

# Application of Lean tools for the improvement of management processes in an agri-food services company

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## ABSTRACT

**Objective:** To analyze and improve the Document and Record Control process through the Lean Office approach and the use of Value Stream Mapping (VSM) in an agri-food services company, aiming to reduce Lead Time and improve efficiency.

**Methodology:** Current state and future state VSMs were developed based on time data collected before and after improvement. Statistical validation was conducted using 95% confidence intervals ( $n=5$ ,  $SD=5\%$ ), ensuring data reliability. Improvement actions included the implementation of standard times, the elimination of non-value-added activities, and the incorporation of Poka Yoke mechanisms to prevent process errors.

**Results:** The process achieved a Lead Time reduction of over 30% and a significant increase in daily operational capacity. Activities such as Update Master Document Index and Save the procedure and update the folder exceeded 160 daily processes, demonstrating improved flow and process control.

**Limitations:** Some improvements, such as standardization or poka-yoke mechanisms, depend on staff training and existing digital systems, which could affect the long-term sustainability of the results.

**Conclusion:** The application of the Lean Office approach integrating VSM, statistical analysis, and continuous improvement tools effectively improve capacity, reduced processing times, and eliminated waste, validating the applicability of Lean in administrative processes within the agri-food sector. The study confirms that Lean methods can be successfully adapted beyond manufacturing, strengthening organizational efficiency and competitiveness.

**Keywords:** Agri food, Lean Office, Value Stream Mapping, Takt Time.

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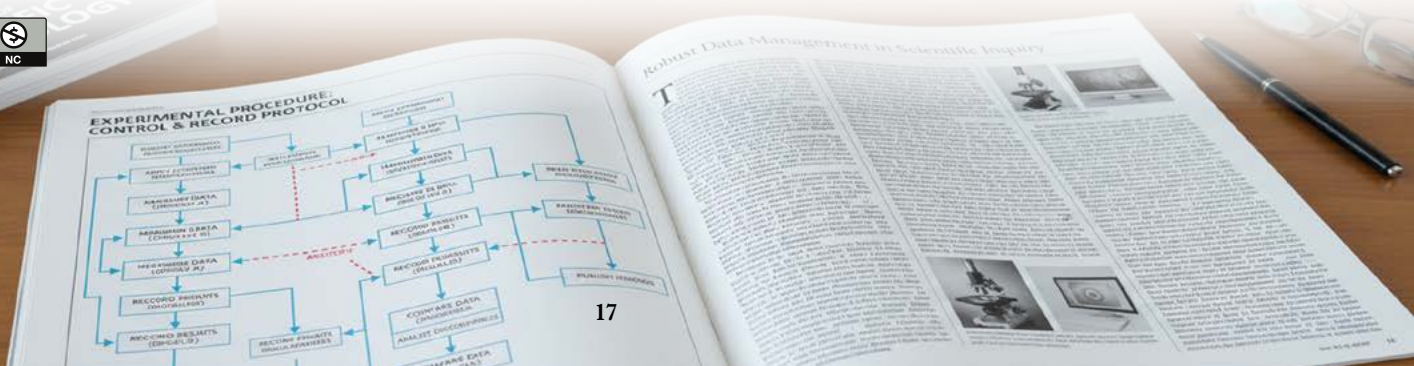
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## INTRODUCTION

In an increasingly competitive market, one of the main strategies adopted by companies to differentiate themselves from others is to control and ensure quality in both products and processes (Bottani *et al.*, 2021). As competition intensifies in the industrial and service sectors, traditional manufacturing systems have become insufficient to achieve operational excellence, prompting organizations to adopt new alternatives such as Lean tools (Nasution *et al.*, 2018). Following the publication of the book “The Machine That Changed the World”, the Lean philosophy emerged as a paradigm for process improvement and waste



elimination. Rooted in the Toyota Production System (TPS) developed by Taiichi Ohno in the 1950s, Lean evolved from industrial practices inspired by Ford, Deming, and Taylor into a universal management system focused on transforming non-value-added activities into value-added ones (Rutman *et al.*, 2015).

Lean has progressively expanded into Lean Management, Lean Startup, Lean Office, and Lean Services, unifying principles that seek to align every activity with customer needs, improving flexibility, productivity, and competitiveness (Plaza & Wandzich, 2016). Applying Lean in administration and not only in production has become essential for developing agile and efficient organizations that foster continuous improvement (Owens & Fernandez, 2014).

The emergence of Lean Office broadened the scope of Lean toward administrative and information-based processes. Lean Office focuses on identifying and eliminating waste in workflows such as redundant approvals, documentary errors, and delays, thereby improving the accuracy and speed of information flow. Recent studies highlight that Lean Office is a key component in the transformation of public and private institutions, achieving cost reductions and improvements in service levels (Refugio-Durón, 2024).

