



Fixed Assets Management System (FAMS) with Rule-Based Predictive Forecasting for Asset Lifecycle Management

Article History:

Initial submission:	07 September 2026
First decision:	10 September 2026
Revision received:	12 October 2026
Accepted for publication:	18 October 2026
Online release:	23 October 2026

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Abstract

Effective management of fixed assets is important for organizations that depend on physical resources to sustain daily operations, comply with regulatory requirements, and maintain financial accountability. This study examined the current fixed asset management practices of an organization and proposed a Fixed Assets Management System (FAMS) that integrates Rule-Based Criteria Matching (RBCM) and rule-based predictive forecasting using asset lifecycle information. The study focused on identifying difficulties in the existing asset management process, determining the features considered necessary for the proposed system, and assessing its potential user acceptance through the Technology Acceptance Model (TAM). This study employed a sequential explanatory mixed-methods design within a descriptive-developmental framework, involving thirty (30) purposively selected respondents consisting of strategic decision-makers, operational users, and technical evaluators. Quantitative data were collected through a structured questionnaire and summarized using frequency counts, percentages, and weighted means, while semi-structured interviews and open-ended responses provided explanatory qualitative insights. Results indicated that respondents considered the existing manual asset management process to have substantial operational difficulties, particularly in maintaining inventory accuracy, monitoring compliance, and planning for asset replacement. The proposed system features were likewise regarded as highly important. Among the most highly evaluated functions were predictive replacement forecasting, warranty monitoring, automated compliance monitoring, diagnostic reporting, and asset lifecycle tracking. In terms of user acceptance, the proposed system obtained high ratings across the TAM constructs, suggesting that respondents believed it could enhance productivity, simplify asset-related procedures, and contribute to organizational decision-making. The study concludes that incorporating rule-based predictive forecasting into fixed asset management may provide a practical approach to strengthening operational processes, compliance monitoring, and asset lifecycle planning in the participating agency and in comparable private security settings. As an exploratory study of a single organization with a purposive sample, its findings are context-specific and should be validated in larger and more diverse settings. The proposed FAMS may further assist the organization in using asset-related information to make timely decisions and adopt a more proactive approach to asset management.

Keywords: fixed asset management system, rule-based criteria matching, rule-based predictive forecasting, decision support system, asset lifecycle management, Technology Acceptance Model, private security agency



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INTRODUCTION

Effective asset tracking and inventory management are important to organizational accountability, operational continuity, and financial planning. Fixed assets provide continuing operational value and therefore require systematic management from acquisition through utilization, maintenance, renewal, and disposal. Many medium-sized

enterprises in the Philippines continue to use paper-based records, logbooks, and spreadsheets, creating risks of human error, delayed reporting, weak traceability, and high administrative workload. The need for timely asset information is particularly important in private security agencies, where assets such as firearms, communication equipment, patrol vehicles, and information technology equipment support daily service delivery.

The evolution of asset management has moved from basic physical counting toward integrated lifecycle management. This progression includes the development of computerized inventory systems, enterprise systems, asset lifecycle management, and analytics. ISO 55000 provides an important conceptual foundation because it treats asset management as a coordinated activity intended to realize value from assets throughout their lifecycle (International Organization for Standardization [ISO], 2024). In parallel, developments in business intelligence and analytics have enabled organizations to move from retrospective reporting toward analysis of future needs (Delen & Ram, 2018; Sharda et al., 2020).

The problem addressed by the study is not simply the absence of a computerized inventory database. Conventional systems may answer what assets an organization has and where they are located, but may provide limited support for explaining recurring failures, identifying compliance gaps, or anticipating replacement and warranty events. The proposed FAMS therefore uses Rule-Based Criteria Matching (RBCM) as the central analytical mechanism. RBCM applies predefined IF-THEN rules to asset attributes such as age, condition, maintenance history, warranty status, and compliance status. Within the proposed architecture, the rule engine supports descriptive reporting, diagnostic analysis, and predictive alerts while maintaining traceability of the rules used to generate system actions. Rule-based expert systems have long been applied where decisions must be consistent with codified knowledge and explainable to users (Liao, 2005).

The study is also informed by Asset Lifecycle Management Theory, Decision Support System (DSS) Theory, Expert Systems principles, and the Technology Acceptance Model (TAM). Asset Lifecycle Management Theory provides the lifecycle perspective; DSS Theory supports the use of timely data, models, and interfaces for organizational decisions; Expert Systems principles provide the foundation for

transparent IF-THEN rule processing; and TAM provides constructs for assessing user acceptance through Perceived Usefulness, Perceived Ease of Use, Attitude Toward Using, and Behavioral Intention to Use (Davis, 1989; Venkatesh & Davis, 2000).

