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Web-Based Gym Membership System with Semi-Automated QRIS Verification Developed Through Agile-Scrum

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ABSTRACT

Gym membership administration that depends on manual processes is correlated with elevated rates of recording inaccuracies, protracted payment verification periods of membership status. This study presents the development and evaluation of a web-based gym membership information system at TGW Gym, Indonesia, integrating semi-automated QRIS payment verification through the Agile-Scrum framework. The system was built using Laravel and MySQL across five iterative sprints, encompassing member registration, package selection, QRIS payment proof upload, administrator verification, and membership renewal modules. Functional validation used black-box testing across all modules with eight test scenarios spanning the package selection, payment, and renewal pages. Performance metrics were obtained through structured pre and post-implementation observation over 15 transaction cycles. Black-box testing confirmed that all functional requirements were satisfied. Following implementation, the task success rate reached 92%, error rates decreased from 15-20% to 3-5%, and verification time fell from 10-15 minutes to 2-5 minutes per transaction. The system usability scale score of 78 (Grade B, Good) confirmed acceptable usability. The novelty lies in combining admin payment verification, an expiry-aware renewal workflow, and a semi-automated QRIS flow within a single architecture, a combination not present in prior gym management systems.

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1. INTRODUCTION

Fitness centers increasingly operate at a scale where manual administration breaks down. Member registration using physical forms, cash payment recorded in ledgers, and renewal status tracked by hand worked for small operations. Once membership grows past a few dozen, the error rate compounds with every transaction [1],[2]. Duplicate registrations accumulate, payments get logged against the wrong member, and no one notices an expired membership until the member shows up and asks. These are not edge cases but the predictable failure modes of any paper-based record system under load. Web-based information systems address them by centralizing data, enforcing validation at input, and making membership status visible in real

time [3],[4]. Adoption in the fitness sector has grown as the operational cost of manual processes has become measurable and avoidable [1], [3].

TGW (The Good Wife) Gym, a fitness center in Kuningan Indonesia, runs entirely on manual procedures. Registration uses physical forms, payments are recorded by hand, and membership renewal depends on staff manual checking. Five weeks of structured observation across 15 transaction cycles confirmed what the staff already knew: error rates ran between 15 and 20 percent per cycle, and each transaction took 10 to 15 minutes from initiation to completion. Four failure modes repeated consistently, namely duplicate member records from unverified re-registrations, payment entries logged against incorrect accounts, processing delays from sequential one-by-one verification, and no mechanism to flag expiring memberships. As active membership grew, these failures scaled with it.

Prior gym IS studies confirm the general case for digitalization without solving the payment problem. Waterfall-based membership system and confirmed improvements in registration accuracy [5], but included no payment integration and no renewal automation. Applied Extreme Programming to a fitness center IS and improved data recording [3], but excluded payment workflows entirely, and functional systems with the same gap [6],[7]. Membership data improved, yet payment verification, the step responsible for most delays and disputes in cash and transfer based operations, stayed manual in all of them. On the payment side, QRIS has shown consistent improvements in transaction speed and traceability across service contexts [8], [9] ,[10], [11]. What the literature has not produced is a system that handles both: membership lifecycle management integrated with a structured QRIS verification workflow, built under a method designed for the mid-project requirement changes small gyms reliably produce.

Three gaps remain in the published literature. First, no prior gym IS study integrates membership renewal tracking with a payment verification workflow in a single unified system. Second, QRIS integration studies in service IS focus on adoption behavior and user satisfaction rather than on the IS architecture needed for semi-automated verification at organizations without payment gateway infrastructure. Third, Agile-Scrum development has not been applied to gym IS in the published literature, despite the documented mismatch between Waterfall's fixed-requirements assumption and the reality of small-business IS projects, where stakeholder needs shift mid-development and linear methods fail [12], [13]. This study addresses all three by developing and evaluating a web-based gym membership system at TGW Gym that combines lifecycle management, expiry-aware renewal, and semi-automated QRIS verification within an Agile-Scrum-developed architecture.

2. METHODS

The research methodology employed in this study follows a software engineering approach using the Agile development model with the Scrum framework, supported by structured data collection through observation, interviews, and document studies. The methodological steps are detailed in the following subsections.

