompassing this diverse array of stakeholders, this study aims to garner a comprehensive and holistic understanding of the intricacies surrounding E-Services implementation in Ethiopian higher education.

The secondary sources cast a wide net, incorporating a range of authoritative materials such as books, articles, peer-reviewed journals, and existing research works, serving as a vital knowledge repository. These secondary sources, buttressed by insights garnered from exploratory internet searches, collectively contributed a substantial layer of contextual understanding to the research's thematic framework. This dual-pronged approach, combining the lived experiences of stakeholders with the wealth of documented knowledge, ensured a robust and multifaceted foundation upon which the study's insights were meticulously built.

3.2. Framework Development Process

The development process of the framework for successful implementation of electronic services in higher learning institutions was guided by Design Science Research (DSR) and Soft Systems Methodology (SSM). DSR structured the process through problem identification, iterative artifact design, evaluation, and contribution to theory. SSM contributed by capturing diverse stakeholder perspectives through rich pictures, defining core problems, creating conceptual models, promoting dialogue and learning, and addressing social and human aspects alongside technical considerations, resulting in a comprehensive and effective framework.

3.2.1. Design Science Research Methodologies (DSR)

Strategic research aimed to increase knowledge. Diverse research approaches were used to find, select, and build data gathering, processing, and analysis research designs, strategies, and procedures. Pierce (1931) used deductive research to learn from theories. Experimental design and quantitative data collecting dominated this method. Logical research routes also generalised the research artefact. Inductive research focused on real-world situations and involved the researcher, unlike deductive research. This pathway developed design structures, artefacts, and complicated scenarios using qualitative data (Saunders et al., 2003).

Through iterative data collection and analysis, inductive and abductive research identified causal relationships, yielding significant artefacts or theories. Pierce (1931) and Vaishnavi et al. (2004)

produced important discoveries supporting this cyclical method. A careful contextual analysis showed how inductive research fits this research's goals. After careful consideration, the inductive research process was judged to be the optimum way to navigate and emphasise the research environment.

Investigation methods that supported induction were essential. Research objectives determined methodology selection. These included synthesising studies on framework development, modelling e-Service services, maturity models, and information security maturity models, and creating, building, and assessing a comprehensive framework. Given these criteria, design science research (DSR) was chosen.

Design science research (DSR) was chosen because it fosters creativity and defines technical capacities and products for artefact development, according to Denning (1997), Hevner et al. (2004), Tsichritzis (1998), and Vaishnavi (2004). The structured DSR process started with problem identification and ended with solid solutions. Abductive reasoning was used to construct the tentative design phase from the problem domain's knowledge after numerous processes. This thorough process produced a provisional design to lead the inquiry.

After tentative solutions, artefact design. Here, development and assessment were deduction-based. Figure 3-2's defined arrows indicate how this iterative design process improved the real-world problem from awareness to proposal, creation, and evaluation. Design science ended with conclusions. Figure schematically demonstrates design science's thorough reasoning process.