While existing asset management systems emphasize inventory recording and tracking, limited studies have integrated compliance monitoring, lifecycle-based predictive forecasting, and transparent rule-based decision support within a single framework tailored to regulated organizations such as Philippine private security agencies. Predictive maintenance research has advanced considerably, but much of it relies on sensor data and machine-learning models that require large historical datasets and specialized technical capability, which medium-sized organizations often lack (Lee et al., 2014; Zonta et al., 2020). Conventional inventory systems, on the other hand, record what assets exist but offer little support for anticipating replacement, warranty, and regulatory events. FAMS differs from these approaches in three respects: (a) it applies explicit, auditable IF-THEN rules rather than opaque statistical models, so that each alert can be traced to a specific policy; (b) it combines financial, operational, and compliance attributes, including firearm licensing obligations under Republic Act No. 10591 (Republic of the Philippines, 2013), in a single lifecycle record; and (c) it was evaluated for user acceptance before full deployment. The study therefore addresses the need for a system that operationalizes asset-management concepts, bridges finance and operations with compliance requirements, and responds to the particular lifecycle requirements of regulated security assets.

Research Objectives. Effective fixed asset management is essential for maintaining operational efficiency, ensuring regulatory compliance, and supporting informed decision-making throughout the asset lifecycle. Despite the importance of these functions, organizations often encounter challenges related to inventory monitoring, compliance

tracking, and asset replacement planning. In response, this study proposes a Fixed Assets Management System (FAMS) with rule-based predictive forecasting and seeks to evaluate its relevance and potential effectiveness. Specifically, the study aims to:

1. Assess the challenges encountered by respondents in the current management of fixed assets in terms of data latency, operational costs and inefficiencies, compliance management, and asset refresh, replacement, and disposal.
2. Identify the desired features and capabilities of a Rule-Based Asset Management System, particularly compliance automation, diagnostic analytics, predictive forecasting, usability and integration, and adaptability.
3. Determine the level of user acceptance of the proposed system using the Technology Acceptance Model in terms of Perceived Usefulness, Perceived Ease of Use, Attitude Toward Using, and Behavioral Intention to Use.

Conceptual Framework. Figure 1 presents the conceptual framework of the study. Asset data, such as acquisition cost, age, warranty status, and maintenance history, together with organizational policies and compliance rules, serve as inputs. These inputs are processed by the RBCM engine, which matches asset records against a repository of IF-THEN rules grounded in Expert Systems principles (Liao, 2005). The resulting descriptive and diagnostic analytics and rule-based predictive forecasts, informed by Decision Support System Theory (Sharda et al., 2020), generate asset management decisions such as replacement and tech-refresh alerts, compliance deadline notifications, and maintenance and budget planning across the asset lifecycle (ISO, 2024). The final stage evaluates user acceptance of the system through the TAM constructs of Perceived Usefulness, Perceived Ease of Use, Attitude Toward Using, and Behavioral Intention to Use (Davis, 1989). A feedback loop allows decision outcomes and user feedback to refine

rule parameters and policies, consistent with the iterative development approach adopted in the study.

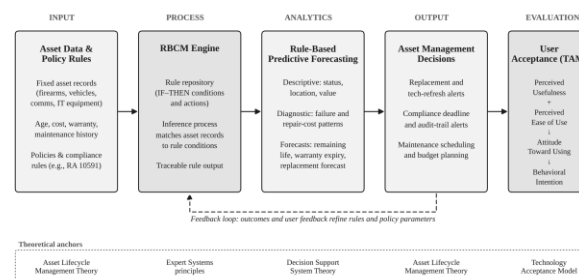


Figure 1

Conceptual Framework of the Study

Note. RBCM = Rule-Based Criteria Matching; TAM = Technology Acceptance Model. Dashed line indicates the feedback loop through which outcomes and user feedback refine rules and policies.

METHODS

Research Design. This study employed a sequential explanatory mixed-methods design (Creswell & Creswell, 2018), in which quantitative data were collected and analyzed first, and qualitative data were then collected and analyzed to explain and elaborate on the quantitative results. The overarching development paradigm was descriptive-developmental. The descriptive component examined the existing asset-management practices of a private security agency in the Philippines and identified operational problems and requirements. The developmental component focused on designing and proposing the Rule-Based Asset Management System as an intervention based on the identified needs. The system-development process adopted Agile Scrum (Schwaber & Sutherland, 2020) so that requirements and rule parameters could be refined through iterative stakeholder feedback.