2.1 Data Collection Techniques

Data collection involved three complementary techniques applied during product backlog formation and validated throughout sprint cycles. Direct observation was conducted over five weeks across 15 complete transaction cycles at TGW Gym, covering registration, payment recording, and renewal handling. Each cycle was timed from initiation to completion and assessed for input or recording errors against the staff log. Interviews with the gym manager and two administrative staff provided requirement details that could not be derived from observation, particularly the verification workflow and the membership renewal procedure. Literature study sourced from peer-reviewed journals and software engineering textbooks supplied the methodological foundation for sprint planning, black-box test case design, and System Usability Scale (SUS) administration.

2.2 System Development Methods

The Agile method with Scrum framework was selected because the development of a membership information system integrated with QRIS payment verification requires flexibility, rapid adaptation, and active stakeholder involvement at each development stage [12]. Requirements in the research object were dynamic and likely to evolve through evaluation cycles and management feedback [2], [14],[13]. Scrum enables iterative and incremental development so that each feature can be developed, tested, and evaluated in stages [13]. This approach allows stakeholders to assess deliverables at the end of each sprint, reducing the risk of implementation errors from the early stages.

Scrum was preferred over the linear Waterfall approach and over Prototype methods that focus on initial system models, because Scrum produces usable increments in each sprint iteration [8]. For QRIS implementation specifically, the system applies a payment proof upload mechanism with admin verification

rather than fully automated payment gateway integration. This decision reflects the operational reality that single-location small gyms typically lack merchant certification, yet prior research confirms that even semi-automated QRIS workflows improve transaction efficiency and ease of use [15]. Modules such as membership management, package selection, and transaction recording are designed to be portable to other fitness centers [16], while the verification workflow and business rules remain calibrated to TGW's operational constraints.

The Scrum implementation in this study consisted of five sprints, each lasting two weeks, executed sequentially over ten weeks of development. Sprint 1 produced the member registration and authentication modules. Sprint 2 delivered package selection and member dashboard. Sprint 3 implemented the QRIS payment upload and admin verification flow. Sprint 4 built the membership renewal queue with expiry tracking. Sprint 5 integrated reporting and conducted system-wide testing. Two of the five sprints required mid-cycle backlog revisions following stakeholder review, namely the addition of an expiry-aware renewal queue (Sprint 4) and the relocation of payment proof verification from a separate page into the admin dashboard (Sprint 3). These revisions demonstrate why Agile-Scrum was the appropriate choice over Waterfall, which would have required re-baselining the requirements document. The stages of system development based on the Scrum framework are summarized below.

1. Product Backlog (Identification of System Requirements). The initial stage was carried out through observation and interviews to identify problems and system needs at TGW Gym. Analysis showed that membership administration and payment recording were still carried out manually, with potential for errors and inefficiencies. All functional and non-functional needs were summarized in a product backlog that became the basis for subsequent sprint planning [17].
2. Sprint Planning. Product backlog items were prioritized and selected for each two-week sprint cycle. Sprint planning included determining features to be developed, dividing development tasks among team members, and estimating work effort. Each sprint was designed to produce increments in the form of system parts that can be run and tested [18].
3. Sprint Execution (System Development). This stage involved iterative implementation based on the predefined sprint plan. The system was developed using PHP with the Laravel 11 framework following MVC architecture, and MySQL 8 as the database. Development included user interface design, implementation of business logic such as membership and transaction management, and the QRIS payment upload feature with admin verification. Functional testing using black-box testing was conducted at the end of each sprint to ensure that the system met defined requirements [19].
4. Sprint Review and Testing. After each sprint, a Sprint Review was conducted to evaluate development outcomes with users and stakeholders. Testing focused on functional black-box testing to ensure reliability and suitability of the developed features [20].
5. Sprint Retrospective and Increment Improvement. This stage evaluated the development process for each sprint. Feedback and findings during system use were used as the basis for further improvement in the next sprint. This process reflects the concept of continuous maintenance within Agile, allowing the system to adapt to changing user needs.

2.3 System Testing and Usability Evaluation

Two evaluation methods were applied to assess the system. First, black-box testing was performed across the package selection page (two scenarios), payment page (three scenarios), and member extension page (three scenarios), yielding eight test scenarios in total. Each scenario specified an input, expected output, and pass criterion. Tests were executed by the development team and reviewed independently by the gym administrator. Second, system usability scale (SUS) assessment was administered post-implementation to 20 respondents consisting of 15 active members (recruited from the gym's active membership roster, selected to span new and renewing members) and 5 administrative staff (the entire admin team using the dashboard daily). The SUS questionnaire used the standard 10-item, five-point Likert format. Responses were collected during a two-week post-launch window and scored using the conventional SUS calculation. Operational performance was further assessed through pre and post implementation observation over 15 transaction cycles, recording error rate and processing time per transaction in both conditions.

