

Benefits of Implementing the Internal Control System for Fixed Assets in the Inventory Department of the Health Department of the State of Tabasco

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Resumen

Este artículo presenta los resultados de una encuesta realizada antes y después de la implementación de un sistema de control de activos en la Secretaría de Salud. Los hallazgos revelan una mejora significativa en varios aspectos clave de la gestión de activos. Antes de la implementación, se observaron desafíos en la recepción de bienes, con errores frecuentes y una falta de consistencia en el registro de activos. Sin embargo, después de la implementación del sistema, se experimentó una notable reducción en errores, con un 95% de los encuestados notando esta mejora. Además, el sistema demostró un impacto positivo en la eficiencia, con un 85% de los encuestados reportando una mayor eficiencia en la distribución de bienes y un 75% informando una reducción en los costos operativos. La comunicación con proveedores se volvió más eficiente, y la cantidad de personal involucrado en los procesos de gestión de activos disminuyó significativamente. En conjunto, estos resultados respaldan la idea de que la implementación del sistema ha tenido un impacto positivo en la eficiencia y el control en la gestión de activos en la Secretaría de Salud, lo que representa un avance significativo en comparación con el control manual que se llevaba anterior. Este estudio destaca la importancia de la tecnología en la mejora de la gestión de activos en entornos gubernamentales de atención médica.

Abstract

This article presents the results of a survey conducted before and after implementing an asset control system at the Ministry of Health. The findings reveal a significant improvement in various key aspects of asset management. Before implementation, challenges were observed in goods reception, with frequent errors and a lack of consistency in asset recording. However, after the system's implementation, a notable error reduction was experienced, with 95% of respondents noting this improvement. Additionally, the system demonstrated a positive impact on efficiency, with 85% of respondents reporting increased efficiency in the distribution of goods and 75% indicating a reduction in operating costs. Communication with suppliers became more efficient, and the number of personnel involved in asset management processes decreased significantly. In sum, these results support the notion that the system's implementation has positively impacted efficiency and control in asset management at the Ministry of Health, representing a significant advancement compared to the previous manual approach. This study underscores the importance of technology in enhancing asset management in government healthcare settings.

Palabras Clave: Clave: Gestión de activos, Implementación de sistema, Eficiencia operativa, Control de inventario, Salud pública

Keywords: Asset management, System implementation, Operational efficiency, Inventory control, Public health

1. INTRODUCTION

The healthcare sector faces monumental challenges in efficiently managing its resources, particularly regarding real estate assets that constitute fixed assets. The need to optimize these assets' acquisition, maintenance, and disposal processes is a constant priority to ensure economic sustainability and healthcare quality. This literature review article explores the importance of the real estate management process of fixed assets in the Health Sector's inventory department from a technological perspective.

A fixed asset, whether tangible or intangible, represents a business resource that, by its very nature, cannot be transformed into cash in the short term. Its fundamental purpose is to contribute to institutional functioning

and is not intended for sale; its use aims to generate future benefits. Common examples of fixed assets include machinery, vehicles, computer equipment, real estate, office supplies, bonds, and stock investments. In this context, fixed asset management encompasses a systematic approach to the physical elements of the institution, addressing aspects such as its accounting record, depreciation, tax treatment, and other procedures that provide crucial information for the planning of business policies [1].

Based on the available information, any entity will make crucial decisions related to the efficient allocation of resources, planning for the disposal of fixed assets, including scrapping, recycling, or selling vehicles and machinery, and acquiring new assets, contributing to resource optimization. In this context, decision-making is conceived as a procedure through which one chooses several options to solve a problem. Consequently, asset control emerges as a highly effective tool to ensure that the decision-making process results in significant gains and efficient use of available resources [2][3].

The healthcare sector constantly evolves, driven by technological advancements and demographic changes that demand more effective and accessible care. Fixed asset management and genuine estate ensure healthcare institutions meet changing demands and quality standards. In this regard, technology plays a crucial role by offering tools and systems that significantly enhance the administration of these assets from acquisition to subsequent disposal [4].

Managing fixed assets in the healthcare sector involves the disposal, sale, demolition, or reallocation of properties and is a fundamental element often overlooked in asset management in healthcare institutions. The lack of a robust management strategy can result in the inefficient use of resources and the loss of asset value for healthcare organizations. Furthermore, changing regulations and standards require increased transparency and accuracy in documenting these processes [5].

This article investigates how a fixed asset management system improves administrative processes in the Secretary of Health of the State of Tabasco, stemming from a specific issue. The invoice reception and asset registration department assigns an internal inventory number during the process. Subsequently, the asset reception department requests distribution to the corresponding units, with the added requirement of including the name of the final custodian.

As a result of this problem, the following points are mentioned:

- Lack of registration and tracking of the distribution of assets.
- Uncertainty regarding which assets belong to each unit.
- Absence of a record and control of assets assigned to units and personnel.
- Lack of accurate and timely information.
- Absence of a record to monitor the follow-up of movable assets received by the inventory department.
- Lack of control over assets in poor condition.
- Absence of a monthly validation for precise asset control

2. METHODOLOGY

In the development and research, we utilized the following methodology to obtain answers regarding the importance of fixed asset management systems and to assess how much the current process can be optimized

compared to the process generated by implementing a fixed asset management system. We outline the methodology point by point in a summarized manner.

2.1. Literature Review

The literature review is crucial in research as it situates the study within a theoretical and conceptual context based on previous investigations. It helps identify relevant contributions, defines key concepts and theories, and understands how the study fits into the broader research landscape. Furthermore, it influences the methodology by examining how others have approached the variables of interest, formulating hypotheses, and identifying limitations and conflicting results [5].

We have realized the following steps:

- Conduct a comprehensive review of scientific and technical literature on fixed asset management in the healthcare sector and implementing internal control systems in government organizations.
- Analyze studies and relevant documents on best practices and specific considerations for fixed asset management in the context of a government health entity.

2.2. Research Design

The research design plays a fundamental role in providing a structured framework for planning, collecting, and analyzing data in a study. This methodological approach defines guidelines that direct evidence generation, aligning it with previously established criteria and the specific research questions sought to be addressed. Essentially, the research design serves as a roadmap that consistently and systematically guides the entire investigative process, ensuring that the collected data are relevant, reliable, and suitable for answering the questions posed in the study [6].

The following points summarize the research design:

- A mixed-methods approach, combining qualitative and quantitative elements, will be employed.
- Conduct an observational study to analyze the current fixed asset management processes in the Inventory Department of the Health Department of the State of Tabasco and its impact on efficiency and accuracy. Following implementing the fixed asset management system developed in Yii 2.0, evaluate the impact using surveys with closed-ended questions to gather comparative data.
- Perform a qualitative analysis of accounting records to identify the frequency and nature of issues related to fixed asset management. This qualitative analysis will inform the design of a quantitative survey to verify the impact of implementing the new fixed asset management system.