Research Setting and Participants. The study was conducted at a private security agency in the Philippines. Thirty (30) respondents were selected through purposive sampling because they had knowledge or experience relevant to asset management and the proposed system. The respondents were grouped into strategic decision-makers (n=6, 20%), operational users

(n=14, 47%), and technical evaluators (n=10, 33%). This composition was intended to obtain perspectives covering strategic management, day-to-day asset accountability, and technical quality (see Table 1). Because the respondents were purposively selected from a single organization, this study is exploratory and context-specific. Its findings reflect the experiences, perceptions, and conditions of the participating respondents and organization, and they are presented as preliminary evidence about the phenomenon within that organizational setting rather than as conclusions that apply to other organizations, sectors, or populations.

Sampling Justification. Purposive sampling was used because the study required respondents with direct knowledge of the agency's asset-management processes who could evaluate the proposed system after a hands-on trial. This non-probability approach is appropriate when the target population is small and specialized and the aim is informed evaluation rather than statistical generalization (Etikan et al., 2016). Stratifying respondents into three groups ensured that strategic, operational, and technical perspectives were all represented. However, the purposive selection of 30 respondents limits statistical generalizability, and the results may not represent other organizations, sectors, or populations.

Inclusion and Exclusion Criteria. Respondents were included if they (a) were employees of the participating agency or external IT consultants engaged by it; (b) had a direct role in the acquisition, custody, use, maintenance, financial accounting, or technical evaluation of agency assets or asset-related systems; (c) attended the system demonstration and hands-on trial; and (d) gave informed consent. Personnel without asset-related responsibilities, those who did not complete the demonstration and trial, and those who declined consent were excluded.

Response rate. All 30 identified respondents completed the structured questionnaire, yielding a response rate of 100%. A subset of 10

respondents drawn from the three groups subsequently participated in the semi-structured interviews.

Table 1
Distribution of Respondents by Participant Group

Participant group	n	Percentage
Strategic decision-makers	6	20%
Operational users	14	47%
Technical evaluators	10	33%
Total	30	100%

Note. N = 30.

Research Instruments. The primary structured questionnaire contained sections for current challenges, desired system features, and TAM-based user acceptance. Current challenges were rated using a five-point scale from Very Severe to Not a Problem. Desired features were rated from Very Important to Not Important. TAM items used a five-point agreement scale from Strongly Agree to Strongly Disagree. The TAM portion operationalized four constructs: Perceived Usefulness (four items), Perceived Ease of Use (four items), Attitude Toward Using (three items), and Behavioral Intention to Use (three items).

Instrument Validity and Reliability. The questionnaire items were developed from the study's research objectives, aligned with the operational problems identified through document analysis and preliminary interviews, and, for the acceptance section, adapted from the established TAM constructs (Davis, 1989; Venkatesh & Davis, 2000), with an operational definition specified for each item (e.g., job-performance improvement, learnability, conditional intention). However, the research instrument utilized in this study was developed and adapted by the researcher and was not subjected to formal expert validation prior to data collection; no separate pilot test or internal consistency assessment, such as Cronbach's Alpha, was conducted. Consequently, while the instrument was designed based on a review of relevant literature and aligned with the study objectives, its validity was not independently established, and the reliability of the construct scores has not been statistically established (Tavakol & Dennick, 2011). The absence of

validation affects the credibility of the measures, particularly their content validity and construct validity, and the trustworthiness of the data generated. The findings should therefore be interpreted with appropriate caution, as indicative rather than confirmatory. This limitation is discussed further in the Limitations of the Study section.

Additional instruments and sources included a semi-structured interview guide, a System Usability Scale (SUS) questionnaire, and a document-analysis checklist. Existing asset registers, maintenance logs, policy manuals, and compliance-related documents were used to understand current processes and to define the initial RBCM rule set. The questionnaire also included open-ended items, and the responses were used to identify additional system requirements.

Data Collection Procedure. Data gathering proceeded in four phases. First, management permission and respondent consent were obtained, followed by document analysis, interviews, and observation of existing manual asset-management practices. Second, the system architecture and RBCM engine were designed, and a functional prototype was developed. Third, all 30 respondents participated in a system demonstration and hands-on trial before completing the structured evaluation questionnaire and SUS. Fourth, selected participants from the respondent groups participated in semi-structured interviews to provide deeper explanations and suggestions.

