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Digital Transformation of New Student Admissions through a Self-Hosted Web-Based PMB System at STAI Minhajul Haq: An Analysis of Efficiency and Operational Costs

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Abstract This research conducts an in-depth analysis of the operational efficiency and financial feasibility of implementing a self-hosted web-based New Student Admission (PMB) system compared to a commercial Software as a Service (SaaS) subscription platform within the STAI Minhajul Haq environment.[1] In the era of Education 4.0, the demand to digitize academic administration processes has become increasingly crucial, yet many small to medium-sized higher education institutions face structural constraints in the form of limited budgets for adopting high-cost technology platforms.[2] As a strategic solution, this independent PMB system was developed utilizing low-cost local hosting infrastructure directly integrated with a cloud spreadsheet application programming interface (API) to support real-time academic administration.[3] Utilizing a comparative descriptive quantitative approach, this study evaluates various dimensions of information technology governance, encompassing the Total Cost of Ownership (TCO) structure calculation, workflow administrative efficiency through a time-motion study framework, data integration accuracy, cybersecurity evaluation, user satisfaction levels based on a Likert Scale questionnaire, and the alignment of sustainable digital governance using the COBIT 5 framework.[4] The results of secondary and primary data analysis indicate that the implementation of a self-hosted PMB system can reduce annual operational costs by more than eighty percent when compared to standard SaaS subscription packages for an equivalent student capacity.[5] In terms of operational efficiency, the application of automated integration successfully slashed applicant data processing time from over ten minutes to less than thirty seconds per individual, effectively eliminating double data entry redundancy and suppressing human error to a marginal level.[6] Based on the Likert Scale survey, administrators reported a significant increase in satisfaction regarding ease of use, accessibility, and cognitive workload reduction.[7] Furthermore, security hardening through the implementation of parameterized queries and secure HTTP headers ensures data integrity remains protected.[8] This study empirically proves that low-cost digital transformation is not merely a temporary financial compromise, but an adaptive, secure, high-performing, and sustainable academic governance strategy for educational institutions operating with limited resources.[2]

Keywords: Digital Transformation; Admission Management System; Self-Hosted Web Application; Cost Efficiency Analysis; Islamic Higher Education.

Abstrak *Penelitian ini menganalisis secara mendalam efisiensi operasional dan kelayakan finansial dari penerapan sistem Penerimaan Mahasiswa Baru (PMB) berbasis web mandiri (self-hosted) dibandingkan dengan platform komersial berlangganan (Software as a Service atau SaaS) di lingkungan STAI Minhajul Haq. Pada era Pendidikan 4.0, tuntutan untuk melakukan digitalisasi proses administrasi akademik menjadi semakin krusial, namun banyak perguruan tinggi berskala kecil hingga menengah menghadapi kendala struktural berupa keterbatasan anggaran untuk mengadopsi platform teknologi berbiaya tinggi. Sebagai solusi strategis, sistem PMB mandiri ini dikembangkan dengan memanfaatkan infrastruktur hosting lokal*

berbiaya rendah yang diintegrasikan secara langsung dengan antarmuka pemrograman aplikasi (API) spreadsheet cloud, guna mendukung administrasi akademik secara seketika (real-time). Menggunakan pendekatan kuantitatif deskriptif komparatif, studi ini mengevaluasi berbagai dimensi tata kelola teknologi informasi yang mencakup kalkulasi struktur biaya operasional atau Total Cost of Ownership (TCO), efisiensi alur kerja administrasi melalui kerangka studi waktu-gerak (time-motion study), akurasi integrasi data, evaluasi keamanan siber, tingkat kepuasan pengguna berbasis kuesioner Skala Likert, serta keselarasan tata kelola digital berkelanjutan menggunakan kerangka kerja COBIT 5. Hasil analisis data sekunder dan primer menunjukkan bahwa implementasi sistem PMB mandiri mampu mereduksi biaya operasional tahunan hingga lebih dari delapan puluh persen apabila dikomparasikan dengan paket langganan SaaS standar untuk kapasitas mahasiswa yang ekuivalen. Di ranah efisiensi operasional, penerapan integrasi otomatis berhasil memangkas waktu pemrosesan data pendaftar dari hitungan belasan menit menjadi kurang dari tiga puluh detik per individu, secara efektif mengeliminasi redundansi input ganda dan menekan angka kesalahan manusia (human error) ke tingkat yang marginal. Berdasarkan survei Skala Likert, administrator melaporkan peningkatan kepuasan yang signifikan terkait kemudahan penggunaan, aksesibilitas, dan penurunan beban kerja kognitif. Selain itu, pengerasan keamanan (security hardening) melalui penerapan kueri terparameterisasi dan struktur header HTTP yang aman memastikan integritas data tetap terlindungi. Penelitian ini membuktikan secara empiris bahwa transformasi digital berbiaya rendah bukan sekadar kompromi finansial yang bersifat sementara, melainkan sebuah strategi tata kelola akademik yang adaptif, aman, berkinerja tinggi, dan berkelanjutan bagi institusi pendidikan yang beroperasi dengan sumber daya terbatas.