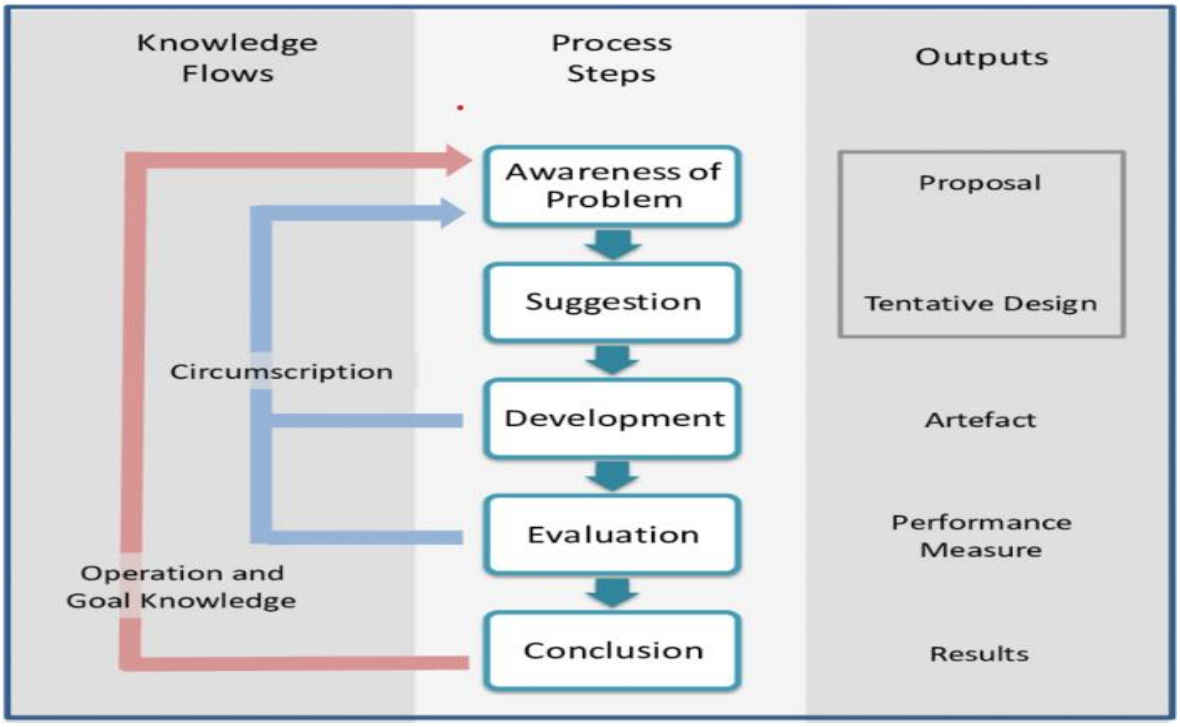

***Figure 1**:* Design Research Methodology (DSR)

3.2.2. Soft System Methodology (SSM)

SSM is often used by IT/IS managers and consultants to solve complicated technical and organisational problems. This approach to creating, assessing, and solving human-integrated system issues is solid. SSM integrates logical, cultural, and political evaluations of a problem scenario to create, negotiate, and execute solutions with stakeholder permission. Its strength is analysing difficult issues and using technological and human insights to discover solutions. SSM solves problems using a systems-based approach that understands complex environmental, project, and stakeholder relationships.

Based on Cleland (1997), Meredith and Mantel (2011), and Kerzner (2017), this comprehensive method helps the project team understand the complex landscape's interdependencies. This understanding covers resources, materials, market dynamics, organisational demands, and stakeholders. This holistic perspective keeps the project on track, allowing the team to employ

resources and techniques efficiently. This holistic approach fosters understanding and keeps the project on track, making it efficient and productive.

