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Application of Lean Service to Increase the Productivity in a Micro and Small Enterprise in the Food and Beverage Sector

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Abstract

This research applies Lean Service principles to the restaurant *Anticuchería Angelita Grill*, aiming to improve productivity and operational efficiency through tools such as standardized work and the SMED method. Starting from an initial assessment of key performance indicators, bottlenecks and non-value-adding activities were identified, which negatively impacted wait times, customer satisfaction, and order cancellation rates. Through process analysis, time measurement, and scenario simulation, significant improvements were implemented, reducing the average wait time from 32 to 21 minutes, lowering the cancellation rate to 0%, and increasing productivity from 1.656 to 1.875 dishes per labor hour. These results demonstrate that applying Lean Service not only optimizes resources but also enhances the customer experience in the food service sector, consolidating its value as a competitive strategy in a growing market.

Keywords
Lean service, smed, kaizen, standardized work, productivity, bottle neck

1. Introduction
The Lean concept can be applied to the service sector. Lean in service follows the same principles as lean manufacturing, namely, continuous improvement and the elimination of non-value-added activities or waste. (Sari et al., 2021). Companies are making efforts to improve service quality by incorporating Lean principles to increase profitability and customer goodwill. Lean in the service sector plays a significant role in increasing customer value by offering higher-quality services and accelerating processes while using fewer and the correct amount of resources (George & George, 2003). Initially, some features of Lean Six Sigma (LSS) were approved by Bowen and Youngdahl (1998) from Lean Manufacturing Systems (LMS). Gradually, the implementation of Lean Service (LS) increased in healthcare, education, public services, hotels, financial and IT industries, and restaurants. In January 2024, the restaurant sector grew by 1.45% compared to the same month in 2023, driven by the positive evolution of restaurants, beverage services, and other meal service activities. However, the supply of meals for delivery decreased (INEI, 2024). Likewise, the restaurant group recorded a 1.32% growth, favored by higher demand in fast food, tourist restaurants, coffee restaurants, local restaurants, rotisserie chicken, and pizzerias, in response to exclusive discounts with credit cards, online reservations, increased pick-up orders, birthday promotions, and extended hours during the summer season. Other meal service activities grew by 0.37%, driven

by catering services for contractors (food services for air and land transport companies) due to the higher frequency of trips to cater to national and international tourism, attracted by tour packages and the start of summer holidays. However, the group was affected by the activity of food concessionaires, which saw a decrease in contracts with certain production, financial, health, and education companies. At the restaurant Anticuchera Angelita Grill, they face significant operational challenges that affect service quality and customer satisfaction. Despite the growth experienced by the Peruvian restaurant industry following health restrictions, Anticuchera Angelita Grill is affected by issues such as long wait times and low customer satisfaction. Currently, the average wait time is 27 minutes, and customer satisfaction stands at 73%. Additionally, there is a high percentage of canceled orders, exceeding 18%. These problems indicate a lack of optimization in the restaurant's internal processes, which compromises both operational efficiency and the quality of the service provided. Thus, at Angelita Grill, a fundamental challenge has been identified that compromises both efficiency and service quality. The lack of optimization of internal processes directly impacts the company's productivity. The absence of efficient resource management and proper planning has created several obstacles. On the one hand, customers experience long wait times both in food preparation and service overall, which negatively affects their experience and the perceived quality of the establishment. Additionally, there is inefficiency in task allocation and resource utilization, resulting in wasted time and effort by the staff. The lack of process standardization contributes to this problem. Therefore, for the literature review, selected studies have shown that the implementation of Lean Service, either through simulation or proposals, improves productivity and efficiency in service companies. In Peru, a model using methodologies like 5S increased productivity by 14.3% through preventive maintenance (Ruiz-Estate et al., 2023). Detailed implementation is crucial to seize market opportunities (Sum et al., 2020). In India, Lean Service provided consistent performance and 20% improvements in critical activities like storage and food handling (Chandran & Saleeshya, 2020; Vadivel et al., 2022; Abdelaal & Elshaer, 2020). In Peru, Lean Service improved productivity in restaurants, reduced process variability, increased efficiency by 27%, and service quality by 50% (Aguilar & Zapata, 2022; Diestra & Perca, 2023; Alondra-Torres et al., 2023). It also significantly reduced wait times and overtime (Jacinto et al., 2022). In Egypt, Lean Service increased business efficiency by 14.98% (Kulsum et al., 2020). In Indonesia, it improved service times by 90% and delivery times by 7.1% in the fast food industry (Indrawati et al., 2020; Habib et al., 2023). In Peru, Kanban increased efficiency by 8%, and PERT-CPM improved effectiveness by 21% (Romero & Trejo, 2023). Effectiveness also increased by 19% by eliminating unnecessary activities (Bermúdez, 2021). Other studies in Peru show that Lean Service reduced lead time by 50.8% and process time by 19%, increasing service quality (Huaman et al., 2021). It also reduced poorly performed repairs by 5.17% (Valenzuela et al., 2020). In Greece, Lean Service improved organizational performance through techniques like 5S and VSM (Keramida et al., 2023). It is recommended to apply Lean Service in service companies alongside information technologies to improve processes and variables (Puja & Hasibuan, 2022). Appropriate Lean tools increase work efficiency, reduce production cycle times, and decrease energy consumption, contributing to a reduction in CO2 emissions (Orynycz, 2020).

