ERP System for Inventory Management in an Agro-Industrial Company

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Abstract **– The present study, aims to optimise inventory management in a company operating within this sector, with a particular focus on enhancing inventory accuracy and turnover. Utilising a quantitative approach through a quasi-experimental model, 40 products were analysed using registration forms for data collection. The inventory accuracy (EI) and inventory turnover (RI) indicators were assessed before and after the ERP (Enterprise Resource Planning) system's implementation. The outcomes demonstrated significant improvements, thus confirming the hypothesis that ERP systems are effective tools for optimising inventory processes. These results emphasise the broader potential of ERP solutions to enhance operational efficiency, reduce waste, and support digital transformation across agro-industrial enterprises, thereby contributing to increased competitiveness and sustainability in the sector.**

Keywords **– ERP, inventory, system, turnover, accuracy.**

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1. Introduction

Agro-industrial companies face various challenges related to the efficient management of their inventories, as these constitute one of the crucial conditions for supporting operational continuity and meeting market demand. The ERP tool has become an integral technological solution that enhances procedures, facilitates more accurate decision-making, and centralizes information [1].

ERP systems represent advanced technological platforms that offer comprehensive solutions for efficient information management within organizations. These tools are designed to address diverse business needs, improving workflows through the systematization and optimization of operational procedures [2].

In the current business environment, improving the quality of service has become imperative. Furthermore, no organization should suffer losses from unused products. For this reason, it is crucial to establish effective control over existing and newly produced items within the company to enhance productivity, avoid unnecessary expenses, and ensure optimal rotation and inventory management [3].

The proposed software solution is defined as an ERP because it integrates multiple key areas of the organization—such as finance, commercial operations, and production—offering specialized functionalities like Kardex systems. This integration enables the simultaneous management of dual measurement units, such as pieces and kilograms, which is especially useful in agro-industrial contexts. These ERP systems can be flexibly designed and configured to include a personalized set of features aligned with each organization's specific needs and strategic objectives. This flexibility enhances internal processes, improves operational efficiency, and allows organizations to respond effectively to market dynamics and emerging challenges.

ERP systems rely on a database structure that consolidates relevant data related to assets across organizational divisions.

They are organized under a modular approach, where each module focuses on a key operational area. It is crucial for these modules to be seamlessly integrated to provide a holistic and real-time view of the business, thereby facilitating more effective decision-making by management [4].

Inventory control plays a central role in managing goods appropriately. It prevents losses from spoilage or damage, reduces storage costs, and optimizes the procurement cycle. For this reason, it is essential to monitor stock levels and establish efficient warehouse product management practices [5]. Inventory planning further seeks to synchronize production with market demand by organizing and forecasting stock needs. This proactive approach enables companies to anticipate future scenarios and align production with actual consumption trends [6].

An effective inventory control system is composed of interrelated elements that, while capable of functioning individually, are significantly more powerful when integrated. Together, these components enhance process efficiency, improve product accessibility, increase customer satisfaction, and automate routine tasks to reduce human error [7]. Whether dealing with raw materials, in-process goods, or finished products, inventory holds economic value and is recorded as a financial asset. Therefore, managing and protecting these assets is essential to avoid theft, misplacement, or deterioration [8].

Understanding inventory types—including in-transit and stored goods—is fundamental for maintaining control. Poor inventory practices can lead to disorganization, inaccurate stock counts, missed inspections, increased losses, and decreased profitability. Consequently, inventory management is one of the most valuable components of the logistics process and must be handled with the same level of care and strategic oversight as human resources. Effective tracking and control strategies reduce storage and transportation costs and ensure that products reach end users at the right time and in the right condition [9].

However, the implementation of a custom ERP solution presents challenges. These systems require substantial financial investment, particularly due to the complexity of reconfiguring modules, implementing integrations, and deploying the system effectively. Expert input is necessary for system design, and ongoing procedural reviews and adjustments are essential for ensuring optimal performance. Adapting ERP systems to specific organizational workflows represents a significant effort, but the long-term benefits justify the investment.

Currently, many agro-industrial companies still rely on spreadsheets to manage inventory, which complicates end-of-day reporting and hinders the generation of timely data.