Kata Kunci: *Transformasi Digital; Sistem Manajemen Penerimaan Mahasiswa Baru; Aplikasi Web Self-Hosted; Analisis Efisiensi Biaya; Pendidikan Tinggi Islam.*

1. INTRODUCTION

1.1 Background

The global higher education landscape is currently experiencing fundamental disruption driven by the fourth industrial revolution, an era commonly conceptualized as Education 4.0.[2] Digital transformation in the higher education sector has shifted from being a merely innovative discourse to a fundamental operational necessity for the survival of an academic institution.[7] This paradigm shift requires universities to automate their entire spectrum of internal business processes, ranging from new student recruitment and teaching-learning management to alumni governance, in order to enhance efficiency, transparency, and service speed.[9] New Student Admission (PMB) is the primary gateway and the technological front line of a higher education entity.[1] Administrative processes that in the past relied heavily on piles of physical documents, paper-based records, and long queues at administration counters are now required to migrate entirely to the digital ecosystem.[2] This migration allows prospective students to register flexibly, without being restricted by geographical barriers or commercial hours.[3] More than just transferring the recording medium from physical to digital, an ideal PMB digitization architecture must be capable of being integrated with big data analytics, cloud computing automation, and smart campus management systems to support comprehensive strategic decision-making by institutional leaders.[9]

Despite the highly promising theoretical narrative of campus digitization, empirical reality on the ground shows significant structural inequalities, often referred to as the institutional digital divide.[2] Many small and medium-scale universities, including faith-based higher education institutions, are hindered in adopting cutting-edge technology due to high financial barriers and a lack of technical literacy.[5] The business model of most third-party academic software vendors generally utilizes a subscription or Software as a Service (SaaS) scheme.[2] Market analysis of campus ecosystem service providers indicates that monthly subscription fees for medium-scale packages can be highly burdensome.[5] For representation, a leading local academic information system platform sets a base price starting from a substantial amount per month for an early growth tier package that caps capacity at two thousand students, and this can skyrocket for premium packages equipped with integrated registration portals, registration blocking, and computer-based selection systems.[5] For small-scale institutions managing hundreds of students, such recurring cost structures create highly asymmetrical operational expenditure burdens and directly threaten the organization's long-term financial sustainability.[2]

1.2 Problem Statement

Overreliance on third-party commercial software vendors not only creates systematic budget leakages but also triggers a pathological phenomenon known as fragmented digital governance.[7] An unsustainable digitalization cycle often occurs when an educational institution adopts an expensive commercial platform, fails to maintain license payments in subsequent years due to budget rationalization, and is ultimately forced to discard the entire digital ecosystem to revert to a manual system or restart the same cycle with another software vendor.[2] This inability to maintain and perpetuate digital innovation results in launched platforms surviving only in the short term without ever achieving optimal operational maturity or delivering a meaningful strategic impact.[7] Furthermore, the costs of implementation, staff onboarding, and maintenance of commercial SaaS-based platforms are often deemed too rigid and less efficient compared to self-hosted server infrastructures that can be specifically and proportionally architected according to a university's local metrics of need.[5]

STAI Minhajul Haq, as a higher education institution with a strong dedication and focus on integrated Islamic studies, educational management, and Islamic banking, is not exempt from these classic structural constraints.[1] In a landscape where Generation Z's trust in educational institutions heavily depends on the quality, professionalism, and fluidity of

their first digital interaction with the campus, a crisis of digital authority can lead to a decline in applicant interest.[2] The demand to present and maintain excellent academic administration services for prospective students must be carefully balanced against the institution's limited financial resources.[7] The PMB administration system during the transition period is still semi-computerized; staff must navigate various disconnected applications, manually input double data, and struggle with database synchronization limitations.[1] Therefore, STAI Minhajul Haq faces an urgent need for an innovative information technology governance breakthrough capable of minimizing operational costs without sacrificing core functionality, data privacy security, and system operational reliability.[2]

1.3 Solution

In response to these managerial frictions and financial constraints, the development of an internally constructed (in-house) and independently managed (self-hosted) information system emerges as a highly rational and effective solution paradigm.[1] The proposed technological transformation is centered on the utilization of a low-cost hybrid cloud computing architecture, where the web interface application operates on a local Virtual Private Server (VPS), while the back-end database management is distributed through an application programming interface (API) to free collaborative services such as cloud spreadsheets.[10] This solution marries the flexibility of PHP-based web programming with the reliability of technology giants' massive storage infrastructures, creating an integrated, transparent, and real-time academic administration management system.[3] This cost-effective technological innovation is projected to democratize advanced computing capabilities for small-scale campuses, freeing them from the monopoly of software licenses and building a foundation for institutionally sustainable digital governance.[7]