1.1 Objectives

The objective of the study is to demonstrate that the implementation of a model based on Lean Service increases productivity in restaurants. First, a diagnosis of the current processes will be conducted to identify areas for improvement and assess their efficiency; secondly, activities that do not add value will be identified and analyzed, aiming to eliminate waste and improve service quality; and finally, SMED techniques and standardized work will be applied to optimize efficiency, establishing a detailed implementation plan and evaluating its economic feasibility and long-term impact on productivity.

2. Literature Review

2.1 Standardized Work in the Restaurant Sector

Standardized work is a key tool within the Lean system that aims to establish specific and repeatable procedures to reduce variability in processes. In the restaurant sector, this methodology ensures that both food preparation and customer service are performed efficiently and consistently. According to Calderón et al. (2022), standardized work contributes to optimizing operational processes and improving service quality by establishing clear sequences that guide staff through all stages of service. This not only facilitates team training but also ensures that operational errors are reduced and that a high speed of customer service is maintained. The implementation of this practice in restaurants has shown positive results in terms of productivity and efficiency. For instance, Alondra-Torres et al. (2023) found that the standardization of processes led to an 18% increase in productivity and a 27% improvement in operational efficiency. Additionally, Valenzuela et al. (2020) reported a 5.17% decrease in operational errors when standardized work was applied to services, highlighting the direct impact this tool has in high-turnover environments like restaurants. The improvement in process consistency also results in a more reliable and satisfying customer experience.

2.2 SMED (Single-Minute Exchange of Die) in the Restaurant Sector

SMED (Single-Minute Exchange of Die) is a Lean Manufacturing technique designed to reduce changeover times between different tasks, thereby increasing the flexibility and efficiency of operational processes. In the restaurant context, SMED is mainly applied to reduce transition times between the preparation of different dishes by classifying tasks into internal and external activities, and performing activities that do not affect service before or after operating hours (Jacinto et al., 2022). This methodology aims to minimize downtime and optimize the use of available resources, enabling restaurants to offer faster and higher-quality service, even during peak demand times. Studies in the food industry have shown that the implementation of SMED can significantly reduce wait times and increase operational efficiency. According to Indrawati et al. (2020), the use of SMED in fast-food companies resulted in a 90% improvement in service times. In the specific case of Angelita Grill, this tool allowed a reduction in customer wait times by more than 12 minutes, which not only improved the customer experience but also optimized workflow and overall restaurant productivity.