System Design and Development. FAMS was designed as a web-based, three-tier application. The Presentation Tier provides the dashboard, asset registry, maintenance log, compliance checker, and related interfaces. The Application Tier contains authentication, routing, the RBCM Engine, the Rule Repository, and the Inference Engine. The Data Tier uses a relational database to store asset, user, maintenance, and related records. The architecture also provides API endpoints for integration.

The RBCM engine was implemented as a modular component within a Laravel-based application. Rules are stored in a dedicated repository and expressed as conditions and actions. When evaluated, the inference process queries asset records, identifies matching conditions, and performs defined actions such as updating asset status, generating alerts, or creating forecast records. The design emphasizes transparency and auditability because each automated result can be traced to a predefined rule. The system-development stack identified in the source includes Laravel, MySQL, HTML5, CSS3, JavaScript, Bootstrap, and a LAMP or LEMP server environment.

Asset Lifecycle and Forecasting Parameters.

The proposed system organizes fixed assets into three broad categories: high-risk regulatory assets; operational and mobile assets; and support and IT assets. Asset lifecycle management is divided into acquisition and commissioning, operational deployment, performance monitoring and maintenance, lifecycle forecasting and planning, and decommissioning and disposal. The RBCM engine applies category-specific rules to compliance, maintenance, replacement, and disposal.

The rule-based predictive forecasting function uses asset age, purchase date, depreciation value, useful life, maintenance frequency, repair cost, number of repairs, last maintenance date, downtime incidents, and maintenance cost. Outputs include remaining useful life, recommended replacement date, replacement priority, failure-risk level, and next maintenance schedule. The system provides configurable lifecycle reference values such as five years for desktops, four years for laptops, and five years for monitors. Firearm lifecycle values are explicitly described as forecasting parameters rather than definitive industry benchmarks, recognizing that asset longevity can vary with usage, environment, maintenance, and inspection outcomes. These forecasts are generated by deterministic rules that compare asset age, useful-life thresholds, and maintenance records against configured

criteria; no statistical or machine-learning model is trained. Accordingly, this paper uses the term rule-based predictive forecasting, rather than predictive analytics, to describe this function.

Diagnostic Features. Diagnostic functionality was incorporated to identify patterns associated with asset deterioration and recurring failures. The specified features include asset-health assessment, fault diagnosis, maintenance analysis, condition indicators, repair-trend monitoring, and diagnostic recommendations. These functions use maintenance history, repair frequency, asset age, and reported issues to support decisions concerning preventive maintenance, repair, technology refresh, or replacement.

Statistical and Qualitative Analysis. Frequency counts and percentage distributions were used to summarize respondent characteristics. Weighted means were used to analyze the Likert-scale responses for current challenges, desired features, and TAM constructs. The quantitative analysis reported in this paper is limited to these descriptive statistics, with verbal interpretations of the weighted means; inferential tests were not applied. Qualitative data from the interviews and open-ended items were analyzed thematically: responses were coded, and the codes were grouped into recurring themes that explain and elaborate on the quantitative results. Qualitative feedback was synthesized into recurring system requirements.

Ethical Considerations. Formal approval to conduct the study was obtained from the management of the participating agency. Before data collection, each respondent received an informed consent form and an electronic Data Privacy Consent statement explaining the purpose of the research, the voluntary nature of participation, the right to skip items or to withdraw at any time without penalty, and the use of the data solely for academic purposes. Only respondents who indicated their agreement proceeded to the questionnaire, and providing a name was optional.

Data Privacy, Confidentiality, and Information Security. The study complied with Republic Act No. 10173, the Data Privacy Act of 2012 (Republic of the Philippines, 2012). Survey responses were anonymized before analysis, and no personally identifiable information is disclosed in this paper. Data files were stored on password-protected devices and used solely for this academic research. The identity of the participating organization is withheld, and organizational documents examined during document analysis, such as asset registers, maintenance logs, and compliance manuals, were used only to define system requirements and rule parameters and are not reproduced.

RESULTS AND DISCUSSION

Current Challenges in Fixed Asset Management. The overall grand mean for current asset-management challenges was 3.69, interpreted as Severe (Table 2). The results indicate that the principal difficulties were associated with data integrity, administrative workload, and lifecycle decision-making.

Table 2
Current Challenges in Fixed Asset Management

Challenge area	Mean	Interpretation	Key result
Data management	4.03	Severe	Physical inventory and recorded data discrepancies
Cost and efficiency	3.73	Severe	Manual tracking consumes excessive staff time
Compliance management	3.30	Moderate	Audit documentation was the highest-rated issue
Lifecycle management	3.70	Severe	Lack of clear refresh/replacement criteria
Overall	3.69	Severe	Substantial challenges with the manual system

Note. N = 30. Items were rated on a 5-point scale from 1 (Not a Problem) to 5 (Very Severe).