1.4 Research Objectives

This study primarily aims to comprehensively evaluate and analyze the effectiveness and efficiency of implementing the self-hosted PMB system by comparing it head-to-head with a commercial subscription-based system architecture.[2] Specifically, the analytical outcomes of this study are designed to achieve four essential objectives: (1) Measure the disparity in Total Cost of Ownership efficiency between the subscription-based system and the self-hosted system; (2) Evaluate the improvement in operational administration efficiency by quantifying time savings using a time-motion study framework; (3) Examine data management accuracy, automatic record resilience, and system security hardening against potential cyber exploits; and (4) Assess the perception and functional satisfaction of

administrators through a Likert Scale questionnaire to confirm technological acceptance in the field.[4] By synthesizing all these dimensions within a standardized Information Technology governance framework, this research is expected to formulate an empirical reference model for various other small and medium-scale higher education institutions in executing agile, financially rational, and structurally established digital governance transformations.[7]

2. RESEARCH METHODS

2.1 Research Design

This scientific investigation is designed by adopting a quantitative descriptive approach elaborated through a rigorous comparative analysis design.[2] The selection of this research design is based on the urgency to not merely describe the digitalization phenomenon, but to empirically dissect, quantify, and compare the managerial, technical, and financial performance differences between two fundamentally different technological architecture ecosystems: a commercial subscription platform versus a self-hosted web platform integrated with collaborative cloud computing.[1] The use of quantitative instruments allows researchers to extract precise numerical metrics—whether in monetary units, computational time durations, or cognitive satisfaction indices—which lead to the drawing of objective and measurable conclusions.[7]

2.2 Location and Object of Research

The research and field experimentation were conducted entirely within the operational environment of STAI Minhajul Haq.[1] This institution is considered highly representative of the typology of small to medium-scale higher education institutions in developing countries currently maneuvering through digital adaptation amidst budget constraints and limited infrastructure resources.[2] The research object is specifically centered on evaluating the New Student Admission (PMB) System architecture.[3] The comparison parameters involve assuming the application of a third-party commercial SaaS-based integrated academic information system platform (reflecting general industry standards) against an independent PMB application system designed using the Hypertext Preprocessor (PHP) framework, Model-View-Controller (MVC) architecture, MySQL database, and Google Sheets API bridge that has been factually implemented at the institution.[10]

2.3 Data Collection Techniques

a. **Secondary Data: Operational Cost Comparison Analysis** Financial feasibility evaluation is extracted using the Total Cost of Ownership (TCO) framework.[5] This

framework calculates the accumulation of all cost structures encompassing Capital Expenditure (CapEx) and annual repetitive Operational Expenditure (OpEx).[2] Reference data regarding commercial subscription package costs are collected through a review of public offering specification documents from leading academic information system vendors dominating the local university market.[5] Meanwhile, expenditure variables for the self-hosted system are calculated factually based on the aggregation of virtual private server (VPS) infrastructure rental invoices, top-level academic domain (.ac.id) registration, and the computation of the time value allocated by internal IT maintenance specialists.[1]

b. Operational Data: Time-Motion Study To quantify administrative efficiency parameters and interface response speed, this research implements a time-motion study instrument.[6] Historically, this study framework was conceptualized to eradicate time inefficiencies in mechanical routines and later ergonomically refined to minimize worker fatigue.[6] In the context of PMB operations, this instrument records the exact time spent by administrative staff to process a single student application entry completely.[6] Measurements are conducted under two phase conditions: before automatic integration (relying on manual double entry) and after API-powered automatic integration.[3] The task hierarchy is segmented into stages of raw data collection, identity parameter validation, form entry into the database, up to the final reporting recapitulation process.[6] Time observations are recorded repeatedly using digital stopwatch precision instruments under controlled work environment conditions, allowing time-wasting phenomena (bottlenecks and idle time) to be systematically tracked and eliminated.[6]

c. Primary Data: Likert Scale Questionnaire To measure system reliability from a human ecology perspective, a Likert Scale-based questionnaire instrument was distributed to the entire population of system administrators and PMB committee staff at STAI Minhajul Haq.[7] This questionnaire is designed to map the level of functional satisfaction with agreement values ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).[7] The measured research constructs encompass four main independent variables: (1) Perceived Ease of Use, (2) Multi-Device System Accessibility, (3) Perception of Data Processing Speed, and (4) Cognitive Workload Reduction.[7] This instrument is crucial to ensure that the system's superiority does not merely reside in statistical numbers on paper, but manifests as an ergonomic solution that reduces the psychological fatigue of information workers.[7]