In the agri-food sector, the Lean concept has been adapted to address challenges such as perishability, variable demand, and supply chain complexity. Lean Farm integrates tools such as Value Stream Mapping (VSM), Takt Time, and visual management to optimize logistics and documentation, achieving reductions in waste and delivery times (Kumar *et al.*, 2018). The combination of Lean with environmental practices, known as Green Lean Six Sigma (GLSS), strengthens sustainability objectives through the optimization of energy, water, and material use (Besser *et al.*, 2022). In Latin America, the applications of Lean Office have rapidly expanded across multiple sectors such as education; universities in Mexico, Colombia, Chile, and Peru have used VSM and 5S to improve administrative activities, accreditation processes, and student services, achieving up to a 40% reduction in processing times (Refugio-Durón, 2024). In the public sector, Lean Office has been applied in government agencies in Mexico, Chile, and Brazil to improve transparency, reduce bureaucracy, and shorten administrative times by 30% to 50% (Besser *et al.*, 2022).

In the healthcare sector, hospitals in Colombia, Mexico, and Argentina have implemented Lean Office to improve admission, billing, and supply processes, achieving cost savings of up to 15% and enhancing accuracy in electronic records (Refugio-Durón, 2024). Similarly, financial institutions such as Banco de Bogotá and Banorte have reported 20% to 30% reductions in credit approval times through the simplification and elimination of redundant steps (Martinez *et al.*, 2015). The most recent developments in Lean stem from its collaboration with Industry 4.0 technologies. Through digital dashboards, robotic process automation (RPA), and digital twins of the VSM, organizations have increased transparency and data-driven decision making (Ramírez *et al.*, 2021). The ISO 22468:2020 standard currently provides a standardized guide for mapping material and information flows, ensuring consistency in VSM applications. However, challenges persist. Studies identify cultural difficulties, lack of statistical validation in data collection, and resistance to change toward new work methods as barriers to Lean Office implementation (Refugio-Durón, 2024). Current research proposes quasi-experimental designs, integration with

sustainability frameworks, and contextualization of Lean Office in administrative and agri-food environments (Ramirez *et al.*, 2021).

Both manufacturing and service companies must redesign and reconfigure their internal processes to increase efficiency, reduce waste, and ensure more agile organizational management. Within this context, process improvement and redesign represent a strategic area of opportunity to achieve higher levels of productivity. This article presents a case study conducted in an agri-food services company, in which the document and record control system was strengthened through the implementation of Lean Office tools such as Value Stream Mapping (VSM), Takt Time, record sheets, Standard Time determination, and the use of the Poka Yoke system as an error-prevention mechanism. The study aims to demonstrate that the combined application of these tools not only promotes continuous improvement in transformation processes but also shows a high degree of impact and adaptability in administrative contexts. The results obtained confirm this perspective, as key performance indicators such as Lead Time, efficiency, customer service, and productivity showed significant improvements after implementation. The quality department of the company under study plays a fundamental role in the management and assurance of organizational processes, being responsible for the control of documents and records that guarantee traceability, regulatory compliance, and continuous improvement in the services provided. However, in practice, various issues have been identified that significantly affect its performance and efficiency.

## **MATERIALS AND METHODS**

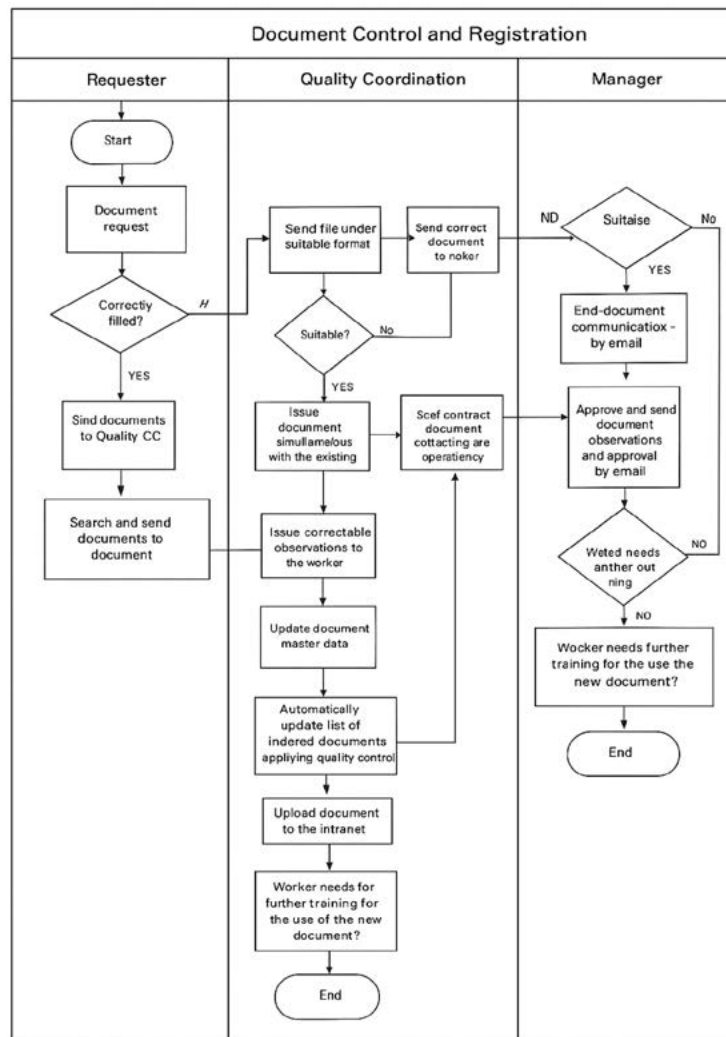
The methodology employed in this project was based on a four phase cycle: diagnosis, design, implementation, and measurement. In the diagnosis phase, the main inefficiencies and waste were identified through the application of Value Stream Mapping (VSM). Subsequently, improvement proposals grounded in the Lean approach were designed. The implementation of these proposals was carried out in collaboration with the company's quality department, and finally, the results were evaluated using efficiency, effectiveness, and productivity indicators.