Data management produced the highest category mean. Discrepancies between physical inventory counts and recorded data received a weighted mean of 4.03, followed by errors or missing information in asset records at 4.00 and delays in obtaining updated reports at 3.97. These results describe a direct gap between the physical state of assets and the organization's recorded information. Such a gap affects the reliability of reports and the availability of information needed for asset-related decisions. This finding is consistent with DeHoratius and Raman (2008), who found that

inventory records were inaccurate for a majority of the items they examined and showed that such inaccuracy undermines decisions that depend on recorded data. It also reflects a broader observation in information systems research that the value of decision support depends on the quality of the underlying data (Laudon & Laudon, 2020).

Cost and efficiency challenges had a category mean of 3.73. Manual tracking consuming excessive staff time received 3.73 and was interpreted as Severe. By comparison, maintenance costs attributed to inefficient scheduling received 3.13 and unexpected downtime received 2.90, both interpreted as Moderate. The pattern indicates that respondents experienced the administrative burden of manual tracking more consistently than the other cost-related problems measured in this section. The relatively low downtime rating may reflect the fact that downtime is rarely recorded in manual systems; predictive maintenance literature notes that the cost of reactive maintenance often remains hidden until failures are systematically tracked (Zonta et al., 2020).

Compliance management challenges were rated Moderate overall. Maintaining proper documentation for compliance audits received 3.30, tracking and renewing regulatory licenses received 3.03, and proving chain of custody for regulated assets such as firearms received 2.93. Although these ratings were lower than the data-management ratings, the study treats compliance tracking as an important system requirement because regulated assets require documented accountability. For firearms, which must be licensed and documented under Republic Act No. 10591 (Republic of the Philippines, 2013), even moderate documentation gaps carry legal and operational risk. This explains why respondents rated compliance automation as Very Important despite rating current compliance problems as only Moderate.

Lifecycle management produced a mean of 3.70. The lack of clear criteria for deciding when to

refresh or replace assets was rated 3.70 and interpreted as Severe. Inconsistent disposal processes and missed warranty expirations both received 3.27. This result connects directly with the proposed predictive functions because lifecycle rules can provide explicit criteria for identifying assets approaching end-of-life or warranty expiration. This is consistent with ISO 55000, which frames asset management as the realization of value across the entire asset lifecycle and requires decision criteria for renewal and disposal (ISO, 2024). Without such criteria, replacement decisions remain reactive.

Desired Features of the Proposed System. The overall grand mean for desired system features was 4.06, interpreted as Very Important (Table 3). Predictive forecasting and compliance automation received the highest category means, while adaptability, usability and integration, and diagnostic analytics were also rated Very Important.

Predictive forecasting had a category mean of 4.14. Warranty expiration forecasting was rated 4.20, end-of-life alerts were rated 4.13, and budget forecasting for replacement planning was rated 4.10. These results show that respondents placed substantial importance on information that anticipates future asset events rather than relying exclusively on retrospective records. This emphasis mirrors the broader shift in organizational decision support from descriptive toward predictive approaches (Delen & Ram, 2018; Sharda et al., 2020).

Table 3
Desired Features of the Proposed System

Feature category	Mean	Interpretation	Selected result
Predictive forecasting	4.14	Very Important	Warranty expiration forecast = 4.20
Compliance automation	4.10	Very Important	Compliance deadline alerts = 4.13
Adaptability and future-proofing	4.09	Very Important	Flexible reports and modularity = 4.10
Usability and integration	3.99	Very Important	Customizable dashboards = 4.07
Diagnostic analytics	3.96	Very Important	Failure-pattern identification = 4.03
Overall	4.06	Very Important	Strong endorsement of proposed features

Note. N = 30. Items were rated on a 5-point scale from 1 (Not Important) to 5 (Very Important).

Compliance automation obtained a category mean of 4.10. Automatic alerts for regulatory deadlines received 4.13, automated audit trails

received 4.10, and built-in compliance checklists received 4.07. These requirements correspond to the study's objective of embedding organizational policies and compliance rules within the RBCM engine.

Diagnostic analytics received a category mean of 3.96. Failure-pattern identification received 4.03, maintenance-cost pattern analysis received 3.97, and vendor performance and reliability reporting received 3.87. The results support diagnostic functions that explain recurring problems and provide evidence for maintenance and replacement decisions.