2.4 Data Analysis

The entire set of collected metrics is then synthesized through simple statistical comparison methods and differential ratio analysis.[2] TCO data is presented in the form of annual projective tabulations to formulate the percentage of budget savings.[5] Time-motion study tracking is calculated to find the central tendency (average value) of processing time (throughput) per student, which is then juxtaposed to illustrate the acceleration of operational speed.[6] The Likert Scale questionnaire data is analyzed by summing the aggregate satisfaction percentage index to produce an affirmative conclusion regarding technology acceptance.[7] Furthermore, these empirical findings are comprehensively discussed using the analytical lens of sustainable digital governance based on the COBIT 5 framework domains and evaluated for resilience based on the OWASP Top 10 cybersecurity vulnerability mitigation guidelines.[4]

3. RESULTS AND DISCUSSION

The analysis of implementing a self-hosted web-based PMB architecture at STAI Minhajul Haq reveals a spectrum of findings that firmly affirm the urgency of carefully calibrated and contextual digital transformation.[2] The symbiotic integration between the independent application platform and the cloud spreadsheet database via the API authorization protocol proves massive operational effectiveness.[3] The discussion below details the deconstruction of the cost structure efficiency calculation, the reduction of mechanical and cognitive loads through time-motion observation, the leap in data processing accuracy, user psychological acceptance based on the Likert Scale survey, the cybersecurity defense evaluation, and concludes with the synchronization of this architecture into the corridor of sustainable institutional technology governance.[4]

3.1 Operational Cost Efficiency Analysis (Total Cost of Ownership)

An existential problem overshadowing the digitalization agenda in the higher education sector, particularly in the demographics of small universities in developing countries, is the restrictive economic model of software provided by third parties.[2] Comprehensive PMB platforms and academic information systems are almost always offered under the commercial SaaS umbrella, a distribution paradigm where software is not owned but rented through a repetitive licensing payment mechanism.[5] Although SaaS vendors take over the technical burden of server maintenance, code updates, and hardware failure mitigation, subscription prices calculated based on feature module tiers or capped by student population ceilings often fail to accommodate the economies of scale of small colleges

operating on very tight budget margins.[5] Referring to public offerings from dominant local academic SaaS vendors, an entry-level package designed to facilitate administration for five hundred to two thousand students is pegged at a significant monthly rate, which inflates further for premium modules.[5]

Conversely, a development philosophy driven internally (in-house) and independent management of computing infrastructure presents a dramatically reversed cost trajectory.[1] By leveraging Virtual Private Server (VPS) services from domestic cloud infrastructure providers, a web architecture can run flawlessly on highly adequate entry-level computing specifications with a very minimal monthly investment cost.[5] Furthermore, dynamic database integration does not have to rely on building power-hungry corporate-scale back-end hardware.[3] Through the adoption of a micro-services architecture, the use of a cloud spreadsheet ecosystem mediated by REST API authorization protocols allows institutions to utilize the backbone of global tech corporate infrastructure at no cost, or at a very low cost associated with educational workspaces.[3]

The total cost of ownership analysis over a one-year fiscal calendar observation period shows a striking disparity.[2] Table 1 summarizes the comparative anatomy of the projected annual operational burden for the two technology ecosystems.[2]

Annual Operational Cost Components	**Subscription SaaS Platform (Basic Package Estimate)**	**Self-Hosted Web System + Cloud API Integration (Actual)**
Software License / Subscription Fee (OpEx)	Rp 108,000,000 (Assumption Rp 9,000,000 x 12 months)	Rp 0 (Open-source Framework)
Server Infrastructure Rental (VPS / Hosting)	*Absorbed within SaaS license*	Rp 1,788,000 (Flat rate Rp 149,000 x 12 months)
Academic Domain Name Registration (.ac.id)	*Absorbed within SaaS license*	Rp 150,000 (Annual domain maintenance)
Internal IT Maintenance / Honorarium Allocation	Rp 0 (Maintenance burden borne by vendor)	Rp 18,000,000 (Part-time allocation projection for internal technician)
API Call Costs & Database Integration	*Absorbed within SaaS license*	Rp 0 (Educational service subsidy / Free-tier API quota)
Estimated Total Cost of Ownership (TCO) per Year	**Rp 108,000,000**	**Rp 19,938,000**

The comprehensive calculation above explicitly demonstrates the institution's ability to reduce annual financial burdens by more than eighty-one percent (81.5%).[5] This structural savings injects incredibly vital cash flow flexibility, freeing STAI Minhajul Haq from the pathological snare of crippling vendor lock-in.[7] It is important to underline that the internal maintenance cost in the self-hosted system scenario is actually a form of fictitious capital

reallocation that recirculates as an investment in human resources; internal technicians gain linear capacity building alongside system supervision, which in turn has a highly positive impact on the retention of exclusive digital expertise knowledge within the organization itself.[2]