To address this inefficiency, an ERP system is proposed to streamline inventory-related operations, such as goods delivery and stock control. Manual inventory methods—using Excel or paper to record purchases, product entries and exits—result in constant data updates and significant time consumption. This often leads to inaccuracies in stock levels and poor purchasing decisions, further affecting overall efficiency.

This study is motivated by the pressing need to enhance operational performance and sustainability in the agro-industrial sector. Implementing an ERP system is expected to reduce product losses, improve the accuracy of inventory data, and facilitate better planning and resource allocation. Ultimately, this approach will help optimize inventory accuracy and turnover, contributing to improved business performance and responsiveness to market demands.

2. Methodology

The following section delineates the research design, type, and data collection methods employed to evaluate the ERP system's impact on inventory accuracy and turnover in an agro-industrial context.

This investigative work falls within the category of applied research, employing a qualitative approach. The design is explanatory in nature and arrives at the conclusion that this research adopts an experimental approach, specifically quasi-experimental, given that the dependent variable will be manipulated. This process entails the meticulous observation of the ERP system's evolution, encompassing both the pre-implementation phase and the post-implementation period.

The data recording sheet was utilized as a tool for data collection. About the population and sample, a total of 40 subjects was considered.

The objective of this study was to analyze the data from the pre-test and post-test using quantitative data analysis software. This facilitated the calculation of descriptive statistics, normality tests, hypothesis testing, and other analytical procedures.

2.1. EI and RI Indicator

In order to assess the effectiveness of the ERP system, two key inventory performance indicators were selected for analysis: The present study investigates the relationship between inventory accuracy (IA) and inventory turnover (RI). The following definitions and formulas elucidate their pertinence.

The EI indicator involves recording data that faithfully reflect real levels, supported by predictive tools and the analysis of consumption patterns [10].

$$IA = \frac{PIQ}{CRD}\ x\ 100 \quad (1)$$

PIQ = Physical Inventory Quantity.
DRQ = Documented Registry Quantity

The RI indicator determines the activity of circulation speed for the organization's inventory [11].

$$RI = \frac{US}{UIT}\ x\ 100 \quad (2)$$

US = Units Sold.
UIT = Units in Stock.

3. Results

This section will demonstrate the effects of implementing an ERP system on inventory management in an agro-industrial company, specifically in terms of inventory accuracy (IA) and inventory turnover (IT) indicators.

A comparative analysis of the results obtained before (pre-test) and after (post-test) the implementation of ERP reveals quantifiable enhancements in the accuracy of stock records and inventory circulation efficiency.

Pre-test for ERP (Table 1): The figure illustrates the initial situation before the implementation of ERP. A considerable discrepancy exists between the physical quantity of inventory and the corresponding recorded value in the system. This discrepancy signifies control errors and the compromised reliability of the stored information, which poses a risk to logistics and financial decision-making processes.

Post-test for Enterprise Intelligence (EI) (Table 1): Following the implementation of the Enterprise Resource Planning (ERP) system, a marked enhancement in the congruence between physical data and system records is evident. This enhancement signifies enhanced control, precision, and oversight of product inputs and outputs, culminating in enhanced inventory accuracy.

Table 1. Pre-test and post-test for AI

	Pre-test			Post-test		
Description	PIQ	DRQ	IA	PIQ	DRQ	IA
Goldenberry	3568.6	4283	83.32%	2603.61	2700	96.43%
Yellow chili pepper	2564.26	2989	85.79%	1936	1936	100%
Blueberry	1105.38	1335	82.80%	2152.75	2223	96.84%
Sweet potato	3730.33	4365	85.46%	3883.22	3471	94.59%
Camu camu	1671.75	2020	82.76%	2482.5	2648	93.75%
Persimmon	2097.02	2435	86.12%	3522.94	3664	96.15%
Starfruit	2628.45	3239	81.15%	1530.87	1621	94.44%
Cherimoya	1951.74	2141	91.16%	3424	3424	100%
Cocona	2673.74	3109	86.00%	1356.42	1410	96.20%
Peach	1140.7	1383	82.48%	3725.05	3847	96.83%
Asparagus	1283.51	1524	84.22%	2513.28	2618	96.00%
raspberry	3114.11	3499	89.00%	2092.04	2147	97.44%
Sabrina strawberry	1829.55	2158	84.78%	1256.02	1293	97.14%
San andrea strawber	3692.87	4233	87.24%	2712.17	2780	97.56%
granada	1808.66	2046	88.40%	1518.24	1572	96.58%

A pre-test for RI is necessary (Table 2): This image illustrates inventory turnover prior to the implementation of ERP. The data indicates that product circulation is suboptimal, as goods remain in storage for extended periods, leading to increased storage expenses and the potential for deterioration.