Usability and integration features received a category mean of 3.99. Customizable dashboards were rated 4.07, while intuitive interface design and integration with existing financial or operational systems were each rated 4.00. Mobile accessibility for field personnel was rated 3.87 and remained within the Very Important interpretation.

Adaptability and future-proofing received a category mean of 4.09. The ability to generate flexible reports and the use of modular design for future additions each received 4.10. The ability to add new asset categories and modify business rules as policies change each received 4.07. These findings are consistent with the use of configurable RBCM rules and an architecture intended to evolve with organizational requirements

Table 4
User Acceptance of the Proposed System Based on TAM Constructs

TAM construct	Mean	Interpretation
Perceived Usefulness	4.13	Strongly Agree
Perceived Ease of Use	3.96	Agree
Attitude Toward Using	4.08	Strongly Agree
Behavioral Intention to Use	4.18	Strongly Agree
Overall TAM	4.09	Strongly Agree

Note. N = 30. Items were rated on a 5-point scale from 1 (Strongly Disagree) to 5 (Strongly Agree). TAM = Technology Acceptance Model.

User Acceptance Based on TAM. The overall TAM grand mean was 4.09, interpreted as Strongly Agree (Table 4). All four constructs received positive results. Behavioral Intention to Use had the highest construct mean at 4.18,

followed by Perceived Usefulness at 4.13, Attitude Toward Using at 4.08, and Perceived Ease of Use at 3.96.

Perceived Usefulness received a mean of 4.13. Productivity improvement was the highest-rated item at 4.17, followed by job-performance improvement at 4.13 and effectiveness and work usefulness at 4.10 each. The responses indicate that participants associated the proposed system with practical improvements to asset-management work. This result is consistent with the TAM literature, in which perceived usefulness is repeatedly found to be the strongest and most consistent determinant of the intention to use a system (Davis, 1989; King & He, 2006). Healthcare information systems research reports the same pattern: in regulated, high-accountability settings, adoption depends heavily on whether a system is perceived to improve work performance (Holden & Karsh, 2010).

Perceived Ease of Use received 3.96 and was interpreted as Agree. Learning to operate the system received 4.00, flexibility 3.97, and both ease of achieving desired outcomes and clarity of interaction 3.93. Compared with the other TAM constructs, this dimension was slightly lower, suggesting that interface clarity, flexibility, training, and user support remain relevant design considerations. In TAM, ease of use influences intention largely indirectly, through its effect on perceived usefulness and attitude (Davis, 1989; Venkatesh & Davis, 2000). The slightly lower Perceived Ease of Use score therefore signals a priority for interface design and training rather than a barrier to adoption, particularly because respondents evaluated after a short trial than after sustained use.

Attitude Toward Using received 4.08. The statement that using the system is a good idea received 4.17, while favorable attitude toward using it received 4.10 and the statement that the system would make asset management more interesting received 3.97. These results indicate positive attitudes toward the proposed system, with practical value appearing more strongly expressed than experiential appeal.

Behavioral Intention to Use received the highest construct mean, 4.18. The conditional intention to use the system received 4.23, regular usage intention 4.13, and recommendation intention 4.17. The results show strong stated willingness to use the proposed system if access is provided and to incorporate it into routine work. The high Behavioral Intention to Use score suggests favorable adoption potential, consistent with TAM theory, which posits that perceived usefulness and perceived ease of use significantly influence attitude and, in turn, the intention to use a system (Davis, 1989). Because behavioral intention is the most proximal predictor of actual use in TAM (Venkatesh & Davis, 2000), this result supports the feasibility of implementation. However, intention measured before deployment does not guarantee sustained use, and post-implementation evaluation is needed to confirm actual adoption.

Qualitative Feedback and Integration of Findings. The open-ended responses complemented the quantitative results by identifying operational requirements for implementation. Frequently requested features included mobile access for field personnel, barcode or QR-code scanning, offline data entry with automatic synchronization, technical support and regular updates, real-time synchronization, and support for multiple branches or remote locations. Other suggestions included SMS or email alerts, accounting-system integration, role-based access control, multiple report formats, asset photo documentation, maintenance reminders, cloud deployment, training materials, and a multilingual interface.

The relationship between the qualitative and quantitative findings is direct. The most severe quantitative issue was the discrepancy between physical counts and recorded data (4.03), while QR/barcode scanning was repeatedly requested as a means of reducing manual data entry and improving tracking. Mobile accessibility was rated 3.87 and was also frequently requested in comments, particularly because assets may be deployed across

multiple locations. Offline synchronization was additionally identified as useful for situations where field connectivity is unreliable.