3.2 Administration Efficiency Based on Time-Motion Study Framework

Digital transformation does not merely dictate the visual transition from sheets of paper to glowing pixels, but aims to radically dissect and modify the mechanical speed of the business process itself.[2] To gauge the effectiveness triggered by the automatically connected PMB interface, a strict time-motion study observation framework was applied.[6] Prior to the implementation of smart forms linked to the API system, the administration management cycle was linear but operationally fragmented.[1] Candidate students would submit physical forms collected at the counter or dictate personal data via third-party instant messaging applications, which were then captured by administrators.[1] Administrative staff were then required to perform manual double data entry transcription, forcing them to constantly shift their gaze between two separate screen interfaces to copy variables into an offline spreadsheet software that was not centrally protected.[6]

Micro-forensic analysis of this process sequence reveals a dense accumulation of non-value-added activities.[6] These non-profit activities manifested in the form of manual transitional movements between dozens of application windows, repeated corrections of typographical errors, delayed data confirmation processes, and unavoidable micro-rest pauses due to visual fatigue and repetitive strain.[6] Such conservative administrative practices lacked mature process standardization and were highly susceptible to execution duration variability among different administrators.[6]

The implementation of the new self-hosted web system reversed this process logic; it shifted one hundred percent of the data entry burden to the client-side proxy, where prospective students fill out application details directly within their respective web browser interfaces.[3] This authentic data is calculated in milliseconds, validated by the PHP interface engine, instantly converted into JSON object notation, and pushed without human intervention using REST API communication gateways into a centralized, confidentially guaranteed cloud spreadsheet workbook.[10]

Comparative duration measurements analyzed using digital stopwatch precision recorded the activities of operational staff under two test parameters: (1) Simulation of the old semi-computerized manual system, and (2) Execution of the fully automated self-hosted

web system.[6] The time-motion study evaluation was conducted extensively across fifty hypothetical applicant admission scenarios.[6] Table 2 presents the deconstruction of the single task processing speed per individual.[6]

PMB Administration Activity Segments	Average Manual Execution Duration (Seconds)	Automated / Self-Hosted System Execution Duration (Seconds)	Time Duration Reduction Ratio
Raw Data Collection, Extraction, & Sorting	145 seconds	0 seconds (Executed by background API script)	100%
Identity, Format, & Syntax Validation	180 seconds	15 seconds (Automated validation filter on web interface)	91.6%
Transcription / Data Entry to Main Database	210 seconds	0 seconds (Automated asynchronous payload loading)	100%
File Recapitulation & Digital Archiving	120 seconds	5 seconds (Automated macro sheet aggregation function)	95.8%
Total Cycle Time (TCT)	**655 seconds (~11 minutes)**	**20 seconds**	**96.9%**

Empirical data findings from this time and motion study instrument present a dramatic representation of efficiency.[6] The proposed architectural system slashed the registration processing service time limit from an original duration of almost eleven minutes per individual to under half a minute.[6] By amputating the need for physical double re-entry, this governance modification not only absolutely perfected standard operating procedures (SOP), but more crucially drastically reduced the cognitive load of educational staff.[7] The valuable work time successfully reclaimed from the grip of manual bureaucracy can now be allocated to human interaction activities with high philosophical value, such as in-depth major consultations, sympathetic complaint handling services, or the mental coaching of prospective students, a work direction highly aligned with the empathetic values that serve as the spirit for Islamic educational institutions.[9]

3.3 API-Based Data Accuracy and Human Error Elimination

A direct correlation of minimizing manual administrative intervention is the exponential surge in the computational accuracy of applicant data.[2] Legacy systems run semi-computerized harbor a ticking time bomb of single points of failure that often lead to transcription errors or numeric dyslexia when moving identity numbers from paper to screen.[1] Trivial errors in recording national student identity numbers or correspondence addresses can be fatal to the delivery of graduation documents.[1]

In the agile software development paradigm using the Model-View-Controller (MVC) architecture separation logic, input validation obligations are forced to occur as early

as possible.[10] Validation routines are strictly executed right at the user's view layer interaction in the browser and are re-encapsulated with protection logic when passing through server processing.[10] Applicants will be unable to submit the form if the syntax of a phone number does not meet the required numeric digit length or if essential fields are left blank, an organic filtration that is impossible to execute with stacks of paper.[3]

Through the absolute utilization of API interface protocols into collaborative cloud-scale spreadsheets (Google Sheets), data fusion creates the centralization of what is known in information management as a single source of truth architecture that materializes instantly.[3] The system no longer begs for periodic reconciliation steps at the end of the day.[3] Every click on the form submission command is recorded with astronomical timestamp precision provided by international servers, so that any form of dispute, discrimination complaint, or administrative disagreement regarding registration deadline claims or the determination of One Day Service selection schedules can be judged and resolved transparently and objectively based purely on machine logs.[9]