A post-test for RI is indicated (Table 2): The implementation of ERP has been demonstrated to result in enhanced inventory turnover. This result suggests that products are sold or replenished more frequently, thereby optimizing available resources and reducing the risk of stockouts or overstocking.

Table 2. Pre-test and post-test for RI

	Pre-test			Post-test		
Description	US	UIT	RI	US	UIT	RI
Goldenberry	1968.76	2346	83.92%	2659.66	2749	96.75%
Yellow chili pepper	1253.52	1440	87.05%	2551	2551	100%
Blueberry	3486.12	4179	83.42%	3419.68	3507	97.51%
Sweet potato	3553	4180	85%	2735.93	2905	94.18%
Camu camu	3169.96	3795	83.53%	3061.58	3257	94%
Persimmon	1098.7	1274	86.24%	4337.17	4442	97.64%
Starfruit	1101.3	1346	81.82%	3408.81	3592	94.90%
Cherimoya	3673.6	4349	84.47%	41.81.67	4311	97%
Cocona	1618.37	1869	86.59%	3152.47	3255	96.85%
Peach	2259.14	2745	82.30%	1179.92	1204	98%
Asparagus	3078.95	3624	84.96%	3917.41	4049	96.75%
raspberry	3635.58	4108	88.5%	4375.7	4481	97.65%
Sabrina strawberry	1231.07	1449	84.96%	3291.96	4002	98%
San andrea strawber	1102.14	1255	87.82%	2705.86	2744	98.61%
granada	3837.5	4322	88.79%	1696.38	1731	98%

3.1. Descriptive Analysis

The implementation of the ERP system was accompanied by an analysis of descriptive statistics, the purpose of which was to identify changes in inventory accuracy and turnover before and after the system's introduction. The results of this analysis highlighted quantitative improvements.

This study was conducted in two phases: Before and after the integration of the ERP system, with the goal of evaluating its effectiveness in improving inventory accuracy and turnover. In the first phase, a pre-test was conducted to calculate the key indicators, taking into account the relevant variables before the incorporation of the ERP system into inventory management. In the second phase, a post-test was conducted to recalculate these indicators after adopting the web-based platform.

Each of these phases was meticulously structured as part of the research design, ensuring a systematic and rigorous approach. The information collected during the study was processed and analyzed using SPSS Statistics V.26. This software not only facilitated the assessment of data conformity to a normal distribution but also allowed for deeper and more detailed analyses.

Through this process, the hypotheses formulated by the expert were carefully evaluated to determine whether they were supported or rejected, providing a robust foundation for the study's conclusions.

To conduct this research, an ERP system was utilized to analyze real-time data and optimize internal communication, thereby enhancing inventory accuracy and turnover within a company in the sector. The study included a pre-test conducted without the ERP system and a post-test conducted after its implementation, establishing baseline and final values for key indicators.

As shown in Table 3, there was a clear variation in the indicator before and after the implementation of the solution. Initially, the value of the indicator was 84.9283, which corresponds to 85% effectiveness. However, after the implementation of the solution, this value increased to 94.4260, reaching 96% effectiveness. This significant improvement not only reflects a quantitative enhancement but also demonstrates a clear increase in inventory accuracy, suggesting more efficient and precise inventory management. In the context of inventory accuracy (IA), the pre-ERP trend registered at 78.69%, while post-ERP it attained 93.75%, indicating an enhancement in the proportion of records classified as high-accuracy following the implementation of the ERP system. The findings indicate not only the attainment of mean improvements but also the augmentation of products achieving elevated control standards, thereby substantiating the comprehensive efficacy of the ERP system.