3. RESULTS AND DISCUSSION

3.1 System Design

The TGW membership system design describes the workflow of the proposed system and defines the data structures used throughout development. The design stage produced a Context Diagram, Data Flow Diagram (DFD), and Entity Relationship Diagram (ERD) as the foundation for web-based implementation. Design decisions were grounded in requirements analysis and the failure modes identified during the manual baseline observation.

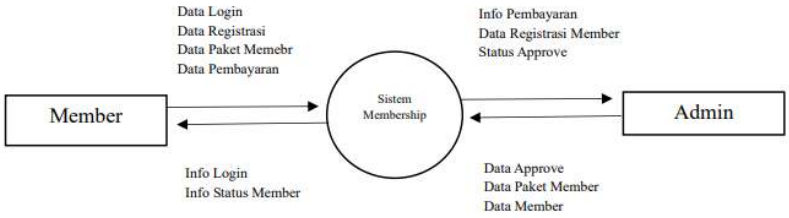

Figure 1. Context diagram

The Context Diagram (Figure 1) shows that the membership information system functions as a centralized data processing hub integrating the Member and Admin entities into one structured service flow [21]. Members interact with the system by transmitting login, registration, package selection, and payment data, which the system processes to generate membership status and access information in real time. The Admin receives payment, registration, and membership status data for verification and approval. Approval results and updates to package and member records are returned to the system as the basis for valid and controlled membership management.

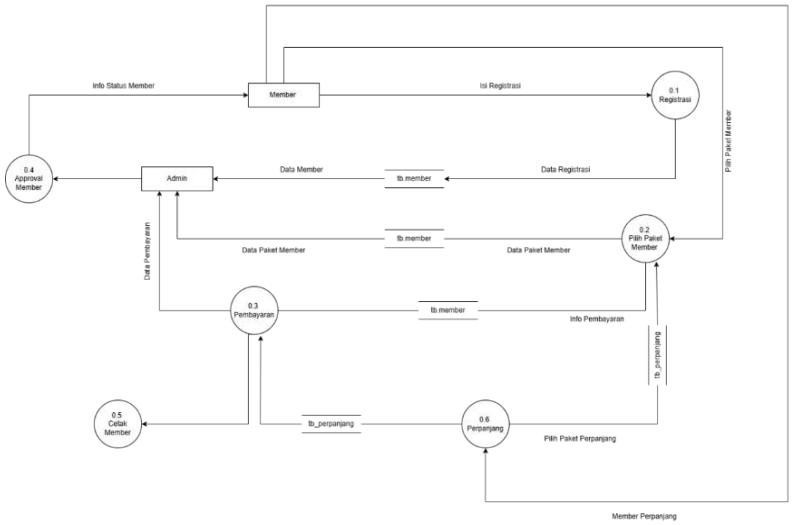

Figure 2. Data flow diagram level 0

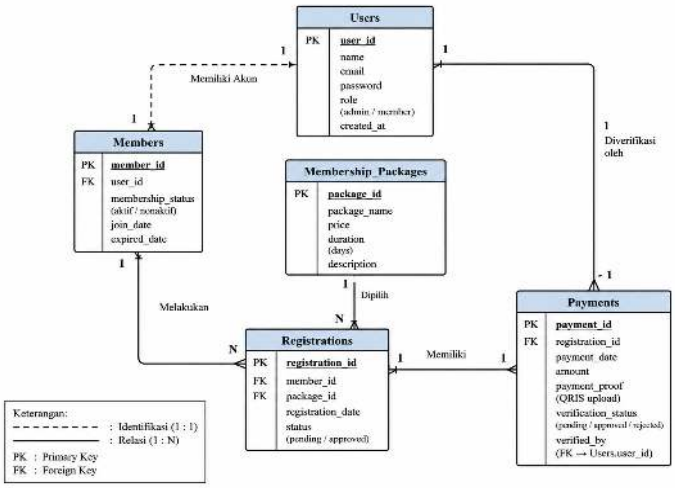

Figure 3. Gym membership system DFD

The Level 0 DFD (Figures 2 and 3) depicts the main business processes between external entities and the system. Two external entities, Member and Admin, drive six core processes: registration (0.1), package selection (0.2), payment (0.3), member approval (0.4), member card printing (0.5), and renewal (0.6). Data