### **Diagnostic**

The Quality Department is one of the areas with the greatest number of responsibilities within the organization, encompassing eight business units. Considering the scope of its functions and its constant interaction with different areas, the department presents several areas for improvement. Nevertheless, given its needs and priorities, the topic of "Document and Record Control" is considered essential to ensure a high level of service. This control involves the coordination of activities, formats, and documents related to the eight business units (seven operational offices and the land transportation area) located in various regions of Mexico and abroad, all belonging to the company. In this context, the process activities are defined as follows: (1) document request by the applicant to the Quality Coordinator, (2) submission of the editable document by the Quality Coordinator, (3) submission of the document to the Quality Coordinator, (4) review and minor corrections of the document by the Quality Coordinator, (5) return

of the document with comments to the applicant, (6) resubmission of the corrected document to the Quality Coordinator, (7) submission of the document for review by Top Management, (8) final validation —if the document is approved, Top Management sends an approval email; otherwise, an email with comments and observations is sent to the involved parties, (9) once the approval email is received, the Quality Coordinator assigns a code to the new document; if not approved, the process is repeated from step six until a correct version is obtained, (10) the Quality Coordinator updates the master document index, (11) updates the electronic folder with the new approved version in both PDF and Word formats, archiving the previous version in the obsolete folder, and (12) notifies all involved personnel that the document is available on the intranet. The Document and Record Control process is presented in Figure 1.

The Document and Record Control process has a documented procedure that describes the activities, responsibilities, and information flows involved. This procedure is available within the company’s system.



**Figure 1.** Flowchart of the document and record control process.

A Current State VSM was created to identify non-value-added activities in the process. Before preparing the current VSM, a table was created to determine the process Takt Time (Table 1).

The data in Table 1 show a total of 28,800 seconds available in an 8-hour work shift, with 3,600 seconds of scheduled stops (meals, breaks, delays in scheduled activities, and basic fatigue), leaving 25,200 seconds available for production. Given a daily demand of two records, each must be processed in 12,600 seconds. This calculation is obtained by dividing the available production time by the number of units requested by customers. Since these 12,600 seconds are considered the Takt Time and set the pace for meeting daily processing needs, a list of process activities and their cycle times was created, as shown in Table 2.

**Table 1.** Takt Time Calculation.

Description	work shift A	Total	Paid Time
Schedules	8 a 4 pm	8	
Paid time (secs)	28800	28,800	
Scheduled Stoppages (secs)	3600		
Food	1500	1500	Scheduled Stoppages
Break	600	600	
Delay in scheduled activities	900	900	
Basic fatigue	600	600	
		0	
Total scheduled stops (in seconds)	3600	3,600	
Total daily available time (in seconds)	25,200 (A)	25,200	Secs/day
	Daily requirement (B):	2	pzs / day
	Takt Time (A / B):	12600	secs / pzs

**Table 2.** List of activities and Confidence Interval.

Activities	Time taken (seconds)	Std Dev (s)	Margin of Error (s)	95% Confidence Interval (s)	Validity
Localization and sending of editable to the client	185	9.25	11.49	[173.51, 196.49]	Valid
Procedure development	22,800	1140	1415.5	[21384.50, 24215.50]	Valid
Review and minor corrections	9,000	450	558.75	[8441.25, 9558.75]	Valid
Make corrections	12,780	639	793.42	[11986.58, 13573.42]	Valid
Review and minor corrections	3,300	165	204.87	[3095.13, 3504.87]	Valid
Request for authorization	210	10.5	13.04	[196.96, 223.04]	Valid
Document authorization	255	12.75	15.83	[239.17, 270.83]	Valid
Update Master Document Index	145	7.25	9	[136.00, 154.00]	Valid
Save the procedure and update the folder	150	7.5	9.31	[140.69, 159.31]	Valid
Enter Intragomsa and update the procedure	140	7	8.69	[131.31, 148.69]	Valid
Informational email regarding the availability and location of the procedure in the system	160	8	9.93	[150.07, 169.93]	Valid

With the information from Table 2, a Takt Time graph was created (Figure 2), which identified the bottlenecks in the process specifically, activities exceeding the available 12,600 seconds.