Table 3. Descriptive statistics for EI

	N°	Mean	Median	Mode
EI_Pre-Test	40	84.9283	85.37	78.69
EI_Post-Test	40	96.426	96.77	93.75

In Table 4, it is evident that there is a variation in the indicator before and after the implementation of the solution. Prior to the intervention, the indicator showed a value of 85.1120, equivalent to 85% effectiveness. However, after implementation, the indicator's value increased to 96.8960, reaching an impressive 97% effectiveness. This significant change not only indicates improved performance but also clearly demonstrates an increase in inventory turnover, suggesting a more streamlined and productive organization of products.

A similar phenomenon was observed in inventory turnover (IT), where the mode shifted from 84.96% to 98%, indicating a predominant frequency of values that closely approximated optimal performance. The findings indicate not only the attainment of mean improvements but also a greater number of products that achieved higher control standards, thereby reinforcing the overall effectiveness of the ERP applied.

Table 4. Descriptive statistics for RI

	N°	Mean	Median	Mode
RI_Pre-Test	40	85.112	84.98	84.96
RI_Post-Test	40	96.896	97	98

3.2. Inferential Analysis

Inferential analysis was conducted to validate the statistical significance of the observed changes. The effectiveness of the ERP system was determined by means of normality tests and hypothesis testing.

Table 5 shows that the significance value (sig.) of the pre-test is 0.812, and for the post-test is 0.096, with both values being greater than 0.05. This confirms the null hypothesis, indicating that the records follow a normal distribution.

Table 5. Normality test EEI

	Shapiro-Wilk		
	Statistician	gl.	Sig.
EI_Pre-Test	0.983	40	0.812
EI_Post-Test	0.953	40	0.096

Table 6 shows that the significance value (sig.) for the pre-test is 0.916 and for the post-test is 0.056, with both values being greater than 0.05. This confirms the null hypothesis, indicating that the records follow a normal distribution.

Table 6. Normality test RI

	Shapiro-Wilk		
	Statistician	gl.	Sig.
RI_Pre-Test	0.987	40	0.916
RI_Post-Test	0.946	40	0.056

3.3. Hypothesis Testing

In accordance with the inferential results, hypothesis testing was employed to ascertain whether the enhancements in inventory indicators could be ascribed to the ERP system implementation.

Indicator 1: EI

H_0: An ERP system does not increase inventory accuracy in an agro-industrial company.

H_1: An ERP system increases inventory accuracy in an agro-industrial company.

The T-Student test was implemented as a tool to assess the validity of the hypothesis. Table 7 shows that the recorded t-value is -36.601 with a bilateral significance level of 0.000, which is less than 0.05. Thus, the alternative hypothesis is accepted, while the null hypothesis is rejected.

Table 7. T-Student test for RI

	T-Student		
	T-Student	gl	Sig. (bilateral)
EI_Pre-Test EI_Post-Test	-36.601	39	0

Indicator 2: RI

H_0: An ERP system does not increase inventory turnover in an agro-industrial company.

H_1: An ERP system increase inventory turnover in an agro-industrial company.

In Table 8, the recorded t-value is -41.314 (means that postest is bigger than pretest), with a significance level of 0.000, which is less than 0.05. Consequently, the alternative hypothesis is accepted, and the null hypothesis is rejected.

Table 8. T-Student test for RI

	T-Student		
	T-Student	gl	Sig. (bilateral)
RI_Pre-Test RI_Post-Test	-41.314	39	0

4. Discussion

The subsequent section is devoted to the interpretation of the statistical findings, with these findings being contextualised within the extant literature. Furthermore, the section examines the broader benefits of ERP adoption in inventory management.

A subsequent evaluation revealed that the implementation of an ERP (Enterprise Resource Planning) software system resulted in a substantial enhancement in inventory accuracy (IA). Initially, the mean accuracy was 85%; however, subsequent to the adoption of the ERP system, this percentage increased to 96%, representing an 11% improvement.

This enhancement is primarily attributed to improvements in the company's internal operations, including the automation of records and stricter monitoring of stock inflows and outflows.

The Shapiro-Wilk test confirmed that the IA indicator followed a normal distribution. Consequently, the Student's t-test was employed, yielding a bilateral significance level of 0.000, which is below the threshold of 0.05.