2.3.-Population and Sample

In research, a population consists of a complete set of elements that share a common attribute. In everyday life, the term 'population' is often used to refer to the total human population of a geographic region, such as a country or state. On the other hand, a sample represents a smaller portion of this population, i.e., a subset of individuals selected to participate in a survey or study [7].

In simple terms, a sample is a smaller group or subset drawn from the overall population to analyze the characteristics or behavior of population data. Various research methods are used to create data samples, including probabilistic and non-probabilistic sampling. The choice of a specific sampling method depends on the nature of the research and the quality of the required information [8].

The population and sample for this study are as follows:

- The target population for this study will consist of the personnel responsible for fixed asset management in the Inventory Department of the Health Department, totaling around 20 employees involved throughout the system process.
- A stratified sample of employees from different areas will be selected for the questionnaire.

The formula used in the sample calculator

There is an entire methodology that validates the calculation of the obtained sample, as indicated by the following formula.

$$\text{Sample Size} = Z^2 * (p) * (1-p) / c^2$$

Where:

- Z = Confidence level (95% o 99%)
- p = .5
- c = Margin of error (.04 = ±4)

For a confidence level of 95% with a 5% margin of error.

2.4. Data collection

In every research process, collecting data is imperative as it constitutes an essential step toward achieving successful results. Proper execution of data collection and the choice of the method require familiarity on the part of any researcher, and acquiring expertise in this aspect is crucial. Data collection is essential as it is the measurement process, a prerequisite for obtaining scientific knowledge. The instruments used for data collection are designed to establish optimal conditions for carrying out such measurements. Data represents concepts that encapsulate an abstraction of the natural world, i.e., what is perceptible by the senses directly or indirectly. In this sense, every empirical aspect is susceptible to measurement, and no aspect of reality cannot be subjected to this possibility of quantification. Ultimately, measurement involves assigning numerical values to these abstractions [9].

Critical aspects of data collection include:

- The primary source of information for this work will be a questionnaire consisting of closed-ended questions. This will be carefully formulated to obtain the maximum relevant information, considering the virtues of closed questionnaires where quantitative data is more accessible for subsequent analysis.

- Semi-structured interviews will be conducted with employees responsible for fixed asset management to gather qualitative information about current processes, challenges faced, and perceptions of the system's efficiency.
- Questionnaires will be administered to a representative sample of employees from the Health Department's inventory department to collect quantitative data on the accuracy of the fixed asset management system and efficiency in management.

2.5. Procedure

1) Implementation of Internal Control System:

- a) Design and implementation of a fixed asset internal control system in the Inventory Department of the Health Department of the State of Tabasco.
- b) Configuration of appropriate roles and permissions for personnel involved in fixed asset management.

2) Interviews:

- a) Individual interviews will be scheduled with selected participants. Informed consent will be obtained, and interviews will follow a predefined guide. Responses will be recorded and transcribed for analysis.

3) Questionnaires:

- a) Electronic questionnaires will be administered, ensuring the confidentiality and anonymity of participants. Responses will be collected and recorded for subsequent analysis.

2.6. Data Analysis

Qualitative and quantitative data analysis represent two distinct approaches, but their interaction can significantly enrich the research. Qualitative research plays a fundamental role by providing perspectives that can serve as a basis for broader quantitative investigations. Qualitative findings can inspire the formulation of hypotheses and the creation of specific surveys or questionnaires for more extensive quantitative research.

On the other hand, qualitative data analysis can play a crucial role in deepening the understanding of results obtained in quantitative research. It allows for identifying nuances, contexts, and underlying aspects that may go unnoticed in purely quantitative analysis. This combination of qualitative and quantitative approaches can provide a more comprehensive and rich insight into the studied phenomena, ultimately enhancing the quality and depth of the research [10].

Analyses conducted in this research:

1) Qualitative Analysis:

- a) Interviews will be analyzed using a thematic analysis approach. Main themes and emerging categories related to efficiency in fixed asset management will be identified.
- b) Qualitative analysis software will organize and code the data.

2) Quantitative Analysis:

- a) Questionnaire data will be analyzed using descriptive statistical techniques.

b) Frequencies and percentages will be calculated to assess efficiency and accuracy in fixed asset management before and after system implementation.

2.7. development of the methodology. Background

2.7.1. Fixed Asset Management in the Healthcare Sector

Managing fixed assets in the healthcare sector is an essential practice that spans the entire lifecycle of physical assets used in healthcare. These assets include real estate, such as hospitals and health centers, and medical equipment, vehicles, furniture, and other physical resources. Efficient management of these assets is crucial to ensure the quality of care, optimize financial and human resources, and ensure the sustainability of healthcare institutions.

Smith (2018) emphasizes that fixed assets and genuine estate are critical elements in the healthcare sector as they provide the necessary infrastructure for healthcare delivery. Proper acquisition and maintenance of these assets are fundamental to ensure that facilities are in optimal condition to provide quality services to patients. Additionally, continuous monitoring of fixed assets, including their performance and lifespan, is essential for long-term planning [11].

To enrich this perspective, García et al. (2019) explored how technology has revolutionized fixed asset management in the healthcare sector. Their article "Technology-Enhanced Asset Management in Healthcare Facilities" highlights how Geographic Information Systems (GIS) and asset tracking tools have enabled real-time monitoring and detailed analysis of real estate and other assets. This technological approach has improved decision-making, strategic planning, and operational efficiency [12].

In addition to technological asset management, the literature addresses the challenges of implementing asset management systems in the healthcare sector. Jenkins and White (2021) examined in their article "Challenges and Solutions in Implementing Healthcare Asset Management Systems" the technological and organizational challenges faced by healthcare institutions when adopting asset management solutions. This source emphasizes overcoming obstacles such as initial investment and staff training [13].

2.7.2. Technological tools

2.7.2.1. Agile Software Development Methodology

The agile approach to software development focuses on continuously delivering functioning software systems through rapid iterations. Although "agile methodology" is commonly used, it is not a rigid set of rules but rather a mindset that prioritizes collaboration, values, and flexible workflows. Agile methodologies aim to provide constant improvements by delivering software increments quickly, favoring regular communication between small, self-organized teams of developers and business representatives. Documentation is kept simple, and changes are welcomed instead of resisted at different stages of development [14].

The agile methodology is based on the Agile Manifesto for Software Development, which establishes four fundamental values:

- People and interactions are more important than processes and tools.
- Functioning software is more important than comprehensive documentation.
- Collaboration with the customer is more important than contract negotiation.