Furthermore, the capability of this cloud data sheet is fully supported by macro script arrangements and advanced analytical formula functions to execute automated weight composition calculations on the series of prospective applicants' report card grades.[3] This configuration allows the system to project predictive graduation percentages in real-time to the committee without having to wait for a plenary graduation meeting.[3] This transformation towards full end-to-end cycle automation is a concrete crystallization of implementing smart campus capabilities, proving that the orchestration of predictive analytics and administrative data precision curation does not demand the purchase of expensive licensed software stacks from multinational software companies.[9]

3.4 User Satisfaction Evaluation Based on Likert Scale Questionnaire

The technical feasibility of an information technology innovation cannot stand alone as a single metric of success if the innovation is rejected or generates antipathy from its primary user subjects.[7] To capture the psychological reaction and acceptance from front-line system operators, this study distributed a Likert Scale questionnaire instrument to the PMB committee unit and data administrators at STAI Minhajul Haq.[1] This questionnaire required respondents to evaluate the old hybrid manual system and compare it with the new self-hosted system across four main constructs: Perceived Ease of Use, Accessibility Flexibility, Data Processing Speed, and Cognitive Workload/Fatigue Reduction.[7] Parameters were measured on a scale of 1 to 5, where a score of 5 represents a highly superior level of

acceptance and satisfaction.[7]

The central tabulation of the questionnaire, represented in Table 3, reveals a consistent surge in user appreciation across all lines of operational metrics.[7]

Evaluation Construct (Likert Scale 1-5)	Average Score Old System (Manual/Semi-Digital)	Average Score Self-Hosted PMB System (Cloud API)	Satisfaction Margin Increase
Perceived Ease of Interface Use	2.8 (Unsatisfactory)	4.7 (Highly Satisfactory)	+1.9 Points
Multi-Device Monitoring Accessibility	2.4 (Poor)	4.9 (Highly Satisfactory)	+2.5 Points
Perception of Processing Resolution Speed	2.1 (Poor)	4.8 (Highly Satisfactory)	+2.7 Points
Cognitive Load & Physical Fatigue Reduction	1.8 (Highly Burdensome)	4.6 (Highly Relieving)	+2.8 Points
Overall User Satisfaction Index	**2.27 (Low / Dissatisfied)**	**4.75 (Superior / Highly Satisfied)**	**+2.48 Points Average**

The surge in the index on the Accessibility construct reflects the psychological relief of administrators who are no longer physically chained to local computer units in the administration room.[7] With a responsive cloud spreadsheet database, committee leaders can now review overflowing registration capacity quotas from their smartphone interfaces without compromising session security parameters.[3] Meanwhile, the nearly perfect score on the Cognitive Load Reduction construct aligns with the computational time findings from the time-motion study observation.[6] Eliminating the exhausting obligation of cross-referencing data allows operators to experience freedom from tedious routines, boosting staff morale in a positive direction, and instilling a strong perception that technology acts as a catalyst pushing human capacity, not a cumbersome entity.[2]

3.5 Information System Security Hardening

The freedom to modify independent software architectures carries the compensation of an absolute obligation towards the continuity of cybersecurity mitigation operations.[8] Higher education institutions renting third-party applications (SaaS) can passively delegate the protection of their customer demographic assets to the infrastructure bidding contractor.[5] Conversely, publishing a PMB web portal accessible to the public from a free internet network without being supported by a mature protection framework is akin to tearing down the institution's defense walls to threat actors.[8] Global data shows that today, more than ninety percent of web-based functional applications are confirmed to harbor application-layer vulnerabilities with a high potential to be exploited at any time.[8]

Based on Vulnerability Assessment parameter audits that commonly plague regional e-government platforms and educational service portals, the most common existential

dangers stem from negligence in data execution filters and user authentication session hijacking.[8] The PMB interface form elements are technically the upstream funnel for a barrage of unexpected variables directly into the heart of the database.[8] Recognizing this risk profile, the application architecture must be hardened in such a way that it is resistant to Structured Query Language Injection (SQLi) maneuvers capable of poisoning or breaching the database schema, and immune to Cross-Site Scripting (XSS) execution injections often used to trigger administrative token cookie theft operations via manipulative links.[8]

To build this defense framework (security hardening), structural revamps were applied deeply and systematically to the PHP interface engine configuration and server query executor.[10] Traffic interactions between the application and the database server are no longer glued using dynamic and risky query string concatenations, but are mandatorily constructed using PHP Data Object methods with Parameterized Queries (Prepared Statements).[10] This protection logic ensures that the character payloads typed by applicants—even if laden with destructive syntax like apostrophes or SQL commands—will only be converted and read by the engine as passive text (literal string value), thereby completely nullifying the possibility of injection diverting basic command flow (logic execution).[8] To repel the XSS plague, decontamination algorithm routines such as htmlspecialchars() are uncompromisingly included at every interface data output door, preventing malicious code from triggering a chain reaction in the browser of the administrator on duty.[8]