The times for each activity of the process were collected on different days and hours throughout a week. The number of observations was calculated using the sample size for a population mean; however, due to company confidentiality policies and restrictions regarding process permanence, only one observation per day could be conducted. These were used to generate average times, and to validate them, an analysis with a reduced sample size ( $n=5$ ) and an estimated standard deviation of 5% was carried out, allowing the identification of the consistency and accuracy of the times recorded in the Document and Record Control process.

In general, most activities present relatively wide margins of error, which is reasonable given the small number of observations (due to company confidentiality policies). This increases statistical variability and widens confidence intervals. Nevertheless, when applying the validity criterion (positive lower limit and margin of error  $<20\%$  of the mean), it is observed that all activities are statistically valid, indicating that the estimated times are consistent and fall within an acceptable range of precision.

Activities with longer times (for example, Procedure development and Make corrections) show broader confidence intervals but remain stable relative to their mean value, suggesting high operational variability but low relative uncertainty. Conversely, short-duration activities (such as Document authorization or Update Master Document Index) maintain smaller error margins, reflecting repetitive and controlled processes.

Finally, it is concluded that although the results are statistically valid under the assumed conditions, precision could be improved by increasing the sample size ( $n>30$ ), a value calculated based on the sample size for a population mean.

According to Figure 2, the bottleneck within the process was identified, that is, the activity that exceeds the Takt time and causes a delay in the completion of the activities, the first activity is (1) "Procedure development" by the internal client (operations manager)



Figure 2. Takt Time Graph.

which exceeds the Takt time by 10,200 seconds. It was observed that within the process there is a second activity that exceeds the Takt time called “Make corrections” exceeding it by 180 seconds, however, this action is not considered within the activities to be attacked since the time by which it is exceeded is minimal compared to activity number 1. Table 3 presents an analysis of capacity and inventory, where activities 2 and 4 are again evidenced as bottlenecks by having utilizations above 100%.

With the above information, the Value Stream Mapping (VSM) of the current state was built (Figure 3), considering the main activities within the document and records control process, thus creating the Mapping of the current state of the process.

### Design

In this section, based on the Current Situation Mapping, the possible tools to be applied within the analyzed process were determined, seeking to contribute to reducing time and activities, taking into consideration the activities that comprise the process and the type of information being handled. The VSM is illustrated below with suggested improvement tools.

### Application

A Poka Yoke information tool was created and the process standardized, reducing procedure preparation times. The tool consisted of an interactive electronic help sheet with two options: create a new procedure or modify an existing one. Upon selecting the desired option, a series of electronic documents and forms were displayed, identifying key points and providing detailed descriptions for completion.

This help sheet was designed in collaboration with the Quality Coordinator, who provided key data and highlighted weak points where applicants frequently made mistakes.

**Table 3.** Capacity and Inventory Calculation.

Name of the Operation	Summary in seconds			Daily inventory in pieces M-L	Days of inventory
	Total Cycle Time per Process (j)	Production capacity (daily processes) $M=K/J$	Production capacity (% of load) L/M		
Localization and sending of editable to the client	185	136.22	1%	134.22	67.11
Procedure development	22800	1.11	181%	-0.89	-0.45
Review and minor corrections	9000	2.80	71%	0.80	0.40
Make corrections	12780	1.97	101%	-0.03	-0.01
Review and minor corrections	3300	7.64	26%	5.64	2.82
Request for authorization	210	120.00	2%	118.00	59.00
Document authorization	255	98.82	2%	96.82	48.41
Update Master Document Index	145	173.79	1%	171.79	85.90
Save the procedure and update the folder	150	168.00	1%	166.00	83.00
Enter Intragomsa and update the procedure	140	180.00	1%	178.00	89.00
Informational email regarding the availability and location of the procedure in the system.	160	157.50	1%	155.50	77.75