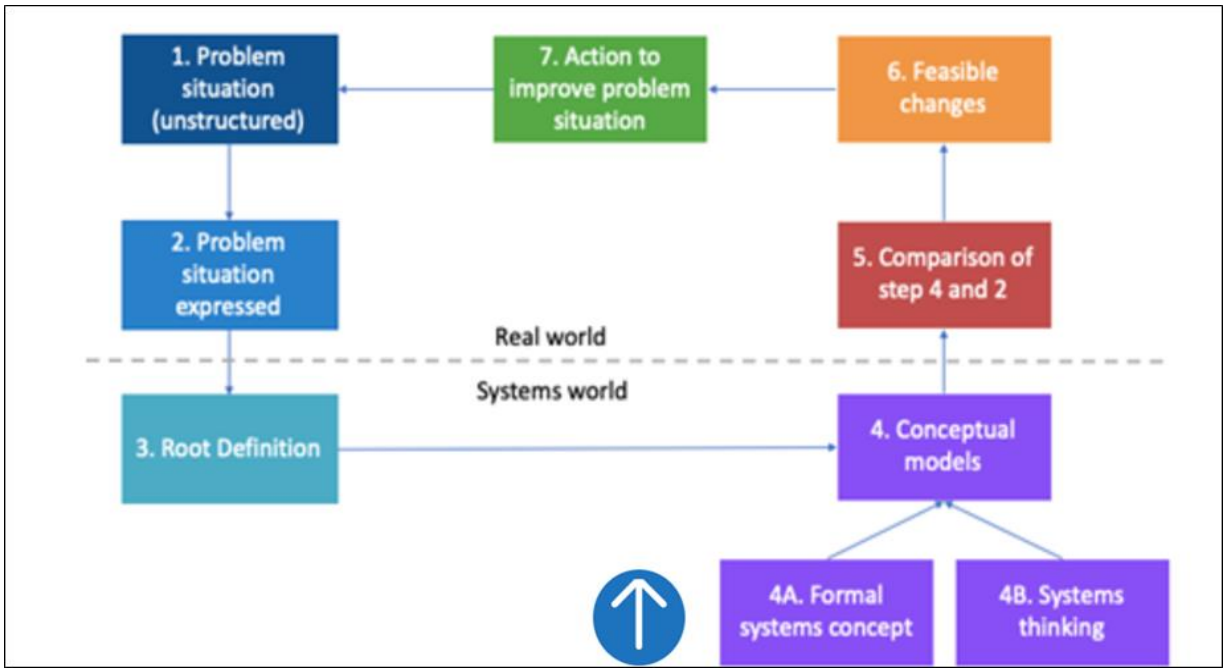

Figure 2: System Software Methodology Seven Steps

The Soft Systems Methodology (SSM) is a systematic approach to tackling complex, ill-defined problems and facilitating organizational change, recognizing the intricacies of human systems and aiming to foster shared understanding among stakeholders. It consists of seven structured steps. First, the Problem Situation Unstructured phase involves recognizing and defining the problematic situation, acknowledging that perceptions may differ among stakeholders. The second step, Express Problem Situation, employs rich pictures to visually represent various perspectives and elements related to the problem, aiding communication and understanding. Root Definitions, the third step, succinctly define the essential components and interactions within the system, helping to identify key aspects for addressing. Following this, Conceptual Models are constructed to depict the system's interactions and dynamics, enhancing comprehension of its complexities.

Comparison with the Real-World, the fifth step, identifies discrepancies between proposed models and the actual situation, revealing areas requiring further attention. Feasible and Desirable Changes, the sixth step, suggests improvements that are technically viable and socially and culturally acceptable, aiming for stakeholder buy-in and effective issue resolution. Finally, the seventh step involves implementing and monitoring chosen changes to enhance the problem situation, aligning actions with identified root definitions and conceptual models to ensure desired improvements are achieved. This structured approach enables a comprehensive analysis and resolution of complex organizational challenges.

3.3. Software Employed

The framework model for implementing electronic services in higher learning institutions was constructed using the Design Science research approach (DSR) as its foundational methodology, which was further enriched by incorporating systemic-holistic and socio-technical perspectives, including the utilization of the soft systems methodology (SSM). To facilitate the comprehensive representation of the framework, Visual Paradigm version 17, a prototyping tool, was employed, allowing for the creation of an aesthetically pleasing and user-friendly visual. This amalgamation of research methodologies and technological tools ensured a seamless and efficient development process, culminating in a robust and all-encompassing framework model. Visual Paradigm's extensive suite of tools and features, including diagramming, modeling, collaboration, and documentation capabilities, significantly contributed to the successful development of the framework. By leveraging these capabilities, institutions can adeptly plan, design, and manage the implementation of electronic services, ensuring their alignment with the institution's overarching goals and meeting the needs of stakeholders effectively.

RESULTS

4.1. E-service Implementation Framework

The overall objective of this paper is to construct a comprehensive and process-oriented framework tailored for the successful implementation of e-services within higher learning institutions in

Ethiopia. This framework is meticulously shaped by a meticulous examination of prevailing theories and practical approaches, aiming to provide valuable insights for future endeavors in this domain. Taking the student survey result as input about the existing e-services challenges in higher learning institutions as well as learning from process frameworks from implementation research (Damschroder, 2020), the researcher designed an e-service implementation process with three phases: pre-implementation, intra-implementation and post-implementation.