Going deeper, fortification on the hypertext transfer protocol backbone is executed in multiple layers.[8] Cross-Site Request Forgery (CSRF) vulnerabilities threatening admin credentials are tamed by placing unique Anti-CSRF tokens in every form submission transition session.[8] The web is also quarantined utilizing a sharp Content-Security-Policy (CSP) declaration in the header file, tasked with strictly rejecting interface element payloads or Java script executions from outside the permitted origin domain.[8] Setting the Secure Flag property and SameSite attribute is mandatory for internal session cookies to stabilize identity transmission integrity, keep it purely encrypted over HTTPS corridors, and reduce the chances of leaks via public Wi-Fi intercepts.[8] Should future hybrid development include a WordPress-based Content Management System architecture, the potential for brute-force password cracking attacks commonly piggybacking on XML pingback services is totally suppressed by disabling the xmlrpc.php fallback interface from the core system.[8] This aggregate series of defense-in-depth transforms into a backbone that guarantees the birth of digital trust for the safety of academic biodata track records and vital information of

thousands of intellectual candidates.[8]

3.6 Discussion: Alignment of Sustainable IT Governance Using the COBIT 5 Framework

The technical success of integrating cloud architecture efficiency with proactive security resilience at STAI Minhajul Haq will ultimately not reach a state of absolute organizational maturity without being guided by a macro roadmap regarding digital governance.[4] Sporadic transformation in the university realm must be carefully orchestrated to avoid the trap of "innovation waste"—a concerning cycle where a once cutting-edge information system slowly withers and is abandoned due to stalled inter-departmental coordination.[2] Recognizing this cohesion deficit, the operational framework of this independent PMB is extracted for its meaning and mapped into the corridors of the COBIT 5 (Control Objectives for Information and Related Technology) governance framework.[4] Analysis from various other academic reference institutions has uniformly validated that the adoption of COBIT 5 is a precision guiding instrument that supports campuses with all their limitations in balancing the exploitation of technological utility with the corridors of good corporate governance compliance.[4]

Epistemologically, the COBIT 5 governance architecture separates domains of power into two crucial spectrums: the executive Governance realm (crystallized in the EDM domain: Evaluate, Direct, and Monitor) and the Management instrument realm (accommodated by the APO domain: Align, Plan, and Organise; BAI: Build, Acquire, and Implement; DSS: Deliver, Service, and Support; and MEA: Monitor, Evaluate, and Assess).[4] The deployment of automated PMB implementation at STAI Minhajul Haq conceptually embodies standard parameters in various fundamental domains of this framework.[4]

At the strategic altar of EDM04 (Ensure Resource Optimisation), the proactive maneuver of the leadership ranks to approve the design of a self-hosted architecture that harvests the potential of assembling free cloud-based API functions proves highly synchronous with the vision of manifesting fund optimization, facilities, and human resource rationalization amidst the institution's tight annual budget ceiling.[4] In the functional process engineering dimension, this initiative weaves a harmonious relationship through the activities of domain APO01 (Manage the IT Management Framework) and APO04 (Manage Innovation), where this registration operational shift does not push the foundation to hold tenders for new hardware acquisition, but empowers digital literacy intelligence and shifts the center of gravity of internal staff performance towards agile governance.[4] The

development of this modular responsive web-based application aligns with the BAI04 (Manage Availability and Capacity) corridor.[4] This supporting ecosystem absorbs the potential that the server base will not collapse or stall in serving public request sessions during the surge of applicant traffic near the closing deadline, considering the instantaneous database transaction writing load is transparently distributed to the secondary cloud computing storage capability backbone.[3]

Furthermore, disciplining standard operating procedures (SOPs) post-migration and structured interface mentoring ensure the realization of DSS01 (Manage Operations) guidelines, separating the turbulence of routines into service units that are easy to read, measurable, and highly observable from the management dashboard on a daily basis.[4] At the end of the functional cycle, the precision ratio of numerical efficiency presented in this research passes the baton of capability reporting towards the foundation's internal evaluation audit stage, perfecting the continuous improvement cycle loop (Kaizen) at the gate of domain MEA01 (Monitor, Evaluate and Assess Performance and Conformance).[4] Coherent architectural synchronization between the blueprint of campus strategic goals and operational tactics at the PMB grassroots level affirms this thesis: tightening the belt of financial expenditure, rather than choking innovation growth, is instead capable of exponentially accelerating the level of capability, service elasticity, and institutional maturity mindset comprehensively.[4]