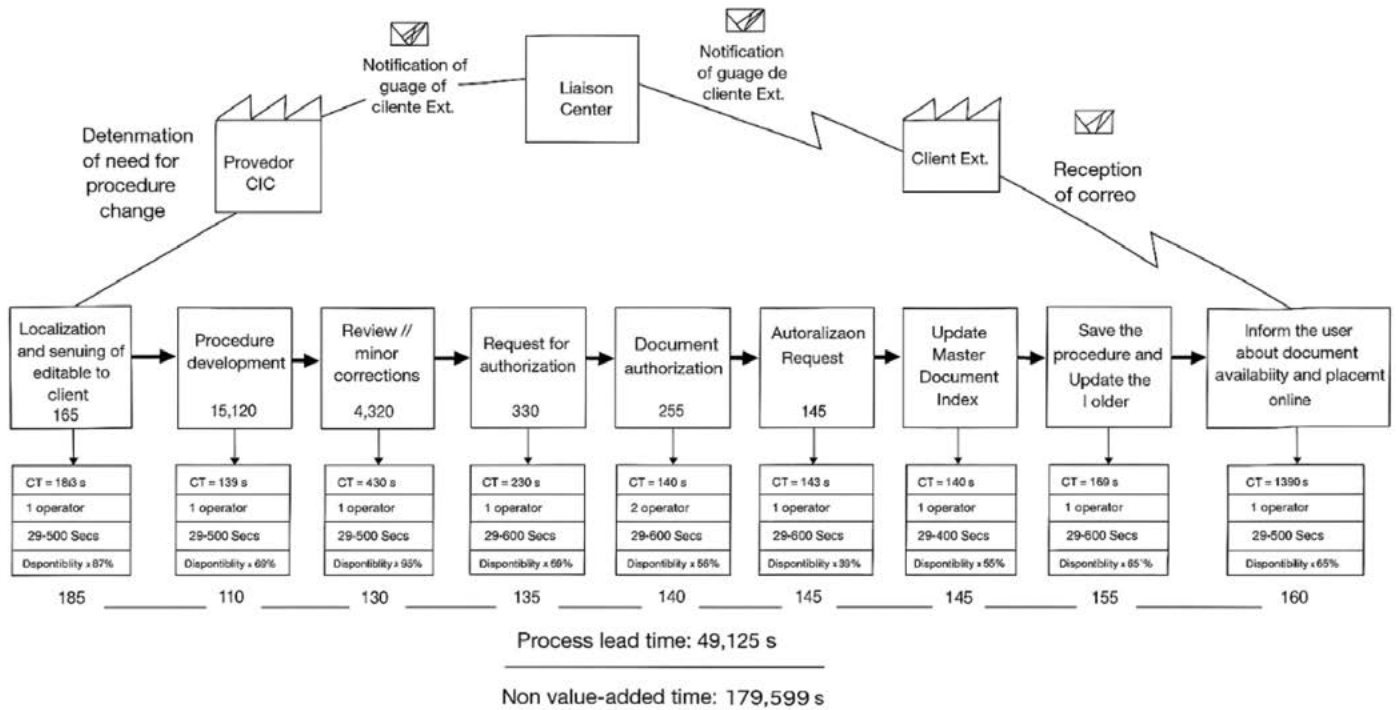


Figure 3. Current State VSM.