- Responding to change is more important than adhering to a plan.

These values guide the agile approach, promoting concurrency and continuity in the development and testing processes, in contrast to the waterfall approaches emphasizing linear sequencing. In summary, the agile methodology offers a more flexible and collaborative approach to software development. In this project, the Scrum methodology was implemented.

2.7.2.2 Scrum

Scrum is a type of agile framework that provides the necessary structure to address complex and adaptive problems while focusing on maximizing productivity and creativity in product delivery [15]. Scrum is based on an iterative process and is characterized by the following:

- Lightweight in its approach.
- Emphasizing self-organization.
- Easy to understand.
- Encouraging teamwork.

The Scrum life cycle consists of the following elements:

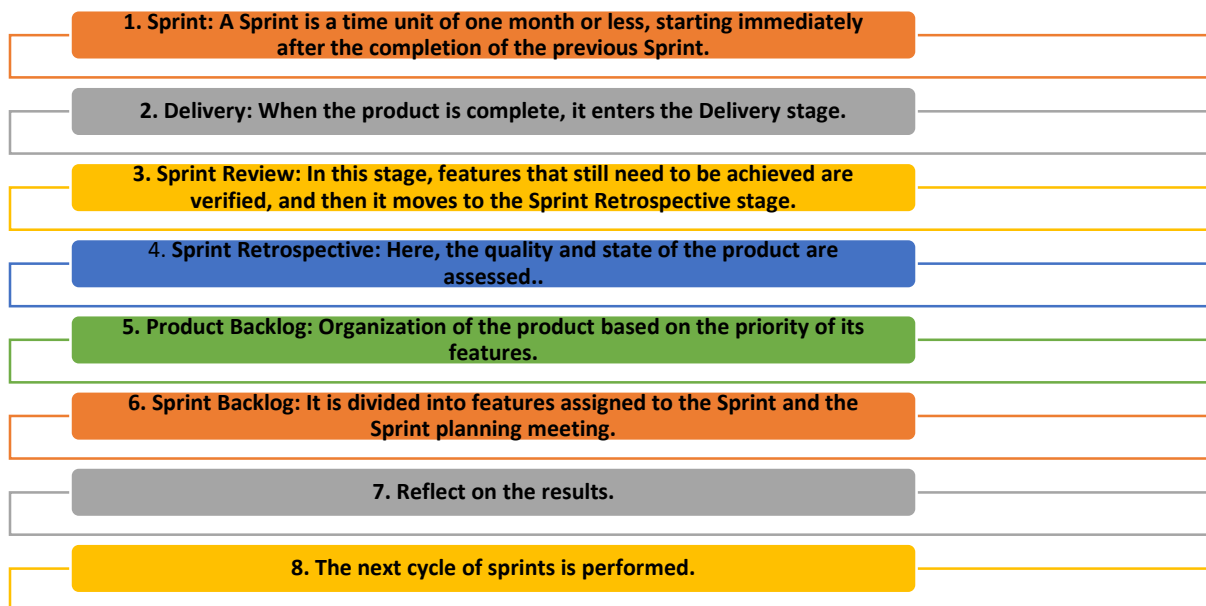


Figure 1. Scrum Lifecycle. Own elaboration

Advantages of Using the Scrum Framework:

- It is fast and cost-efficient.
- Divides a large product into smaller sub-products, following the "divide and conquer" strategy.
- Prioritizes customer satisfaction.
- It is adaptable due to its short sprints.
- Relies on constant feedback, improving product quality in less time.

Disadvantages of Using the Scrum Framework:

- Do not allow changes during a sprint.
- It is not fully described, so additional details, such as Extreme Programming (XP) or Kanban, are needed.
- Planning, structuring, and organizing projects without a clear definition can be challenging.
- Daily meetings and frequent reviews demand significant resources.

2.7.2.3. PHP Programming Language

PHP, which stands for Pre-Processor Hypertext, is a programming language developed to be a programming tool quickly adopted on the Internet due to its ease of learning and the existence of a large developer community [16].

2.7.2.4. Yii2

Yii2 is a PHP-based framework for all types of web applications. The framework is developed using the Model-View-Controller (MVC) design pattern, promoting understandable coding for others who may review the code. Yii2 allows native implementation for developing RESTful web services and enables queries to relational and non-relational databases [17].

2.7.2.5. Database Management System

A Database Management System (DBMS) is a set of programs operating in the background responsible for managing and controlling information contained in a database. These systems, or data managers, act as intermediaries between the database, users, and applications. They handle tasks ranging from allowing business users to store, modify, and access data to running queries and analyses to generate reports [18].

2.7.2.6. MySQL

MySQL, developed by Oracle, is a globally utilized system for database management. Based on relational algebra, this system is primarily employed for data storage in various online services. Examples of well-known Content Management Systems (CMS) that use MySQL include WordPress and TYPO3. As the name suggests, MySQL is a Relational Database Management System (RDBMS) based on SQL. This open-source software is part of Oracle, the same company that created the Java programming language [19].

2.8. Development of the Fixed Asset Control System

2.8.1. Requirements Analysis:

The requirements analysis phase was carried out meticulously and closely with the Health Department's inventory department. During this crucial stage of the software life cycle, a thorough understanding of the organization's needs and operational processes related to asset management was sought. The requirements analysis process is detailed as follows:

- **Interviews with End Users:** Extensive interviews were conducted with end users of the system, including warehouse personnel, supplier administrators, billing personnel, distribution staff, and

recipients. These conversations provided a detailed insight into daily operations, challenges, and improvement opportunities.

- **Detailed Documentation:** The interview results were translated into comprehensive documentation, serving as the basis for system design and development.

This documentation includes:

- **Use Cases:** Specific use cases representing fundamental user interactions and system interactions were identified and documented. This provided a clear understanding of how the software would be used in real-world situations.
- **Process Flow Diagrams:** Detailed process flow diagrams were created to visually represent existing operational processes and how they would be optimized with the introduction of the system.
- **Functional and Non-Functional Requirements:** Functional requirements describing specific functionalities the system must fulfill and non-functional requirements addressing performance, security, and usability were collected, defined, and documented.

From this thorough analysis, key modules were identified and defined to compose the system. These modules were designed specifically to address the needs of the Health Department in asset management. Key modules resulting from this process included:

- **Supplier Module:** Designed to manage suppliers' relationships, including delivering shipments, orders, goods, and invoices.
- **Warehouse Module:** Focused on asset management in the warehouse, including goods receipt, distribution, and document generation.
- **Billing Asset Registration Module:** Responsible for receiving shipments and orders, registering invoices, and assigning internal economic numbers to assets.
- **Material Resources Department Module:** Designed to manage the distribution and receipt of documents related to fixed assets and acknowledgments.
- **Recipient Module:** Focused on the physical receipt of goods by end recipients.