flows from Member to system through registration, package, payment, and renewal submissions, while Admin flows include verification and approval actions. Each process connects to dedicated data stores: member data (D1), membership package data (D2), and transaction data (D3). The integrated flow ensures that all member-facing interactions and admin-side validations operate against a single source of truth, eliminating the duplicate-record and misallocated-payment failure modes observed in the manual baseline.

3.2 System Implementation

The implementation realized all design artifacts as a web-based application accessible to TGW members and administrators. The system was built with Laravel 11 (MVC architecture), MySQL 8 for persistence, and HTML, CSS, and JavaScript for the presentation layer. The interface was designed to be responsive and to handle the complete membership lifecycle from registration through renewal. Implementation produced five main modules aligned with TGW operational needs.

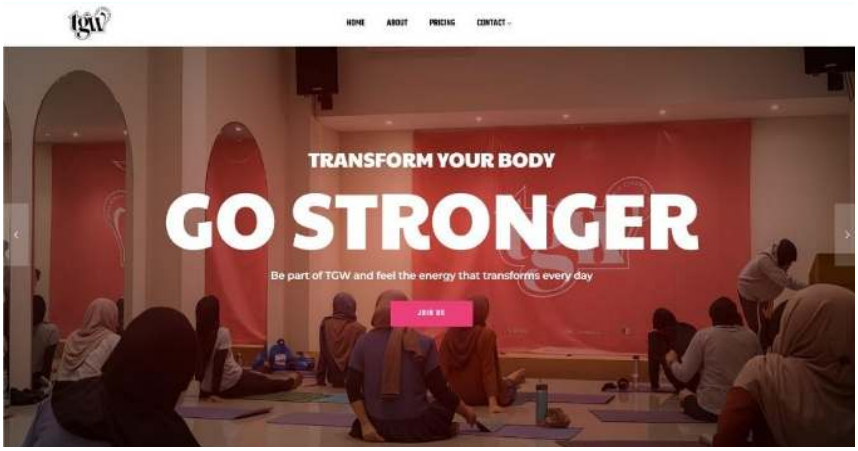

Figure 4. Member home page

The homepage interface (Figure 4) presents a responsive design with clear navigation across Home, About, Pricing, and Contact sections, and a hero area featuring a "Join Us" call-to-action that anchors the registration funnel. The interface satisfies established usability heuristics including visibility of system status, consistency, and minimalist design.