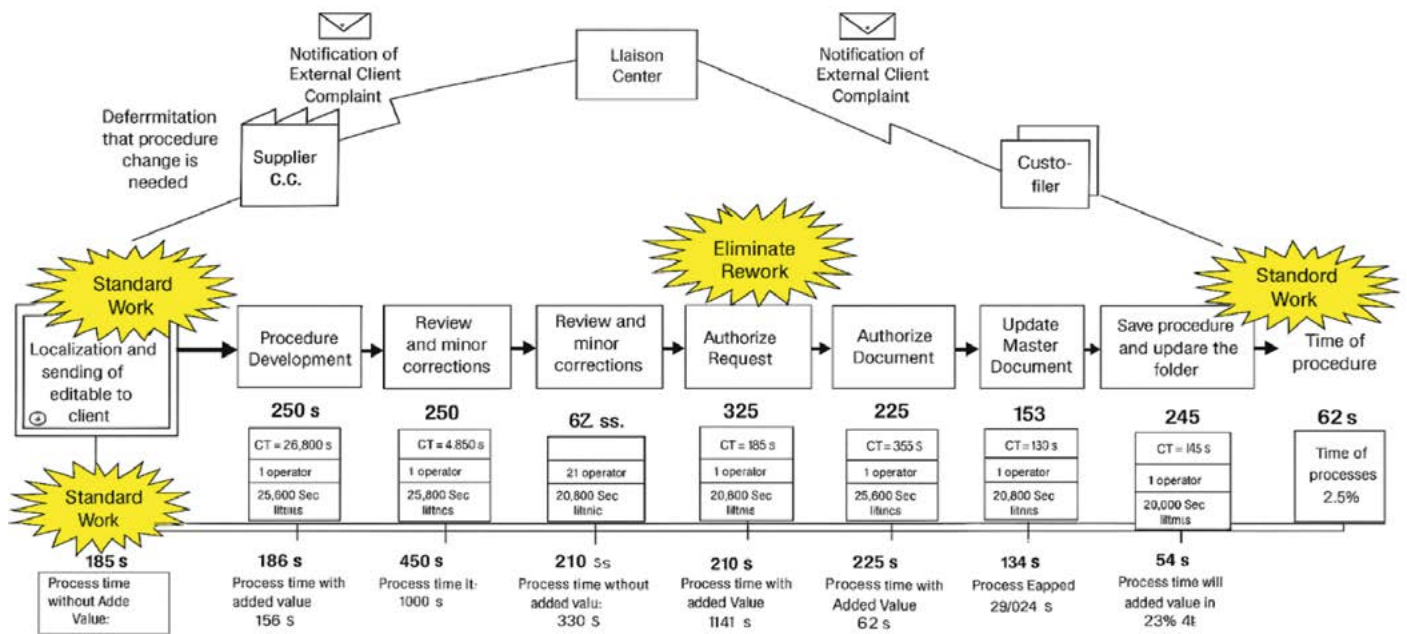


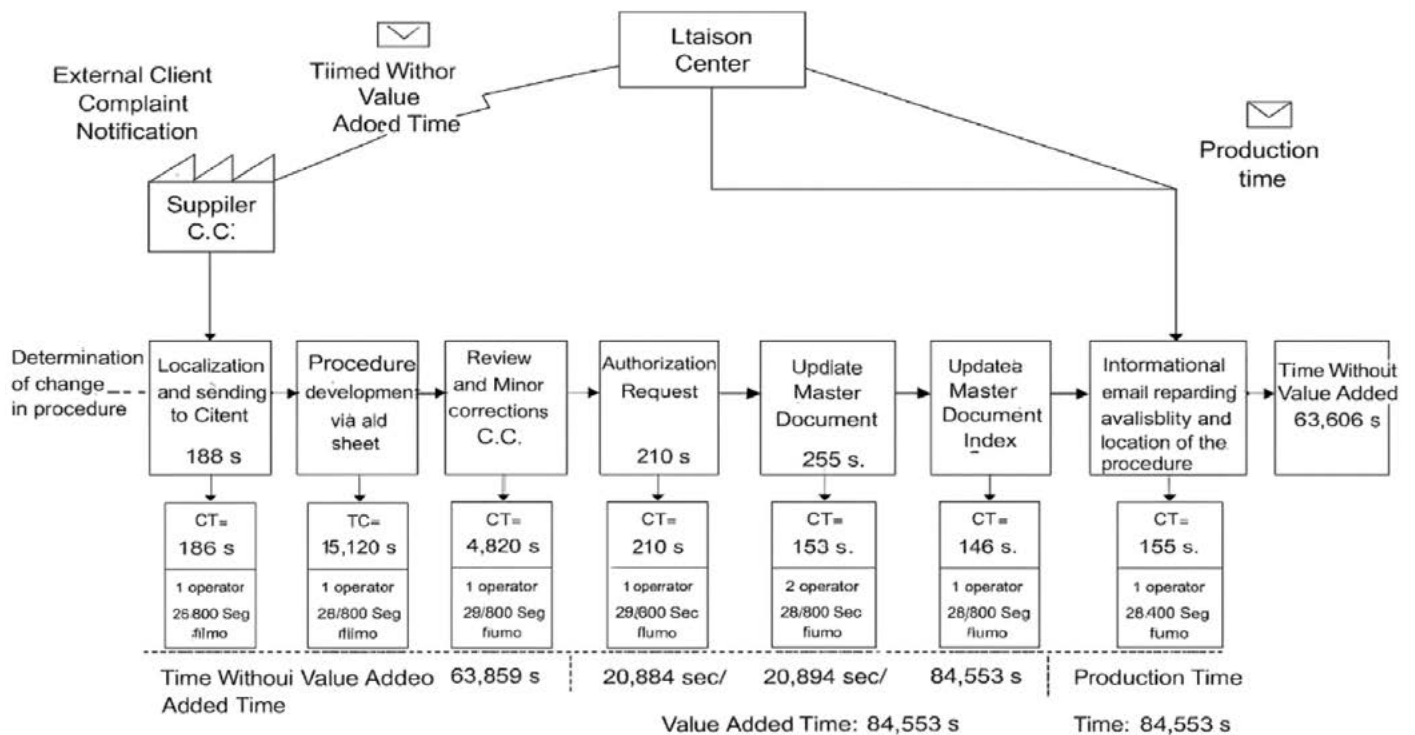
Figure 4. VSM with improvement identification.

Thanks to this help sheet, repetitive tasks were eliminated in Activities 4 and 5 (before implementation). The process, which originally consisted of 11 activities, was streamlined to 9, eliminating redundant review and correction steps. Table 4 shows the comparison.

**Table 4.** Comparison of Activities.

No.	Activities Before	No.	Activities After
1	Localization and sending of editable to the client	1	Localization and sending of editable to the client
2	Procedure development	2	Procedure development
3	Review and minor corrections	3	Review and minor corrections
4	Make corrections	4	Request for authorization
5	Review and minor corrections	5	Document authorization
6	Request for authorization	6	Update Master Document Index
7	Document authorization	7	Save the procedure and update the folder
8	Update Master Document Index	8	Enter Intragomsa and update the procedure
9	Save the procedure and update the folder	9	Informational email regarding the availability and location of the procedure in the system.
10	Enter Intragomsa and update the procedure		
11	Informational email regarding the availability and location of the procedure in the system.		