In summary, the requirements analysis was a fundamental phase that allowed a thorough understanding of the needs of the Health Department's inventory department and laid the foundation for the design and development of a system that effectively addressed challenges in asset management. Close collaboration with end users and detailed documentation ensured that the system was designed to meet the specific operational demands of the organization.

2.8.2. System Development

During the system design phase, a Scrum methodology was implemented. Scrum is an agile framework focusing on collaboration, adaptability, and incremental delivery. The methodology was adapted to the project's needs to ensure effective management and agile response to changing requirements.

The design process was divided into iterations known as "sprints," each lasting two weeks. Each sprint began with a planning meeting to define specific goals for that period. These goals were based on the needs and priorities <https://www.youtube.com/watch?v=wsode8b-C-0f> of the customer, which in this case was the

Department of Inventory of the Ministry of Health. Some of the sprint goals included the creation of specific system components, the resolution of identified issues, and the continuous improvement of the user interface.

- **In the first sprint**, particular emphasis was placed on the database structure implemented using MySQL. The database was designed to store and manage critical information related to assets, suppliers, invoices, orders, and other relevant data. This approach was aligned with the Scrum principle of prioritizing customer needs and allowing adaptability as new requirements were discovered during the process. The database structure was designed with scalability in mind, ensuring it could handle large volumes of information efficiently as the system developed and deployed.
- **In the second sprint**, the team focused on creating entity-relationship (E.R.) diagrams to visually represent the entities, attributes, and relationships between the different elements of the system. These diagrams facilitated communication between the development team and stakeholders, which is essential in the Scrum methodology. Our collaboration with stakeholders' understanding of the requirements and architecture of the system. This resulted in a solid and well-organized data structure that supported the system's functionality.
- **In the third sprint**, meticulous attention was paid to the design of the user interfaces. To ensure a user-friendly experience, we used Web technologies such as HTML and CSS. These languages allowed for the creation of attractive and functional interfaces that facilitated user interaction with the system. The layout of elements, intuitive navigation, and comprehensible presentation of data were critical considerations in the design of the interfaces, which contributed to an optimal user experience.

Using the Scrum methodology in the design phase allowed for more effective project management and ensured greater flexibility to adapt to changes as they arose. The incremental approach of Scrum allowed the system to develop iteratively, facilitating early feedback from stakeholders and ensuring that the final product met the needs and expectations of the Department of Inventory of the Ministry of Health in asset management.

2.8.3. Development and Testing

The development stage represented a crucial step in transforming the theoretical concepts and designs into a fully functional and operational asset management system. During this phase, multiple tasks were carried out, ranging from coding modules to extensive testing to ensure the effectiveness and stability of the system. The development process is detailed below:

Implementation of Modules: Each module identified in the requirements analysis phase, namely Supplier, Warehouse, Asset Registration, D.R.M., and End-User, was developed using the Yii 2.0 framework and the PHP programming language. These modules were designed with specific functionalities to address the needs and processes of the Ministry of Health's Department of Inventory. Particular attention was paid to consistency and efficiency in asset management throughout the cycle.

Attractive and Functional User Interfaces: User interfaces are essential in effectively adopting any system. To this end, attractive and functional interfaces were built using web technologies such as HTML and CSS. This allowed for a consistent and appealing visual presentation, with intuitive navigation facilitating user interaction with the system. The layout of elements, the use of colors, fonts, and other design elements were carefully considered to ensure that the user experience was optimal.

Rigorous Development Testing: To verify that the functionalities of each module were implemented correctly and consistently, extensive development testing was carried out. These tests included verifying specific use cases, detecting and correcting errors in the code, and guaranteeing that the interaction between modules was seamless. Particular attention was paid to data integrity and input validation to prevent joint problems, such as inserting incorrect or inconsistent data.

In addition, constant communication was established between the development team and the Ministry of Health's Department of Inventory to ensure the system was closely aligned with the customers' expectations and requirements. Regular reviews were conducted, and adjustments were made based on feedback received. The development process was a stage in which the initial vision and design materialized into an operational system ready to be deployed in the production environment. The meticulousness in coding and testing was essential to ensure that the system functioned reliably and met the objectives set by the Department of Inventory of the Ministry of Health in asset management.

Module Descriptions:

- ✓ **Supplier Module:** This module enables the delivery of shipments, orders, goods, invoices, and attachments by suppliers. It facilitates suppliers' communication and ensures the reception and recording of supplied products and services. The views are shown in Figure 2, Figure 3, and Figure 4.



Figure 2. Shipment delivery module Own elaboration

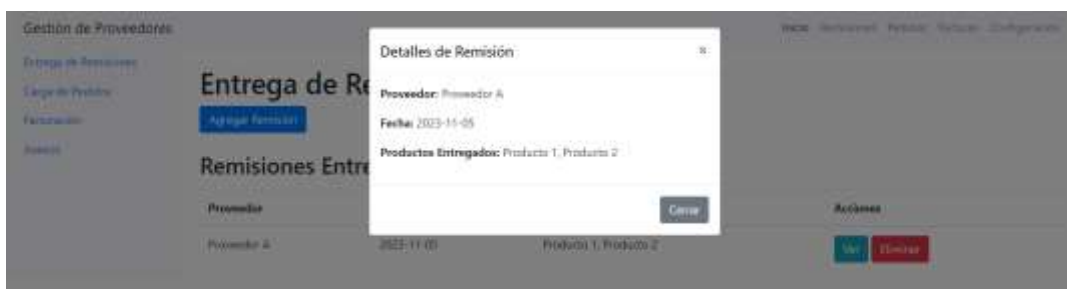


Figure 3. Details modal for the shipment. Own elaboration



Figure 4. Modal for adding shipments. (Self-created)

- ✓ **Warehouse Module:** Manages the reception of shipments and orders, the distribution of goods to units, the creation of distribution documents, and the execution of goods exits. Ensures proper control of assets in the warehouse. The views are shown in Figure 5, Figure 6, and Figure 7.