2.3 Lean Service Focused on Customer Experience

The Lean Service model, when applied from the customer perspective, aims to optimize operational efficiency without losing sight of customer satisfaction. In restaurants, this translates to reducing wait times and improving service quality, key elements in delivering a positive experience. Customer-focused tools, such as measuring tolerance levels for wait times and creating clear service standards, allow restaurants to effectively manage customer expectations, ensuring that their experience aligns with their needs (Onaga-Nishimura et al., 2022).
In the case of Angelita Grill, the implementation of Lean strategies focused on the customer resulted in a reduction in the percentage of dissatisfied customers due to wait times, dropping from 59.87% to 33.91% (Aguilar & Zapata, 2022). This demonstrates how applying Lean approaches centered on the customer can have a direct impact on customer loyalty and the perception of service quality. In fact, studies have shown that applying these practices can increase customer satisfaction by up to 50%, highlighting the importance of aligning operational efficiency with a positive customer experience.

3. Methods

The present research was conducted with a prospective approach, using a pre-experimental design with measurements taken at two points: before and after the intervention. This design, which involves a single study group with minimal control, allows for a close approximation to the operational reality of the analyzed restaurant. The methodology was structured in three stages. In the first stage, the food preparation processes in the main kitchen were diagnosed using an Activity and Process Diagram (APD), identifying the main bottlenecks. In the second stage, analysis tools such as the cause-and-effect diagram and Pareto chart were applied to determine the most relevant causes of delays in order delivery, thus establishing the variables of the initial situation.

In the third stage, the implementation of Lean Service tools was proposed to optimize the identified processes. The SMED technique was used to analyze and reduce the time taken to deliver orders to tables, and standardized work was applied to the preparation of dishes in the main kitchen. The research is classified as applied, as it seeks to transform theoretical knowledge into practical solutions that address real operational needs. Its scope is explanatory, focusing on the analysis of cause-and-effect relationships. The unit of analysis centered on order delivery to customers, considering the variety of dishes offered (anticuchos, grilled meats, traditional Peruvian cuisine), and a sample of 60 regular customers was used over six days of weekly service.

4. Data collection

Data collection for this research focused on the analysis and measurement of information from bibliographic sources (articles, reports, books, among others), complemented by direct sampling and measurements taken from customers during service, in order to obtain a more accurate assessment of the operational context. Based on this information, the main key performance indicators (KPIs) were evaluated, and the causes of low productivity were identified using tools such as the Ishikawa diagram and the Pareto chart (Figure 1). Based on these results, the implementation of Lean Service tools was proposed as an improvement strategy, focusing on standardized work and the reduction of unproductive time. Internal and external tasks involved in dish preparation were analyzed, identifying bottlenecks and standardizing key processes. Figure 2 presents the details of the process carried out to achieve the research results.