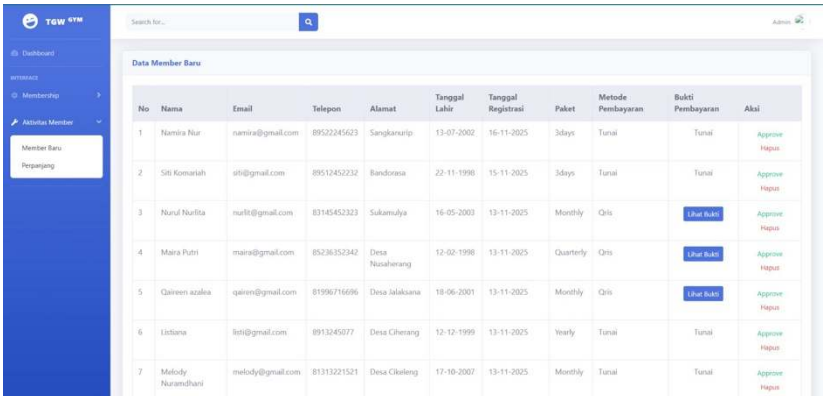

Figure 5. New members page

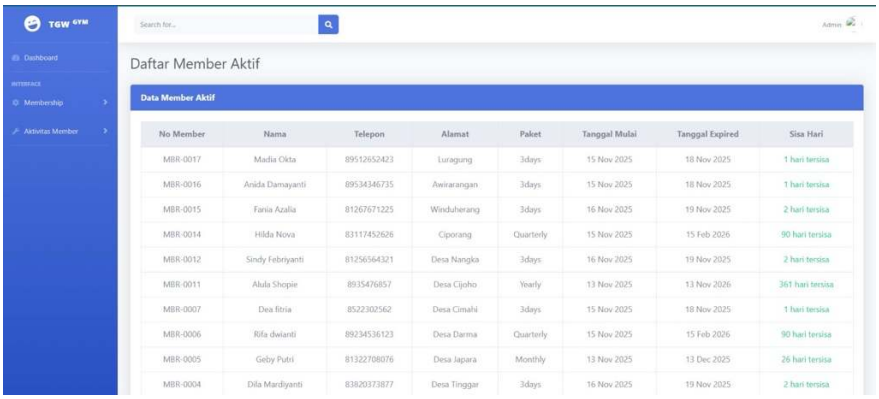

Figure 6. Active members page

The new members page (Figure 5) lists registrants awaiting verification, allowing the admin to inspect submitted data and payment proof before approving or rejecting each application. The active members page (Figure 6) displays members with active status, complete with membership validity, package type, and additional service details. The admin dashboard centralizes member data in tabular form, including identity, package, payment method, and verification status, with action controls for view-proof and approve operations that compress the verification step from a multi-window manual workflow into a single in-place decision.

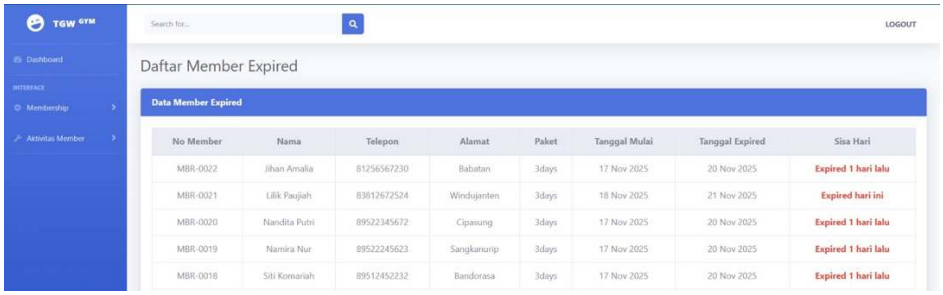

Figure 7. Member expired page

The member expired page (Figure 7) lists members whose active periods have lapsed, enabling proactive renewal outreach by the admin. A linked renewal queue displays renewal applicants and their submitted payment proof for admin verification before validity period extension.