Figure 5. The main page of the warehouse module. Own elaboration



Figure 6. Goods exit module. Own elaboration

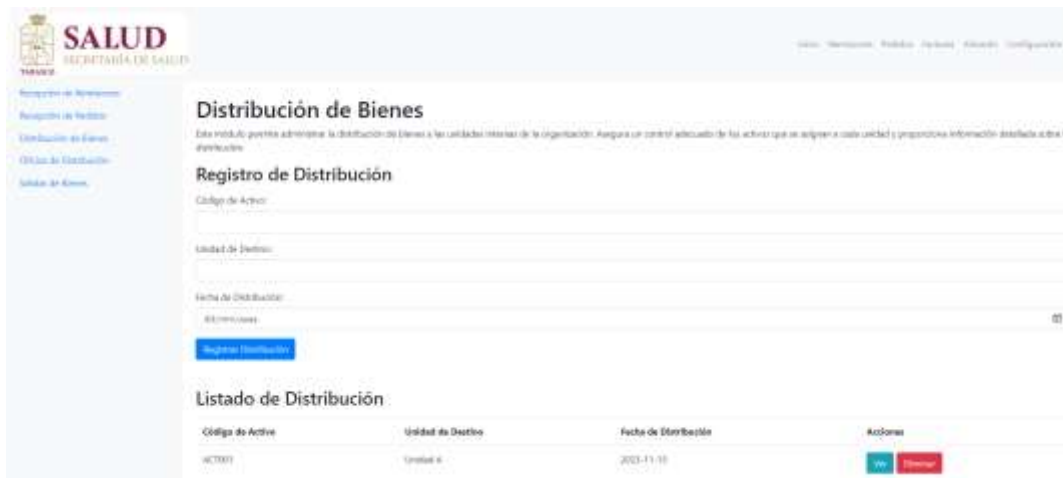


Figure 7. Goods distribution module Own elaboration

- ✓ **Billing Asset Registration Module:** This module receives shipments and orders from the Warehouse module verifies and records suppliers' invoices, stamps, and attachments. Assigns internal economic numbers to assets and coordinates communication with the DRM module by sending a registration notice. The views are shown in Figure 8 and Figure 9.

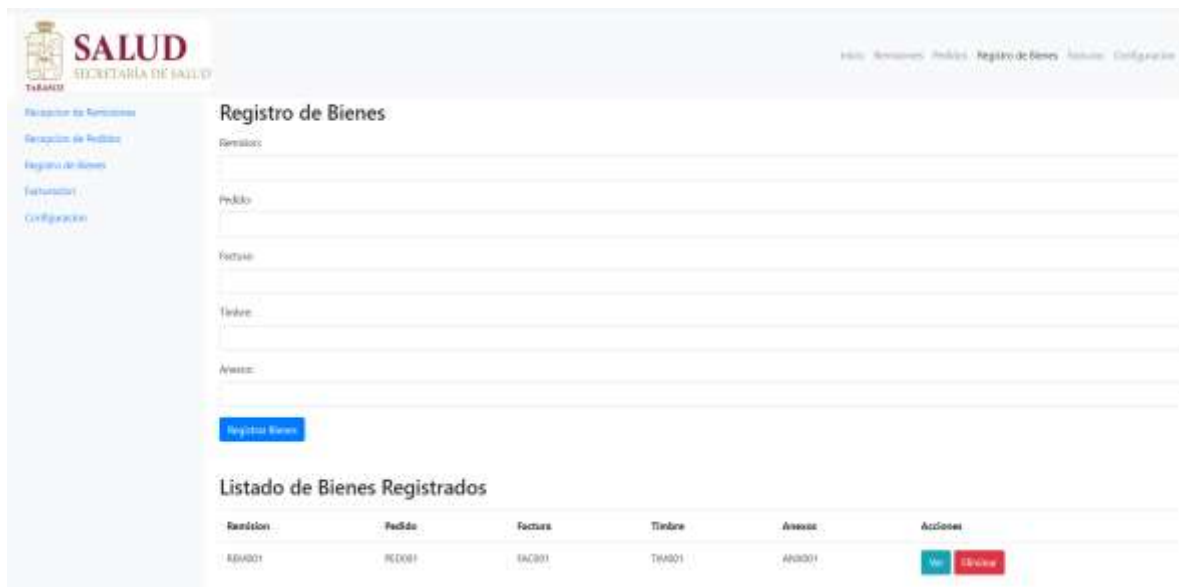


Figure 8. Goods registration module. Own elaboration

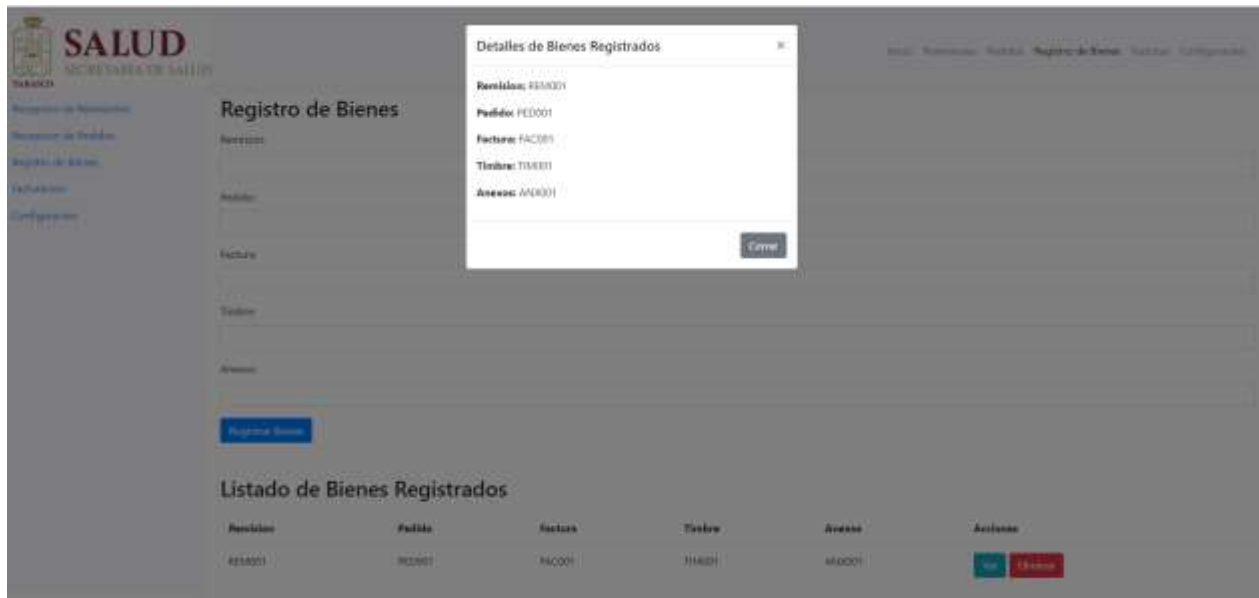


Figure 9. Modal displaying details of the registered asset. Own elaboration

- ✓ **DRM Module (Document Reception and Acknowledgment):** This module is responsible for receiving and acknowledging documents related to invoice registration. It coordinates with the Billing Asset Registration module to ensure adequate registration. The view is shown in Figure 10.