Considering the possible tools to be used in this process, a proposal for a future VSM was developed. Figure 5 shows the generated VSM as a suggestion for process improvement.



**Figure 5.** Future state VSM.

## RESULTS AND DISCUSSION

### Measurement

The time measurements for each activity within the Document and Record Control process were collected again after the implementation of the improvement actions. The validation of these data was conducted under the same statistical parameters used in the previous analysis. The Table 5 presents the results obtained after the application of these improvements.

How can see in the Table 5, the time measurements obtained for each activity in the Document and Record Control process are statistically consistent and reliable.

Most activities exhibit narrow confidence intervals, indicating low variability and high process stability. Short-duration activities such as Document authorization, Update Master Document Index, and Save the procedure and update the folder demonstrate strong control and repeatability in operational execution.

In contrast, activities with higher time values such as Procedure development and Review and minor corrections show slightly wider absolute confidence intervals, which is expected given their longer execution periods. However, their relative error remains below 20%, supporting their statistical validity.

The analysis verifies that the process times are representative and statistically sound, providing a solid quantitative basis for process optimization and supporting the subsequent Value Stream Mapping (VSM) improvement proposals.

The analysis presented in Table 6 demonstrates a significant improvement in the capacity of the Document and Record Control process after the implementation of improvement actions. Short duration activities such as Update Master Document Index, Save the procedure and update the folder, and Enter Intragomsa and update the procedure achieved a capacity exceeding 160 daily processes, reflecting greater efficiency and reduced inventory levels.

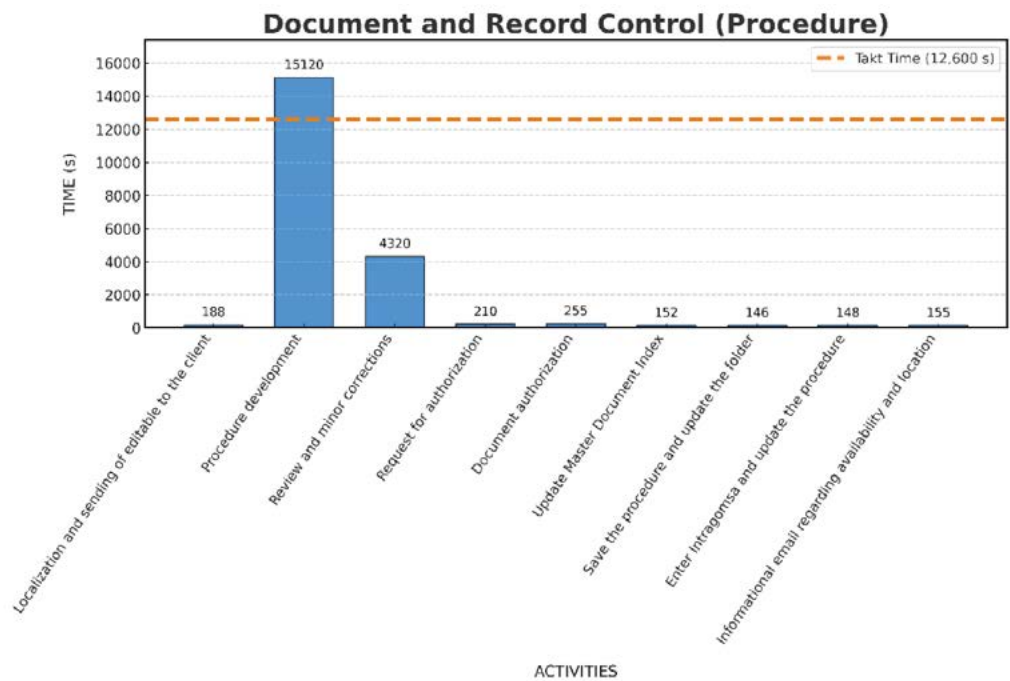
Conversely, longer duration activities, particularly Procedure development and Review and minor corrections, continue to represent bottlenecks within the process, as they concentrate the highest workload and limit continuous flow (Figure 6).