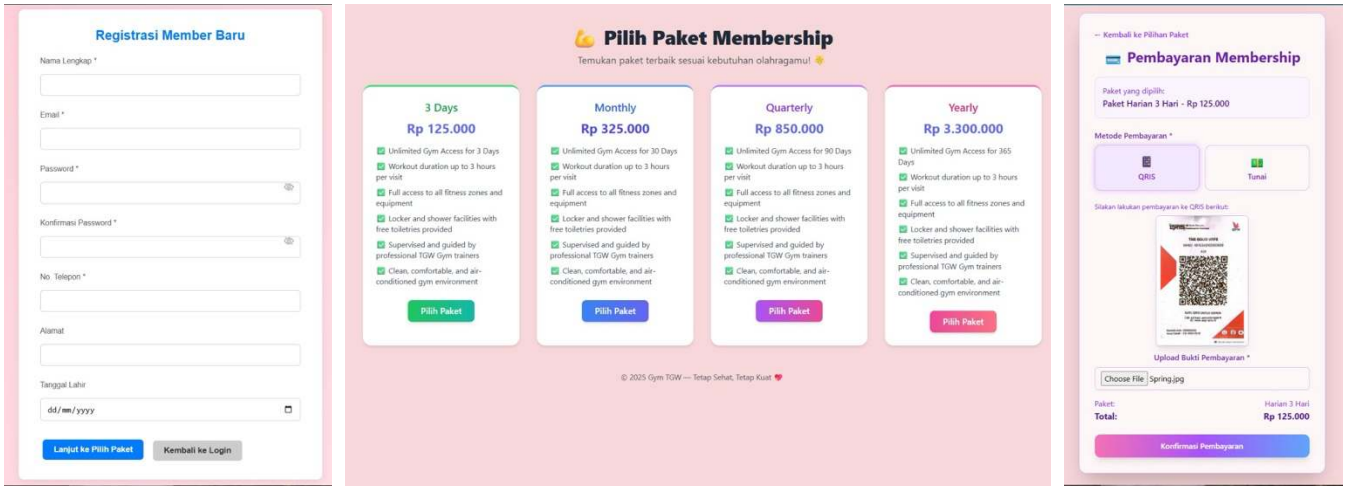

Figure 8. Membership registration, package, and payment pages

The registration and payment page (Figure 8) allows new members to enter personal data including name, email, phone, address, and password, which the system persists to the member account record. Membership package options of 3-Day, Monthly, Quarterly, and Yearly are displayed with duration and cost. After plan selection, users proceed to the payment page offering QRIS or onsite cash payment, with payment proof upload required prior to admin verification.

Table 1. Dashboard interface and usability evaluation

Aspect	Before System (Manual)	After System (Dashboard)	Result/Impact
Interface Design	Not structured	Structured and centralized	Improved organization
Data Management	Manual recording	Integrated system	Higher accuracy
Verification Process	Manual checking	Direct validation via system	More efficient
Processing Time	±10–15 minutes	±2–5 minutes	Significantly faster
Error Rate	15–20%	3–5%	Significantly reduced
Usability Score (SUS)	–	78 (Good)	Acceptable usability
Task Effectiveness	Lower	92% success rate	Highly effective
System Feedback	Not available	Limited	Needs improvement

Table 1 summarizes the operational and usability outcomes. The dashboard significantly improves system performance over the manual baseline. Error rates fell from 15-20 percent to 3-5 percent, processing time fell from 10-15 minutes to 2-5 minutes per transaction, and the task success rate reached 92 percent. The SUS score of 78 places the system in the Good and Acceptable category. The remaining limitation is the absence of real-time post-verification feedback, which surfaced consistently in the SUS open-ended responses and constitutes the primary near-term improvement target.

3.3 System Testing

System testing verified that all TGW membership application features function according to specification without producing errors during use by members or administrators. The primary method was black-box testing, which evaluates system functionality without regard to internal code structure [22], [23], [24], [25]. Eight test scenarios were distributed across the package selection page (two scenarios, Table 2), the payment page (three scenarios, Table 3), and the member extension page (three scenarios, Table 4).

Table 2. Black box results: package selection page

No.	Functions Tested	Test Method	Expected Results	Results	Status
1	Choosing a plan	Choose a package (3-day, monthly, etc.)	Successfully proceeds to payment	As expected	Valid
2	Not choosing a plan	Click Continue without selecting a plan	Message appears "Package must be selected"	As expected	Valid

Table 3. Black box results: payment page

No.	Functions Tested	Test Method	Expected Results	Results	Status
1	Access the payment page	After selecting a plan	Payment method page appears	As expected	Valid
2	QRIS method without upload	Select QRIS, click Continue	Message appears requesting evidence upload	As expected	Valid
3	Full payment	Select method, upload evidence	Successful registration, pending status awaiting admin	As expected	Valid

Table 4. Black box results: member extension page

No.	Functions Tested	Test Method	Expected Results	Results	Status
1	Extended login	Login when membership expired	Redirects to package selection	As expected	Valid
2	Choose a renewal plan	Select renewal plan	Proceeds to payment	As expected	Valid
3	Extended payment	Upload evidence and submit	Renewal pending, awaiting admin verification	As expected	Valid

All eight black-box scenarios returned outputs matching the expected results and were declared Valid. The package selection module correctly processed plan selection (Scenario 1, Table 2) and rejected continuation when no plan was selected (Scenario 2, Table 2). The payment module correctly displayed the payment method page after plan selection (Scenario 1, Table 3), enforced the upload requirement when the QRIS method was selected without proof (Scenario 2, Table 3), and processed full payment with evidence upload into a pending status awaiting admin verification (Scenario 3, Table 3). The membership renewal module correctly redirected expired members to the renewal queue (Scenario 1, Table 4), advanced renewal plan selection to payment (Scenario 2, Table 4), and registered uploaded renewal evidence into the pending verification state (Scenario 3, Table 4).