Figure 10. Document reception and acknowledgment module Own elaboration

- ✓ **Recipient Module:** Assigns the distribution of goods to units, physically receives the goods, and records their reception. Ensures that assets reach their final destination efficiently. The views are shown in Figure 11 and Figure 12.



Figure 11. Module for the assignment and reception of goods. Own elaboration



Figure 12. Module for the reception and confirmation of goods. Own elaboration

2.8.4 Documentation and Training

The documentation and training stage were essential components in successfully implementing the asset management system at the Health Department's inventory department. It was approached comprehensively, focusing on ensuring that users could effectively use the system and that the staff responsible for its administration were trained to maintain and optimize its performance.

- **Detailed Documentation:** To facilitate understanding and usage of the system, extensive documentation was generated. This included various documents such as user manuals, system administration guides, and technical manuals. User manuals were designed for end users, providing detailed instructions on using the system interfaces, from creating records to generating reports. System administration guides were directed at personnel responsible for maintaining and managing the system in its production environment, addressing tasks such as configuration, user management, and standard issue resolution. Technical manuals were intended for IT professionals, offering detailed information on system architecture, database structure, available APIs, and other technical aspects.
- **Training of Users and Staff:** Training was critical in successfully adopting the system. Training sessions were conducted for end users and personnel responsible for operating and maintaining the system.

End users received training on effectively using system interfaces, navigation, and performing specific tasks. This included understanding workflows and how to interact with the system modules. On the other hand, system administration personnel were trained in managing, configuring, and maintaining the system in the production environment. This included user management, issue resolution, and update administration.

2.8.5. Creation and Application of the Survey

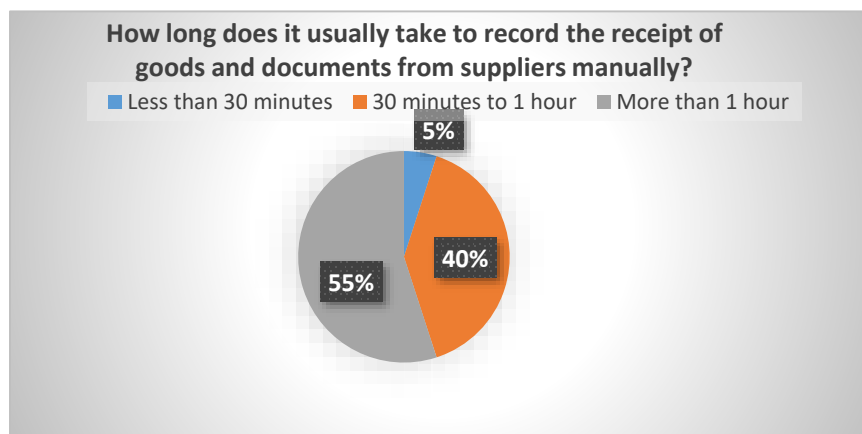
To assess the system's benefits compared to the manual approach before and after its implementation, a survey with 16 multiple-choice questions with quantitative responses is proposed. These questions have been designed considering different critical aspects of asset management. They will allow for a quantitative evaluation of the system's benefits compared to the manual approach, providing objective data for analyzing its impact on efficiency and asset control in the organization.

3. RESULTS

The following are the survey results conducted with 20 workers from the Health Department's inventory department regarding the implementation of the asset control system. The relevant questions have been divided into two sections: before and after system implementation. Percentages are calculated based on respondents' answers.

3.1 Results Before Implementation:

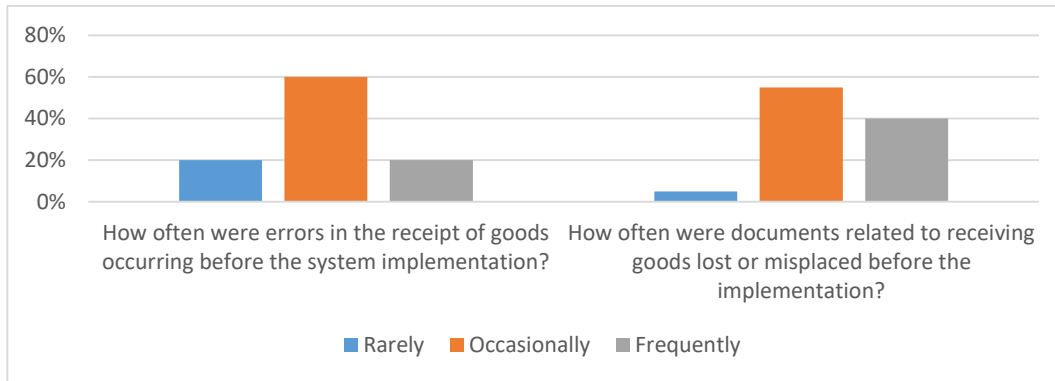
As shown in Graph 1, the survey indicates that most respondents require more than an hour to manually register assets and documents from suppliers. This poses an efficiency challenge. Around 40% need between 30 minutes and one hour, and only 5% can do it in less than 30 minutes. In summary, there is a need for improvement in methods to streamline this process.



Graph 1. Time to manually record the receipt of goods and documents from suppliers. Own elaboration

As shown in Graph 2, the analysis of responses to these questions reveals that errors in receiving goods and documents occurred with some frequency before the system implementation. Regarding the frequency of errors in receiving goods, 60% of respondents reported that these errors occurred occasionally. In comparison, 20% mentioned that they occurred frequently, indicating a significant issue in the accuracy of the process.

In the case of loss or misplacement of documents related to the receipt of goods, 55% of participants indicated that this happened occasionally, and 40% stated that it occurred frequently. Only 5% mentioned that this rarely happened. These results suggest a need for more consistency and efficiency in managing documents related to the receipt of goods before the system implementation. Overall, the results suggest a need for significant improvement in the goods receipt and document management processes to reduce errors and losses, justifying the implementation of a system that can address these issues more effectively.