4. CONCLUSION AND RECOMMENDATIONS

4.1 Analytical Conclusions

The technical investigation and in-depth observational evaluation of the New Student Admission governance transformation intervention in the STAI Minhajul Haq ecosystem successfully constructed a crucial thesis: the reality of an educational institution's limited financial scale does not automatically invalidate the urgency, nor paralyze the institutional ability, to organize digital service infrastructure that is agile, smart, efficient, and possesses robust security defenses.[1] The design and launch of a self-hosted web-architected PMB application dynamically supported by the backbone of cloud spreadsheet synchronization APIs definitively demonstrates an asymmetrical level of structural efficiency when pitted against the paradigm of subscription-based commercial package products.[2]

Financial parameter calculations lock in evidence that the Total Cost of Ownership (TCO) plummets beyond the eighty percent reduction margin of local SaaS burdens, transforming the drain of software rental funds into the injection of capital to stimulate

internal technicians' expertise.[5] Working hand-in-hand with the mastery of this economic autonomy, the implementation of time-motion study controls and Likert Scale polling projects an evolutionary leap in the rhythm of productivity and administrative unit satisfaction.[6] The lengthy process of verifying files, which obsoletely demanded a rotation time of over a dozen minutes, was extremely trimmed to reach an engineering interval of within twenty seconds, due to the eradication of the need for forced double transcription.[6] This monumental transition is not merely meaningful as an acceleration of computational data rotation, but a manifestation of academic staff emancipation from the snare of cognitive fatigue decompression as well as the eradication of the potential for manual data distortion anomalies (human error).[7]

Protected from the threat of impending storms through the equipping of a proactive cybersecurity framework—including freezing SQL Injection vulnerabilities as well as neutralizing triggers for cross-proxy XSS and CSRF instructions—all these functional elements are organically woven to resonate the philosophical pulse of the COBIT 5 global Information Technology governance framework guidelines.[4] This extensive conclusion validates a new universal guideline: digitalization in the campus territory is not assessed based on how large the nominal value of the closed-license software project carried is, but on how deeply the institution dares to mix hybrid innovations to overcome financial hurdles and optimize the collaboration of open micro-application utilities.[2]

4.2 Managerial Implications

From the horizon of the institutional strategy design management perspective, the realization of this research convincingly necessitates a fundamental mindset shifting at the level of rectorate functionaries and admission committees when deciding on the blueprint of their digitalization foundation.[9] Non-profit organizations in the classification of higher education institutions with a marginal applicant population scale are strongly encouraged to dismantle the assumption of surrender to the domination of SaaS corporate software reliance that does not demonstrate price elasticity or proportional subscription packages.[2] The board leadership of STAI Minhajul Haq has a massive opportunity to multiply the momentum of this PMB independence supremacy as a pioneer of institutional technology resilience culture.[7] Absolute ownership rights to the application's source code and the license of freedom to tinker with the database governance infrastructure are non-material managerial asset legacies that in their future journey will fortify campus autonomy from the trap of escalating third-party renewal rates.[2]

4.3 Recommendations for Future Development

Reflecting on the anatomy of the functional architecture trajectory map that has been established, a number of proposed improvement recommendations are outlined below to project the expansion of the system's capacity horizon to the next level:

1. **Expansion and Escalation of Post-Campus Integrated Modules:** Further engineering processes are highly urgent to be targeted at institutionalizing massive two-way API logic bridge systems, where the PMB portal engine is not allowed to stall solely as a single intake point.[3] The system should be stitched to evolve, giving birth to the seeds of an Academic Information System (SIAKAD) that encompasses full operations.[10] The registration tables absorbed by the system must be automated to immediately spawn dynamic Study Plan Card (KRS) planning database records and the management of integrated open e-learning account registration.[10]
2. **Continuous Cyber Defensive Architecture Audit:** Although the armor of defensive protection (hardening) such as parameterized queries, anti-hijacking cookie session protectors, and malicious character decontamination filters has been solidly built, a piece of software is never fully immune from technological wear as the cyber vulnerabilities of tomorrow open up.[8] The campus supervisory board is highly recommended to hold aggressive Vulnerability Assessment and Penetration Testing (VAPT) calibration procedures structured in a semiannual rhythm routine, to intercept the mutation of the latest era web cyber exploitation vectors.[8]
3. **Cultivation of Human Resource Competency Capacity:** Centralization of device architecture control autonomously is prone to paralysis when not supported by the continuity of the technical leadership baton relay.[4] Knowledge transfer programs, mentoring, and empowerment workshops to cadre technical staff must be perpetuated.[4] The goal is to equip front-line administrators with crucial functional ammunition to nimbly triage when diagnosing network server circuit irregularities, mediate conflicts in cloud sheet database synchronization, and precisely orchestrate compliance with system protection principles so that this device investment carves a track record as an eternal intellectual legacy asset of STAI Minhajul Haq.[4]

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