Taken together, the results support the proposed FAMS architecture as a response to the identified requirements. The data indicate a need for centralized and accurate asset records, rule-driven compliance monitoring, lifecycle-based alerts, diagnostic analytics, and predictive forecasting. At the same time, user acceptance results show that implementation should address ease of use through interface design, training, technical support, and operational integration.

Practical Implications, Scalability, and Sustainability. For the participating agency and comparable organizations, the findings indicate that the greatest value of FAMS lies in establishing a single, accurate asset record and in converting lifecycle and compliance rules into automatic alerts. Because the logic is explicit, administrators can audit why an asset was flagged for replacement or a license for renewal, which matters where regulators require documented accountability. These implications may extend to other regulated, asset-intensive settings. Healthcare organizations, for example, manage medical equipment subject to maintenance, calibration, and regulatory requirements, and healthcare information systems research shows that acceptance in such settings depends on perceived usefulness and fit with existing workflows (Holden & Karsh, 2010). The rule-based approach could be adapted to such contexts by replacing the rule repository with sector-specific policies, although this transferability was not tested in the present study.

From a digital transformation perspective, FAMS represents a process-level transformation: it digitizes manual records and embeds organizational policy in software. Vial (2019) observes that such transformation changes how organizations create value but requires complementary changes in structure, skills, and culture. Implementation should

therefore be accompanied by the cleansing of existing records, the designation of a system administrator responsible for maintaining business rules, and user training.

In terms of scalability, the three-tier, modular architecture and the separation of the rule repository from the application logic allow new asset categories, branches, and rules to be added without redesigning the system. Respondents' requests for cloud deployment, multi-branch support, and offline synchronization indicate the direction of future scaling. Long-term sustainability depends as much on governance as on technology: rules must be reviewed as policies, regulations, and asset portfolios change, and the system's predictive value will improve as maintenance and failure histories accumulate. A phased implementation, beginning with high-risk regulatory assets such as firearms and extending to operational and IT assets, would limit disruption and allow benefits to be measured at each stage.

Limitations of the Study. This study has several limitations. First, it was conducted in a single private security agency with 30 purposively selected respondents; the purposive selection of respondents limits statistical generalizability, and the results may not represent other organizations, sectors, or populations. The findings should therefore be regarded as exploratory and context-specific, providing preliminary insights rather than broadly applicable conclusions. Second, a key limitation of this study is the absence of formal instrument validation before its administration. The instrument did not undergo expert content validation, pilot testing, or internal consistency testing (e.g., Cronbach's Alpha). Without expert review or statistical validation procedures, the extent to which the instrument accurately measured the intended constructs cannot be fully established, which limits the content and construct validity of the measures. This limitation may influence the precision and generalizability of the findings. Third, the quantitative analysis relied on descriptive statistics, and no inferential tests were applied.

Fourth, user acceptance was measured after a demonstration and a short hands-on trial of a prototype; the results therefore reflect anticipated rather than actual use and may be affected by social desirability bias. Fifth, the forecasting functions are rule-based and depend on configurable reference values, such as useful-life thresholds, rather than on models trained on historical failure data, and their forecast accuracy has not yet been tested against actual outcomes. Finally, the scope was limited to design and prototype evaluation and did not cover full-scale deployment.

Future research should (a) conduct comprehensive validity assessments of the instrument, including expert validation, pilot testing, and reliability analysis, before implementing it in larger populations; (b) involve larger and more diverse samples across multiple settings to validate and extend the present findings, including other security agencies and regulated sectors such as healthcare and logistics; (c) apply inferential and structural analyses of the relationships among the TAM constructs; (d) conduct longitudinal post-implementation evaluations of actual use, data accuracy, compliance outcomes, and forecast accuracy; and (e) examine IoT integration and hybrid approaches that combine transparent rules with data-driven forecasting as asset histories accumulate.

Conclusion. The study found that fixed asset management at the participating private security agency is affected by substantial challenges associated with manual processes. The overall challenge mean of 3.69 was interpreted as Severe, with data-management issues, excessive staff time spent on manual tracking, and insufficient criteria for asset refresh or replacement emerging as prominent concerns.

The proposed Rule-Based Asset Management System addresses these needs through an integrated lifecycle-oriented architecture. The desired-feature grand mean of 4.06 indicates that respondents considered compliance

automation, predictive forecasting, diagnostic analytics, usability and integration, and adaptability Very Important. Predictive forecasting and compliance automation were particularly emphasized, including warranty-expiration forecasts, end-of-life alerts, and automated compliance deadlines.