Consequently, the null hypothesis was refuted, thereby validating the alternative hypothesis. This outcome signifies that the ERP system exerts a statistically significant positive effect on inventory accuracy.

These findings are consistent with those reported in previous studies. For instance, one researcher noted that implementing an ERP system focused on control has proven effective, as demonstrated by the high approval rate obtained [12]. Moreover, the implementation of corporate ERP software, which integrates numerous functionalities into a unified platform, is imperative for organizational leadership and strategic decision-making [13].

With regard to the secondary indicator, inventory turnover (IT), analogous favorable outcomes were identified. Prior to the implementation of the ERP software, the IT index registered at an average of 85%. Subsequent to the implementation, however, it exhibited an increase to 97%, signifying a 12% enhancement. This shift is indicative of accelerated product sales and restocking cycles, which in turn contribute to enhanced inventory management efficiency.

The Shapiro-Wilk test further confirmed the normal distribution of this indicator, thereby validating the application of the Student t-test. Once more, the bilateral significance level was determined to be 0.000, resulting in the rejection of the null hypothesis and the confirmation of the substantial impact of ERP on inventory turnover.

Consistent with extant findings, the implementation of ERP systems has been shown to reduce registration times, from 357.24 to 88.65 seconds for outflows and from 450 to 184.51 seconds for inflows. This, in turn, has been demonstrated to promote faster turnover and enhance stock control [14]. Another author has emphasized that ERP integration can lead to gains in operational efficiency and productivity across various organizational areas. The implementation of blockchain technology has been demonstrated to enhance data security, facilitate traceability and scalability, automate key processes, and ultimately contribute to cost reduction and increased competitiveness in the field [15].

A study conducted with internal auditors in Portugal revealed that SAP ERP is the most widely used system, with the "Stocks" module being among the most frequently employed.

This underscores the importance of ERP in inventory and accounting control, supporting more efficient audits and transparent resource management [16].

Furthermore, ERP systems are regarded more favourably by users due to their compatibility with existing hardware and software, the quality of training, and the sense of reliability during use—factors that result in high levels of user acceptance [17].

Beyond the operational efficiency that ERP systems facilitate, they also support sustainable development goals by optimizing resource use, improving infrastructure sustainability, and enhancing transparency. These strategic advantages enable organizations to address broader global challenges while also improving internal performance [18].

5. Conclusion

The conclusion summarizes the main findings, discusses their practical implications, and emphasizes the strategic value of ERP systems for agro-industrial businesses.

The results of this research demonstrate that the adoption of an ERP system has a significant and beneficial impact on inventory management. The accuracy of records increased by 11%, rising from 85% to 96%, thanks to improvements in internal processes such as automation and stricter control of entries and exits. Similarly, inventory turnover improved by 12%, reaching 97%, reflecting greater efficiency in the flow and replenishment of products.

Statistical tests, such as Shapiro-Wilk and T-Student, confirmed normal distributions and significant results ($p < 0.05$), validating the alternate hypothesis regarding the befits of the ERP system on these indicators. These finding align with previous studies highlighting that ERP system optimize inventory management, improve traceability, reduce operational times, and enhance organizational competitiveness. Thus, ERP implementation is established as a strategic tool crucial for business efficiency.

This study reveals that implementing the ERP tool improved the inventory management process enabling greater accuracy and speed in control operations. By optimizing tasks and ensuring consistent monitoring, the ERP system has contributed to overall improvements in operational efficiency and organizational competitiveness.

Additionally, adopting an ERP system helps reduce risks associated with manual data and process management. The automation and centralization of information minimize the likelihood of human errors, contributing to greater reliability and accuracy in daily operations.

Beyond operational benefits, implementing an ERP system can strengthen the company’s adaptability to market changes or regulatory demands. The ERP’s flexibility allows the organization to quickly adjust processes and strategies to respond to net requirements or unforeseen situation. This system also fosters innovation by facilitating data collection and analysis, enabling the company to identify new opportunities for improvement and development in its products or services.

Finally, by enabling better analysis of historical and current data, the ERP system can serve as a key tool for identifying continuous improvement opportunities, helping the organization remain comparative. This ability to analyze large volumes of data facilitates trend forecasting, process refinement, and informed executive decision-making, directly impacting profitability.

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