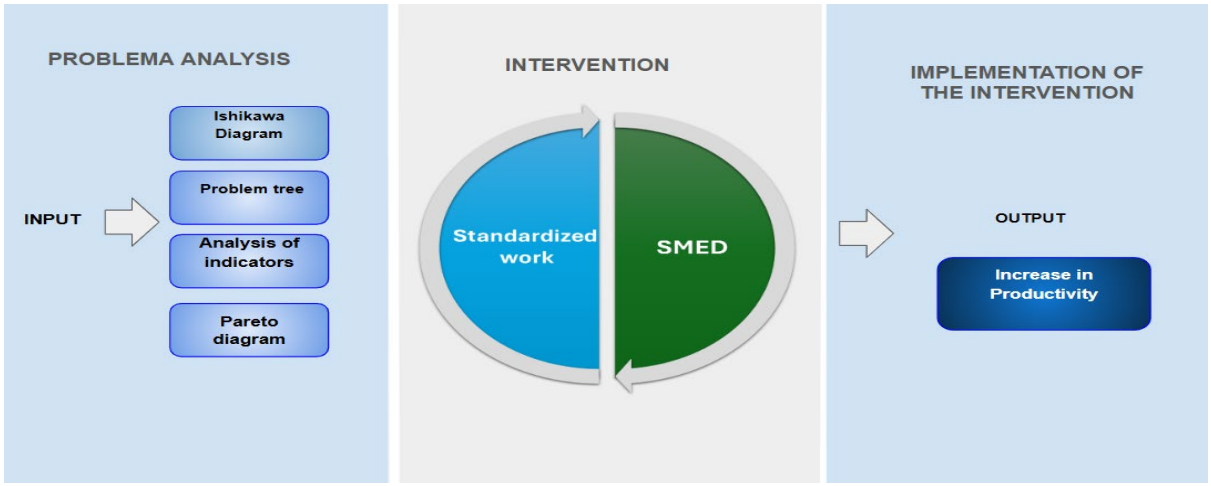

Figure 1. Proposed model

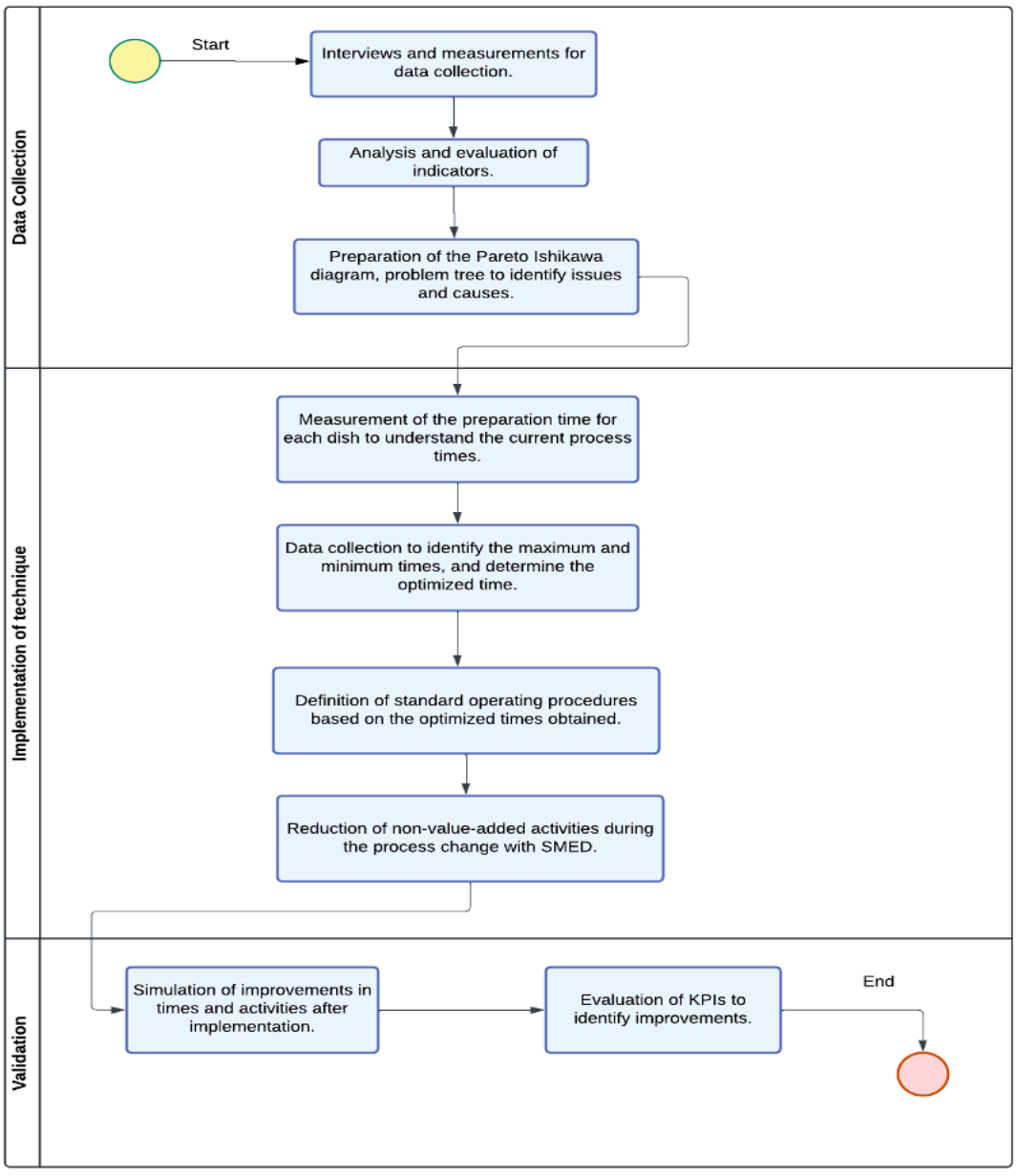

Figure 2. Diagram of the results

4.1. Implementation of Standardized Work and SMED

The implementation of standardized work at Anticuchería Angelita Grill aims to identify key processes and develop precise operational standards for each of them. This procedure begins with a detailed analysis of current processes, followed by the implementation of specific standards across different stages of order preparation. A continuous monitoring system was also established to evaluate compliance with these standards and make the necessary adjustments to optimize processes and increase the restaurant's productivity. To ensure accurate measurement of the time required to prepare each dish, a time study was conducted focusing on the most important activities in the process. This study meticulously recorded the duration of each task involved—from ingredient selection to final presentation to the customer. In particular, the preparation times of the three most frequently ordered dishes were measured. The systematic collection of this data provided a solid foundation for process standardization, enabling a more accurate understanding of operational times and facilitating data-driven decisions aimed at continuous improvement. The specific activities analyzed, the time measurements obtained, and the corresponding standardizations are summarized in Table 1, Table 2, and Table 3, respectively.

Table 1. Standard Time for "Mixto Anticuchero" before improvement

No	Operation	Standard Time before the upgrade	Responsible
1	Select portions	3 minutes	Assistant
2	Peel and cut potatoes	3 minutes	Assistant
3	Husk corn	2 minutes	Assistant
4	Fry anticuchos with rachi, pancita, and choncholí	8 minutes	Cook
5	Plate dish	2 minutes	Cook

Table 2. Standard Time for "Pulpo Anticuchero" before improvement

No	Operation	Standard Time before the upgrade	Responsible
1	Cut octopus	4 minutes	Assistant
2	Peel and cut potatoes	3 minutes	Assistant
3	Husk corn	2 minutes	Assistant
4	Peel and cut avocado	2 minutes	Assistant
5	Fry	12 minutes	Cook
6	Plate dish	2 minutes	Cook

Table 3. Standard Time for "Lomo Saltado" before improvement

No	Operation	Standard Time before the upgrade	Responsible
1	Cut meat	3 minutes	Assistant
2	Peel and cut vegetables	5 minutes	Assistant