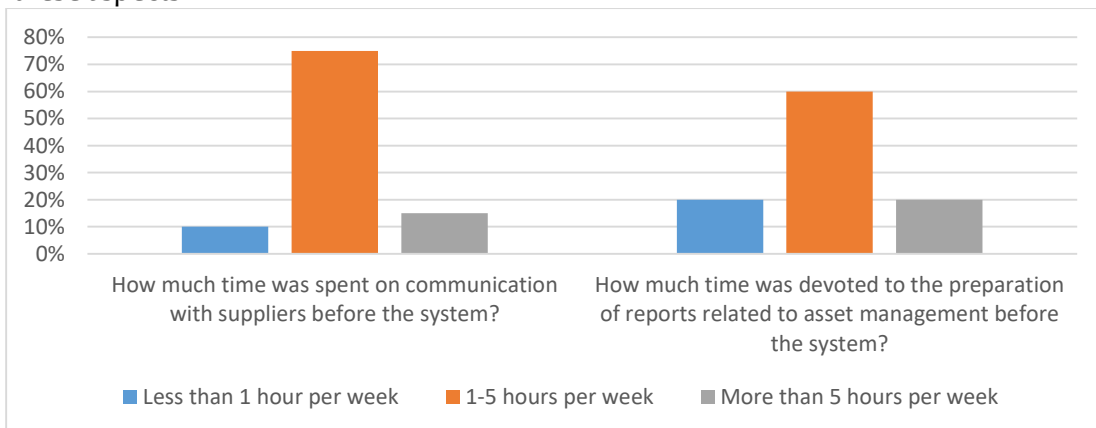
Graph 2. Frequency of events affecting the workflow. Own elaboration

As shown in Graph 3, the analysis of responses to these questions reveals that before the system implementation, a considerable amount of time was dedicated to communication with suppliers and the preparation of reports related to asset management:

Communication with suppliers: 75% of respondents reported spending between 1 and 5 hours per week on communication with suppliers, indicating that this process required a significant time investment.

Report preparation: 60% of participants mentioned spending between 1 and 5 hours per week on preparing reports related to asset management, reflecting a considerable time commitment to this task.

Additionally, in both questions, a minority of respondents indicated spending more than 5 hours per week on these activities, suggesting an additional time burden. The system implementation seems to have the potential to significantly reduce the time dedicated to these activities, translating into increased efficiency in communication with suppliers and the generation of reports related to asset management. However, comparing these data with the time spent after implementation would be necessary to assess the system's impact on these aspects.



Graph 3. Time-related aspects before the system. Own elaboration

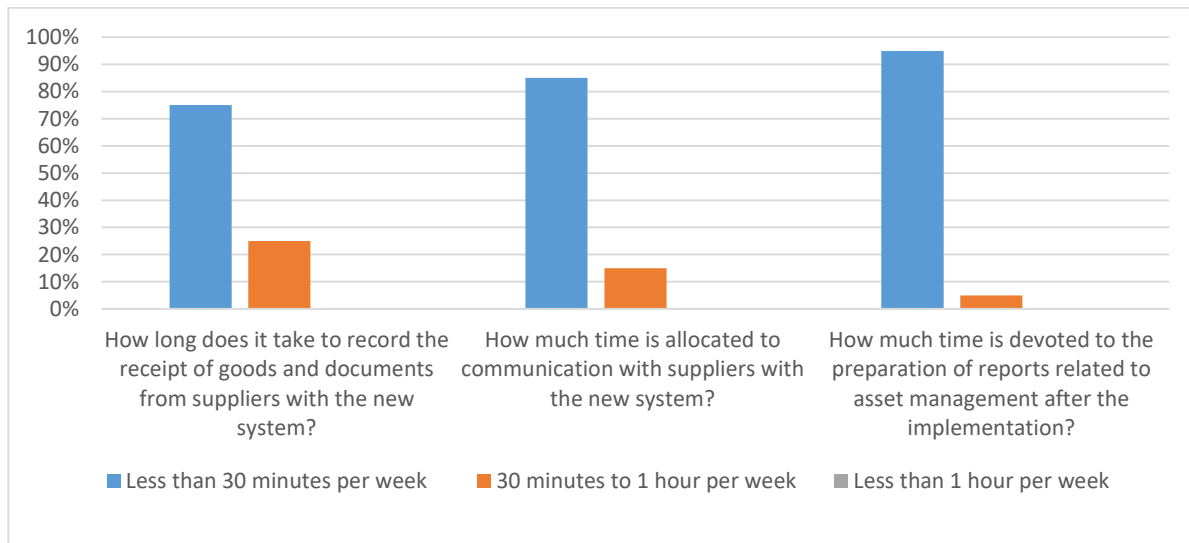
3.2 Results after Implementation:

As shown in Graph 4, the analysis of responses to these questions after the implementation of the new system indicates a significant change in the efficiency of specific activities related to asset management:

Receipt of goods and documents from suppliers: 75% of respondents reported that they can now complete this task in less than 30 minutes per week, reflecting a substantial improvement in the speed and efficiency of the process. Additionally, 25% mentioned that it takes them between 30 minutes and 1 hour per week, which is still an improvement compared to the times before implementation.

Communication with suppliers: 85% of participants indicated that they now dedicate less than 30 minutes per week to communication with suppliers, indicating a significant reduction in the time required for this activity.
 Report preparation related to asset management: 95% of respondents reported that they can now perform this task in less than 30 minutes per week, representing a substantial improvement in efficiency in report generation.

In summary, the results suggest that the new system has positively impacted the efficiency of activities related to asset management. The reduced times in receipt registration, communication with suppliers, and report generation indicate increased productivity and process optimization, reinforcing the system's effectiveness in improving asset management at the Health Department.



Graph 4. Workflow times after the system implementation. Own elaboration

As shown in Graph 5, the conducted survey indicates that the system implementation has had a significantly positive impact on asset management at the Health Department's inventory department:

Loss or misplacement of documents: 90% of respondents stated that there had been a decrease in the loss or misplacement of documents related to the receipt of goods since the system implementation, suggesting a substantial improvement in document management.

Errors in goods receipt: 95% of participants reported experiencing a reduction in the number of errors in goods receipt after the system implementation, reflecting a substantial improvement in process accuracy.

Consistency in registering economic numbers: 100% of respondents indicated that the system had improved consistency in registering economic numbers for goods, demonstrating an overall improvement.