Table 5. Pre and post implementation operational performance comparison

Aspect	Before System (Manual)	After System (Web-Based)	Improvement Indicator
Membership Registration	Manual recording, prone to input errors	Automated input with validation	Error rate reduced
Payment Processing	Manual chat or receipt confirmation	QRIS upload with admin verification	Faster verification
Data Accuracy	High duplication and inconsistency	Structured MySQL 8 database	Increased consistency
Transaction Recording	Written or spreadsheet	Automatic system storage	Reduced data loss
Processing Time	±10–15 minutes per transaction	±2–5 minutes per transaction	Time efficiency
Transparency	Limited tracking and reporting	Real-time transaction tracking	Increased transparency
Error Rate	±15–20% (manual input errors)	±3–5% (system validation)	Error reduction

Table 5 reports the pre and post implementation operational comparison observed across 15 transaction cycles. Error rate fell from approximately 15-20 percent to 3-5 percent, while transaction processing time fell from 10-15 minutes to 2-5 minutes per transaction. Data accuracy improved through use of a structured MySQL 8 database that eliminates duplicate records and inconsistencies. Automated recording with QRIS-based verification improved efficiency and reduced data loss risk, while real-time tracking strengthened transparency in membership and payment management.

3.4 Discussion

The empirical results enable a direct comparison with the three gaps identified in the introduction and indicate where the present system advances prior gym IS literature. The system reported here closes this gap by binding membership lifecycle management to a structured QRIS verification dashboard within one architecture, an integration not documented in the cited gym IS studies. The choice of Agile-Scrum proved consequential for this integration. Two of the five sprints required mid-cycle backlog revisions following stakeholder review, specifically the addition of an expiry-aware renewal queue in Sprint 4 and the relocation of payment proof verification from a separate page to the admin dashboard in Sprint 3. The observed 92 percent task success rate and SUS score of 78 are consistent with values reported for Scrum-developed service IS in comparable Indonesian contexts.

Performance gains are substantial yet bounded by the measurement design. The reduction in error rate from 15-20 percent to 3-5 percent and processing time from 10-15 minutes to 2-5 minutes per transaction reflects pre and post implementation observation across 15 transaction cycles, which is sufficient to detect operational shifts of this magnitude but not powered to estimate effects within sub-populations such as new versus renewing members. The SUS sample of 20 respondents, comprising 15 active members and 5 administrative staff, falls within the recommended range for usability assessment, although a larger sample would tighten the confidence interval around the score of 78. The QRIS workflow specifically benefits both populations differently: members report reduced wait time at the front desk through asynchronous proof upload, while staff report reduced dispute incidence through the auditable transaction trail in the admin dashboard.

Three limitations qualify these findings. First, QRIS verification remains semi-automated and depends on admin review, which scales linearly with transaction volume. A direct payment gateway integration would remove this dependency but requires merchant certification beyond the scope of a single gym deployment. Second, the system was validated at a single site, and the operational gains observed may partially reflect TGW-specific process characteristics that may not generalize uniformly to gyms with different staffing structures or member profiles. Third, real-time feedback after verification, identified by both SUS open-ended responses and the dashboard review, remains absent and constitutes the primary near-term improvement target. These limitations indicate clear next steps without weakening the central claim that integrating membership lifecycle, renewal tracking, and structured QRIS verification within a single Agile-Scrum-developed architecture is feasible and yields measurable operational improvement at small fitness facilities.

4. CONCLUSION

This study developed and evaluated a web-based gym membership information system at TGW Gym, integrating member registration, package selection, semi-automated QRIS payment verification, administrator approval, and expiry-aware renewal within a single architecture built through five two-week Agile-Scrum sprints using PHP Laravel 11 and MySQL 8. Black-box testing across eight scenarios spanning the package selection, payment, and renewal pages confirmed that all functional requirements were satisfied. Pre- and post-

implementation observations over 15 transaction cycles recorded an error rate reduction from 15-20 percent to 3-5 percent, a verification time reduction from 10-15 minutes to 2-5 minutes per transaction, and a task success rate of 92 percent. The System Usability Scale assessment with 20 respondents, consisting of 15 active members and 5 administrative staff, produced a score of 78 (Grade B, Good), confirming acceptable usability. The contribution lies in combining admin-mediated payment verification, an expiry-aware renewal workflow, and a structured QRIS flow within a single Agile-Scrum-developed system, a configuration not documented in prior gym management literature. Future work should integrate a certified payment gateway to remove the admin verification bottleneck, implement real-time post-verification feedback identified as the principal usability gap, and replicate the design at multiple sites to test generalisability beyond a single fitness facility.

CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest regarding the publication of this paper.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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