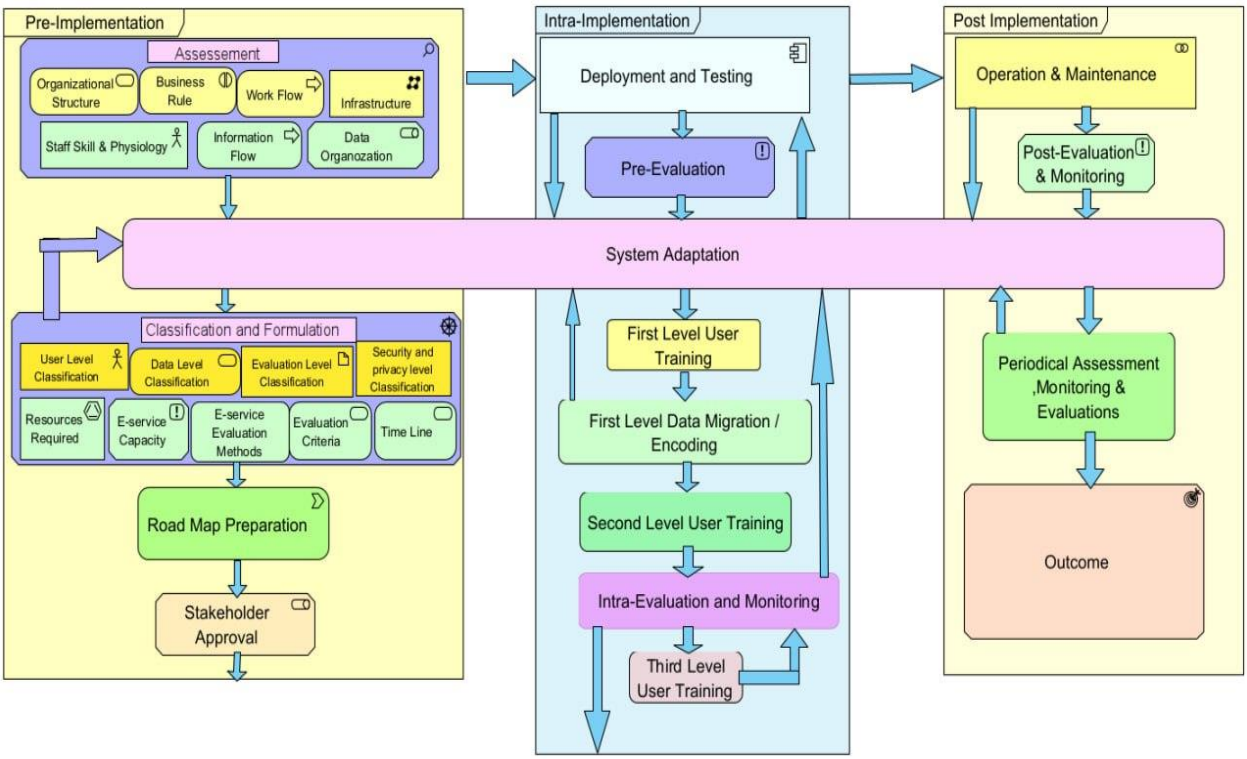

Figure 3*:* Implementation framework for e-service in higher learning institutions of Ethiopia

Source: Authors schetch based on survey result, 2023

4.1.1. Pre-Implementation Stage

Assessment

Higher education institutions must analyse their structure before deploying e-services.

Understanding the institution's hierarchy, departments, and reporting links is crucial to integrating the e-service software and how stakeholders will use it. The hierarchy determines access permissions, whereas departments define functional areas and affect system use. Reporting relationships provide command chains that affect data management. Interviews, reviewing organisational charts, policies, and procedures, and observing the organisation in action can help the institution identify and address structural gaps before implementing e-services, ensuring a successful integration that improves operational efficiency.

Implementing e-services in higher education requires assessing business norms. Admission, grading, and course registration policies are covered by these rules. Compliance and efficiency depend on e-service installation following these standards. These rules are identified and documented through policy reviews, stakeholder interviews, and process observations. This documentation clarifies and identifies gaps and contradictions. Analysing these rules' conformity with the institution's goals may require software or rules enforcement changes. This proactive strategy improves risk reduction, cost-effectiveness, efficiency, regulatory compliance, and customer happiness, making e-service adoption more successful.