The TAM findings indicate positive user acceptance. The overall mean of 4.09 was interpreted as Strongly Agree, with Behavioral Intention to Use at 4.18, Perceived Usefulness at 4.13, Attitude Toward Using at 4.08, and Perceived Ease of Use at 3.96. The results provide preliminary evidence that the proposed system is perceived as useful and acceptable by the participating stakeholders. Because the study is based on a single organization and purposively selected respondents, the results should be interpreted within that organizational context. As an exploratory study, these findings should not be read as universal conclusions about fixed asset management systems.

The proposed FAMS therefore provides a structured design for integrating asset records, lifecycle rules, compliance requirements, diagnostic functions, and predictive alerts. Future work should include post-implementation evaluation after six to twelve months, investigation of IoT integration, replication in other security agencies and regulated industries, development of configurable compliance modules, and formal cost-benefit analysis.

The study contributes to asset management literature by providing preliminary evidence of the applicability of rule-based predictive forecasting for improving asset lifecycle planning, compliance management, and decision support within a private security organization. Theoretically, it integrates Asset Lifecycle Management, Decision Support System Theory, Expert Systems principles, and TAM into a single framework that links system design to user acceptance. Practically, it offers a transparent, policy-driven model that organizations with limited historical data and technical resources can adopt and audit without

depending on complex machine-learning models.

Recommendations. Organizations implementing FAMS should establish key performance indicators, including inventory accuracy rates, asset utilization rates, compliance adherence levels, maintenance response times, and forecast accuracy measures, and should record baseline values before deployment. The following recommendations are presented with their expected outcomes:

1. Implement and refine predictive forecasting rules for warranty expiration, end-of-life alerts, replacement planning, and maintenance scheduling. Expected outcome: fewer missed warranty expirations and replacements planned before failure, measured by forecast accuracy (forecast versus actual replacement dates).
2. Implement compliance automation with configurable deadline alerts, audit trails, and compliance checklists. Expected outcome: no lapsed licenses or permits for regulated assets and audit-ready documentation, measured by compliance adherence rate.
3. Integrate barcode or QR-code scanning and mobile functionality to improve field asset tracking. Expected outcome: closer agreement between physical counts and system records, measured by inventory accuracy rate.
4. Provide offline data capture with automatic synchronization for locations with unreliable connectivity. Expected outcome: timely updates from remote posts, measured by the time between a field event and its record update.
5. Maintain a modular architecture that permits new asset categories, configurable business rules, custom reporting, and future technologies. Expected outcome: new

asset categories and rules added without system redesign.

6. Provide user training, documentation, and continuing technical support, particularly to address the comparatively lower Perceived Ease of Use result. Expected outcome: higher ease-of-use ratings and fewer user errors, measured through follow-up usability and TAM surveys.
7. Conduct a post-implementation evaluation after six to twelve months using measurable indicators such as data accuracy, staff time, compliance adherence, maintenance outcomes, and user satisfaction. Results should be compared against the baseline values reported in this study.
8. Replicate the research in other private security agencies and other regulated asset-intensive organizations to examine transferability.
9. Conduct a formal cost-benefit analysis to quantify potential effects on labor, compliance, asset life, and replacement timing. Expected outcome: a documented return on investment to guide wider adoption.

DISCLOSURES

Author contributions. The author was responsible for the conceptualization of the study, methodology, data collection, formal analysis, investigation, interpretation of results, from original draft to final approval of the manuscript.

Conflict of interest. The author declares that there are no conflicts of interest associated with this study. The research received no financial support or funding from any public, private, or commercial organization, and the author has no financial, personal, or professional relationships that could have influenced or been perceived to influence the research or its findings.

Funding source. This research received no external or institutional funding. No financial support, grants, or other funding were received from any government agency, private organization, commercial entity, or other funding body for the conduct of this study.

Artificial intelligence use. AI-assisted language editing and refinement were performed using ChatGPT to improve the clarity, grammar, and overall readability of the manuscript. The author carefully reviewed, revised, and approved all AI-assisted content and remains fully responsible for the accuracy, integrity, and originality of the work. ChatGPT was not used for data analysis, interpretation of findings, or decision-making processes.

Ethics approval statement. Ethical approval was obtained from the Polytechnic University of the Philippines Office of the Vice President for Research, Extension, and Development Research Management – Office University Research Ethics Committee, with reference code: OUSREC 0226-0114.

Data availability statement. Due to ethical restrictions, the data are not publicly available but may be obtained from the corresponding author upon reasonable request.

Acknowledgement. (Not available)

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