**Table 5.** List of activities and Confidence Interval.

Activities	Time taken (seconds)	Std Dev (s)	Margin of Error (s)	95% Confidence Interval (s)	Validity
Localization and sending of editable to the client	188	9.4	11.67	(176.33, 199.67)	Valid
Procedure development	15,120	756	938.7	(14181.30, 16058.70)	Valid
Review and minor corrections	4,320	216	268.2	(4051.80, 4588.20)	Valid
Request for authorization	210	10.5	13.04	(196.96, 223.04)	Valid
Document authorization	255	12.75	15.83	(239.17, 270.83)	Valid
Update Master Document Index	152	7.6	9.44	(142.56, 161.44)	Valid
Save the procedure and update the folder	146	7.3	9.06	(136.94, 155.06)	Valid
Enter Intragomsa and update the procedure	148	7.4	9.19	(138.81, 157.19)	Valid
Informational email regarding the availability and location of the procedure in the system.	155	7.75	9.62	(145.38, 164.62)	Valid

**Table 6.** Capacity and Inventory Calculation.

Name of the Operation	Summary in seconds			Daily inventory in pieces M-L	Days of inventory
	Total Cycle Time per Process (j)	Production capacity (daily processes) $M=K/J$	Production capacity (% of load) L/M		
Localization and sending of editable to the client	188	134.04	1	132.04	66.02
Procedure development	15120	1.67	120	-0.33	-0.17
Review and minor corrections	4320	5.83	34	3.83	1.92
Request for authorization	210	120.00	2	118.00	59.00
Document authorization	255	98.82	2	96.82	48.41
Update Master Document Index	152	165.79	1	163.79	81.89
Save the procedure and update the folder	146	172.60	1	170.60	85.30
Enter Intragomsa and update the procedure	148	170.27	1	168.27	84.14
Informational email regarding the availability and location of the procedure in the system.	155	162.58	1	160.58	80.29



**Figure 6.** Takt Time Graph.

The results confirm a better workload distribution and workflow optimization, validating the effectiveness of the improvements implemented through the Value Stream Mapping (VSM) approach.

During the diagnosis phase, performance indicators were defined to measure the current efficiency of the process, establishing quantitative and achievable goals that could later be assessed after implementation. Table 7 presents the indicators established for this

**Table 7.** Comparison of Performance Indicators.

Indicator	Before	After	Improvement
Lead Time	228,684 sec	84,553 sec	36.97%
Efficiency	5.50%	14.90%	9.4%
Productivity	11.0%	29.85%	18.85

process, comparing their measurement before and after the project's implementation, as well as the percentage of improvement obtained.

The comparative analysis of performance indicators shows clear improvements after the implementation of the informational Poka Yoke in the document and record control process. The decrease of 144,131 seconds demonstrates greater agility in management, enabling timely responses to both internal and external organizational needs, it is important to mention that the lead time is composed of value-added time and non-value added time, both of which were measured in the before and after stages. An improvement of 18.85% reflects more efficient use of available resources, optimizing routine activities and reducing rework. The increase of 9.4% confirms that standardization and systematization of procedures strengthen control and ensure greater reliability in administrative management. These results confirm the effectiveness of applying Lean Office tools to administrative processes in service companies, providing evidence of their adaptability beyond manufacturing contexts.

It was possible to corroborate what was stated by Refugio-Durón (2024): the implementation of methodologies such as Lean Office represents an effective strategy for improving administrative processes. The results obtained in this study support the adaptability and applicability of Lean Manufacturing tools in service companies, particularly in administrative areas that have traditionally not been systematically addressed. This adaptation not only strengthens internal processes but also enhances the organization's ability to provide higher-quality services in highly competitive environments, such as the agri-food sector.

Based on the reviewed literature, several aspects can be discussed in relation to the results of this research. First, the findings confirm that Lean principles traditionally applied in manufacturing can be effectively adapted to administrative and service environments (Abu *et al.*, 2019; Kafuku, 2019). This adaptation demonstrates the flexibility of Lean tools such as Value Stream Mapping, Poka Yoke, and standardization to identify and eliminate waste in information flows. Second, according to Gupta *et al.* (2015) and Nasution *et al.* (2018), the reduction of lead time directly contributes to increased productivity and the quality of both internal and external services.

Third, the research highlights that the sustainability of Lean improvements largely depends on human and technological factors, such as staff training, digital system maturity, and organizational culture, as mentioned by Bottani *et al.* (2021) and Gupta (2015). Fourth, this study provides a relevant methodological contribution by incorporating statistical validation as part of the Lean evaluation process, a practice still uncommon in administrative applications. Finally, the results align with the vision proposed by Besser

(2018), which relates operational efficiency and digital transformation to the sustainable competitiveness of Mexico's agri-food sector.

## CONCLUSION

In conclusion, this research reaffirms the importance of applying tools such as VSM to foster a culture of continuous improvement that integrates technological and human dimensions to ensure organizational sustainability, operational efficiency, and user satisfaction. However, it is important to recognize that some improvement initiatives, such as process standardization or the implementation of Poka Yoke mechanisms, depend on staff training levels and the development of digital skills, factors that could influence the long-term sustainability and replicability of the results obtained. A contribution of this research was the statistical validation of the time data for each process activity, conducted through 95% confidence interval tests with a sample size of  $n=5$  and an estimated standard deviation of 5%.

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