Assessing the business workflow is crucial to implementing e-services in higher education. This workflow orchestrates stakeholder interactions to manage e-service information, including application submission, document verification, fee payment, and applicant communication. This examination helps identify bottlenecks and inefficiencies, which can be reduced and automated to improve efficiency. This assessment requires identifying the diverse stakeholders in the e-service process, including students, instructors, staff, and administrators. Next, map the sequential activities and interactions between these stakeholders using a flowchart for clarity. This mapping activity clarifies process dynamics. Finally, examine any bottlenecks or inefficiencies, focusing on duplicated, time-consuming, or needless tasks. These methods will help the institution identify and fix e-service process bottlenecks, improving efficiency and effectiveness for all stakeholders.

A complete network infrastructure assessment is needed to effortlessly integrate e-services into higher education. This evaluation verifies availability, dependability, and security so approved personnel can use e-services everywhere. Even amid power outages or hardware failures,

availability requires network operation. A network with suitable bandwidth and capacity to meet predicted user numbers and data transfer volumes is needed for e-service reliability. Data security requires firewalls and IDSs. To support e-services, the organisation detects and fixes network infrastructure issues to improve data security.

Staff abilities affect e-service implementation. Thus, pre-implementation assessments must evaluate technical abilities, digital service expertise, and learning readiness. E-services require user interface and troubleshooting expertise. Additionally, they should know digital services' pros and cons. Digital services are fluid, thus adaptation and skill acquisition are crucial. This assessment eases e-service adoption. Training or workshops can fill employee knowledge gaps. Proactively using e-services improves effectiveness.

Information flow analysis is essential to understanding enterprise data and information movement. This involves data source identification, collection, storage, and distribution. This understanding helps E-services integrate with current data streams, reduce redundancy, and optimise department and stakeholder data exchange. Specific actions may be taken to assess completely. Identify internal and external data sources such databases, files, social media, and government websites. Next, examine manual entry, surveys, and sensors. Understanding how the university saves data, files, and security is crucial.

E-services software installation requires data organisation assessment. This technique examines e-service data format, structure, and integrity. An audit ensures the software can manage different data kinds, maintain consistency, and deliver accurate reporting and analytics. Data migration strategies for software implementation are also prepared. Steps are needed for this assessment. Find the text, numbers, dates, and images used to store e-service data. After that, data structure and coding must be carefully checked. Checking for errors and inconsistencies determines data integrity. Data organisation enhancements may involve structure, code, or storage. The data, format, and tools needed for migration are determined during data migration preparation. This thorough review finds data organisation inefficiencies and improves efficiency and effectiveness. It also facilitates data migration from the old to the new system.

System Adaptation

System adaptation or modification in e-service implementation involves the strategic process of refining an existing electronic service based on the outcomes of a comprehensive assessment. This assessment scrutinizes the e-service's effectiveness, efficiency, and user-friendliness, aiming to pinpoint areas requiring enhancement for an improved user experience. Following this evaluation, the steps entail meticulously identifying specific modification areas, prioritizing changes based on their impact, analyzing requirements, designing and developing the necessary alterations, rigorous testing and quality assurance, seamless implementation, user training and support for significant changes, and ongoing monitoring and evaluation. This meticulous process ensures that the electronic service aligns seamlessly with user needs and operates optimally in its intended environment, guaranteeing sustained effectiveness and user satisfaction.

Classification and Formulation

The third phase of the e-service assessment framework, Classification, establishes critical categories for success. This level requires carefully identifying Software User Level, Data Level, Evaluation Level, and Security and Privacy Level classifications. The Software User Level classification assigns access levels to administrators, personnel, and consumers based on their jobs. This ensures that each user type uses the e-service according to their system functions. However, the Data Level classification organises data by sensitivity, guiding its storage, processing, and protection. Establishing rules to protect personal, financial, and intellectual property data requires this.

The Evaluation Level classification covers functional, security, and usability testing of the e-service. Functional testing ensures the e-service works as planned. Security testing is essential to ensure the e-service is secure from unauthorised access, data loss, and breaches. Usability testing guarantees the e-service is easy to use. The Security and Privacy Level classification protects against unauthorised access, data loss, and breaches. To protect sensitive data, secure authentication, encryption, and access controls are used. This stage underpins later implementation processes, ensuring that the e-service is built and deployed with security and privacy in mind.