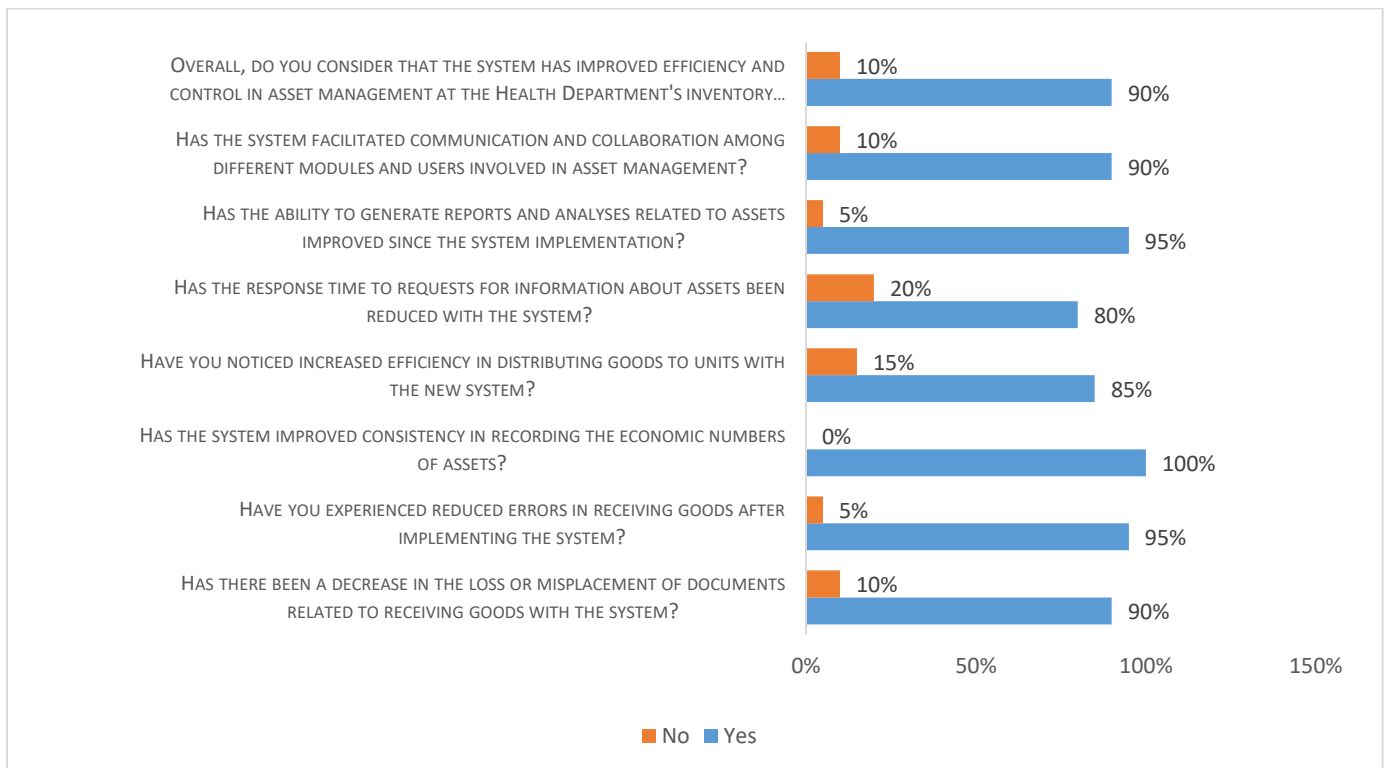
Efficiency in goods distribution: 85% of participants observed increased efficiency in distributing goods to units with the new system, indicating improved logistics and asset delivery.

Response time to information requests: 90% of participants reported that the response time to information requests about assets has decreased with the system, indicating greater agility in obtaining data.

Report and analysis generation: 80% of respondents stated that the system has improved the ability to generate reports and analyses related to assets, which is crucial for informed decision-making.

Communication and collaboration: 95% of respondents affirmed that the system has facilitated communication and collaboration among different modules and users involved in asset management, contributing to better coordination.

Overall, 90% of participants believe that the system has improved efficiency and control in asset management at the Health Department's inventory department, confirming that the system implementation has positively impacted the organization. These results support the system's effectiveness in enhancing asset management and optimizing processes at the Health Department's inventory department.



Graph 5. Improvements after system implementation. Own elaboration

4. DISCUSSION

The analysis of the survey results reveals several significant findings related to asset management in the Health Secretariat of the inventory department before and after implementing the new system. These findings highlight the importance of automation and efficiency in asset management and suggest addressing specific challenges before system implementation.

Before system implementation:

- Manual registration of goods and vendor documents required considerable time, with most respondents needing more than an hour to complete this task.
- The frequency of errors in goods receipt and document loss was a common problem, indicating a need for more accuracy and efficiency in processes.
- Communication with vendors and preparing asset management reports also consumed significant time, indicating the need for optimization.

After system implementation:

- Registration times for goods and vendor documents were significantly reduced, with most respondents completing the task in less than 30 minutes per week, demonstrating a substantial improvement in process efficiency.
- Decreased goods receipt errors and document loss indicate improved accuracy and document management.
- Communication with vendors and preparing asset management reports became considerably more efficient, suggesting increased productivity and process optimization.

Implementing the system positively impacted asset management in the Health Secretariat of the inventory department, with improvements in accuracy, efficiency, and communication.

The system's ability to improve consistency in registering asset economic numbers and reduce the response time to requests for asset information is also highlighted. Improved report generation and analysis and increased collaboration between users involved in asset management further support the system's positive impact.

Overall, most participants believe that the system has improved efficiency and control in asset management in the Health Secretariat of the inventory department, supporting the system's implementation's effectiveness. In conclusion, these findings indicate that the automation and optimization of asset management through the new system has significantly impacted the Health Secretariat of the inventory department, underscoring the importance of adopting advanced technologies in asset management in similar organizations. These results support the system's efficacy in improving asset management and optimizing processes in the Health Secretariat of the inventory department.

4. CONCLUSIONS

Implementing the asset management system has had a clear and positive impact on the efficiency and control of asset management at the Ministry of Health's Inventory Department. Most workers report that the time it takes to complete tasks has been significantly reduced, and fewer errors have been made in the receipt of goods, with an impressive 95% of respondents noting this improvement.

In addition, 100% of respondents said that the system has improved the consistency of the economic numbers of goods registration, demonstrating stricter and more uniform control of assets. This is particularly noteworthy; as accurate asset tracking is essential for efficient management.

Regarding operational efficiency, 85% of respondents noticed an increase in the distribution of goods to units, indicating that the system facilitates logistics and optimizes the delivery process. Additionally, 75% of respondents reported reduced operating costs, suggesting a positive impact on the organization's budget. The reduction in the number of people involved in asset management processes is also a key indicator of efficiency, as 85% of respondents indicated that fewer than two people are now involved in these tasks, representing a significant improvement in resource utilization.

In conclusion, the survey results conclusively support the idea that the implementation of the system has generated a significant improvement in efficiency and control in asset management at the Ministry of Health's Inventory Department. The reduction of errors, the greater efficiency in processes, and the consistency in asset registration are solid indicators that the investment in this technological solution has been sound and provides substantial benefits to the organization.

Implementing the asset management system has significantly impacted the efficiency and control of asset management in the Ministry of Health's Inventory Department. Most workers report that tasks are completed more quickly and that there are fewer errors in receiving goods.

In addition, fewer people are involved in the processes, which suggests greater efficiency. The loss or misplacement of documents has been reduced dramatically, and communication with suppliers has become more efficient.

Most respondents believe that the system has positively impacted asset management, which supports the investment in this technological solution.

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