4.1.2. Intra-Implementation Stage

Deployment and Testing

The deployment and testing phase in the intra-implementation stage involves the installation and comprehensive testing of the e-service system to verify its proper functionality and integration of pre-implementation modifications. Firstly, the e-service system is installed on designated servers or cloud infrastructure, requiring hardware, software, and network configurations. Configuration follows, aligning the system with specific institutional requirements by setting user permissions, access levels, communication protocols, and customizing it accordingly. Integration testing ensures seamless operation and compatibility with pre-implementation modifications, covering user interfaces, databases, external integrations, and customizations. Functionality testing assesses various features, executing different scenarios to validate performance, identify potential flaws, and ensure proper behavior. Stress and load testing evaluate system scalability and stability under heavy workloads, while security testing identifies vulnerabilities and ensures compliance with data protection regulations. Usability testing confirms user-friendliness and alignment with user needs.

Pre-implementation evaluation

The pre-implementation evaluation is a crucial step in the development and deployment of an e-service system, focusing on identifying potential issues or limitations before its full-scale rollout to users. The objective is to ensure the system's functionality, user-friendliness, and alignment with the needs and expectations of its intended users. This assessment employs various methods, including surveys, interviews, and focus groups, to gather feedback from potential users, stakeholders, and experts, providing valuable insights and perspectives on the e-service. Surveys enable the collection of quantitative data and opinions from a broad participant base, addressing aspects like usability, functionality, and overall satisfaction. Interviews offer in-depth discussions with selected individuals or groups, allowing for a detailed exploration of specific concerns. Focus groups, on the other hand, involve a small representative sample engaging in guided discussions to gather collective opinions, ideas, and suggestions. The feedback and data gathered are then analyzed to pinpoint potential problems or limitations in the e-service system. This evaluation

empowers organizations to make necessary adjustments, refinements, or improvements, ensuring the system's readiness for seamless deployment. By proactively addressing any issues or concerns, organizations minimize risks and enhance the overall user experience, facilitating a smooth transition from development to successful adoption and usage of the e-service.

System adaptation or modification

Based on feedback gathered during the pre-implementation evaluation, adjustments may be necessary to enhance the functionality of the e-service system. This could involve modifying the system or refining processes to improve its overall effectiveness. The process encompasses several critical stages. Firstly, the initial group of users, known as the first wave, undergoes comprehensive training to establish a strong foundation in using the e-service system effectively. Subsequently, migrating data from the old system to the new e-service system requires careful planning and execution to ensure a seamless transition without data loss or inconsistencies. Once the first group of users is proficient with the system, the next wave receives training, covering all necessary aspects albeit potentially with slightly less depth. Following this, advanced training is delivered to the second tier of users, including staff and students who regularly use e-services.

This training delves into intricate and advanced topics, enabling users to maximize the system's capabilities. Continuous evaluation and monitoring of the new system are then crucial to ensure its alignment with user needs and effective utilization, with regular assessments enabling the identification of issues or areas for improvement. Additionally, the third level of users, responsible for system administration and management, undergoes comprehensive training in configuring the system, troubleshooting, managing user accounts, and ensuring seamless system operation. Finally, new users joining the organization and requiring proficiency in the e-service system receive training to ensure a smooth onboarding experience. These steps collectively contribute to the successful implementation and adoption of the e-service system, addressing user needs, promoting proficiency, and facilitating effective system utilization.

4.1.3. Post-Implementation Stage

Operation and Maintenance

The Operations & Maintenance phase of software management involves a range of activities, including operating software applications, monitoring system performance, addressing defects, testing after modifications, and fine-tuning the released software system. In the context of modern software solutions, ongoing updates and maintenance are crucial, and it's a misconception to view software costs as a one-time expense incurred during development or purchase. In reality, experts estimate that more than 90% of costs associated with relatively modern software pertain to ongoing maintenance. The objectives of this phase encompass managing system changes to support end users, monitoring system performance, conducting essential security activities such as backups and contingency planning, and ensuring continued end user support through training and documentation. The overarching goal is to maintain the system's full functionality and optimal performance throughout its lifecycle until it reaches its end of life.

Post-Evaluation and Monitoring

The post-implementation stage is characterized by a commitment to ongoing evaluation and continuous monitoring. This process involves regular assessments and observations to gain insights into the system's performance and effectiveness. It serves as a dynamic mechanism to pinpoint potential areas for improvement. By iteratively refining the e-service implementation plan based on real-world observations and user feedback, the institution ensures that the system remains in sync with evolving needs and consistently provides value. Ultimately, this phase embodies the institution's dedication to perpetual improvement and optimization, emphasizing the iterative nature of technological integration. It combines responsiveness to user dynamics with a proactive stance towards evolving challenges, resulting in a sustainable and impactful e-service ecosystem.

Periodical Assessment, Monitoring & Evaluations

The Periodic Assessment serves the purpose of ensuring ongoing compliance with regulations, suitability for intended use, and alignment with HLE policies and procedures for the computer system. It should also integrate seamlessly with the HLE Operation Excellence / Continuous

Improvement program. The frequency of these reviews depends on factors like complexity, criticality, novelty, and operating history of the e-service. As the system stabilizes with minimal incidents and changes, the review frequency can be extended. The review process involves assessing Design Documents, Incident Logs/Fault Sheets, Maintenance, Deviations, and Change Controls. It begins by checking for any regulatory or HLE policy changes since the last review and conducting a gap analysis against the system and associated documentation. Trends in system faults are identified, and if any are spotted, root cause analysis is carried out with an action plan. Standard Operating Procedures, design documentation, and security measures are reviewed for currency and alignment with changes. The review results, actions, and recommendations are logged in the HLE system, and the cumulative impact of changes on the overall design intent is considered. Additionally, risk assessments made during system design and implementation are reevaluated, and a report is generated detailing the system's validation and compliance status. This thorough approach ensures the ongoing integrity and effectiveness of the computer system.

E-Service Quality benefits most from real-time incident and deviation monitoring and trends. Finding tendencies and correcting them can improve E-Service and ensure compliance. It takes time to search change control, deviation, and incident databases and analyse and report the results of a periodic review. This hinders continual improvement, early issue identification, and improvement. To assure ongoing compliance most efficiently, utilise a hybrid strategy. As mentioned before, important, sophisticated, or customised E-Services are monitored continuously. Periodic reviews may be beneficial for demonstrating compliance in simpler, stable systems.

SUMMARY AND CONCLUSSION

The study on Strategic Framework for Implementing E-Services in Higher Educational Institutions of Ethiopia outlines a comprehensive approach to the implementation of e-services in higher education institutions. The pre-implementation stage involves a thorough assessment of the institution's structure, business norms, workflow, network infrastructure, staff capabilities, and

information flow. This stage aims to identify and address any structural gaps and ensure compliance with policies and procedures, setting a strong foundation for the subsequent stages.

Moving into the implementation stage, the research emphasizes the significance of system adaptation or modification. This involves refining the electronic service based on a comprehensive assessment, ensuring its effectiveness, efficiency, and user-friendliness. The process includes identifying specific modification areas, prioritizing changes, analyzing requirements, designing and developing alterations, rigorous testing, seamless implementation, user training, and ongoing monitoring and evaluation. This meticulous process aligns the electronic service seamlessly with user needs, ensuring sustained effectiveness and user satisfaction.

In the post-implementation stage, the focus shifts to operations and maintenance. This phase encompasses activities such as operating software applications, monitoring system performance, addressing defects, testing after modifications, and fine-tuning the released software system. The objective is to maintain the system's full functionality and optimal performance throughout its lifecycle until it reaches its end of life. The research also highlights the importance of ongoing evaluation and continuous monitoring in this stage, serving as a dynamic mechanism to pinpoint potential areas for improvement and emphasizing the iterative nature of technological integration. Additionally, the research introduces the concept of periodic assessment, monitoring, and evaluations, which ensures ongoing compliance with regulations, suitability for intended use, and alignment with policies and procedures. This approach provides a comprehensive framework for the successful implementation and maintenance of e-services in higher educational institutions.

COMPETING INTERESTS

The authors have no competing interests to declare.

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