3	Saute vegetables	3 minutes	Cook
4	Sear meat	6 minutes	Cook
5	Cook and combine meat	1 minutes	Cook
6	Fry potatoes	5 minutes	Cook
7	Plate dish	3 minutes	Cook

Following these calculations, it was determined that the current standard preparation times for the three most popular dishes are as follows: *Mixto Anticuchero* — 18 minutes, *Pulpo Anticuchero* — 25 minutes, and *Lomo Saltado* — 26 minutes. These results revealed that such times significantly influence the customer waiting time indicator, as the total execution time for all activities is relatively high—especially considering that customers are waiting for their orders at the counter. In response, the SMED (Single-Minute Exchange of Dies) methodology

was applied to reduce preparation times and improve operational efficiency. The validation of the SMED tool was conducted in line with the prior analysis, evaluating current activities to propose a new workflow for dish preparation. All processes were considered—from the customer's arrival to their departure—simulating dish selection and calculating the waiting time. A key aspect of this approach was understanding how customers perceive wait times, which was assessed through surveys. The results showed that:

- If the waiting time is between 0 and 25 minutes, it is considered acceptable.
- If it exceeds 25 minutes but is less than 30 minutes, it causes discomfort and may lead the customer to leave.

This scale reflects the critical importance of wait time in customer satisfaction and its impact on retention. In a competitive market, where service quality is a key differentiator, the ability to deliver orders promptly and efficiently is essential for maintaining customer loyalty and ensuring a positive dining experience. In this context, the average order preparation time—assessed in relation to the established tolerance limits—provides valuable insight to support the implementation of the SMED tool. Additionally, the total number of activities involved in the preparation of each dish is presented, including a breakdown between internal and external tasks. This helps identify concrete improvement opportunities and redesign workflows to significantly reduce operational times. These results, including the preparation times and task classifications, are detailed in Table 4.

Table 4. Activity Distribution

Dish	Internal Activities	External Activities	Total
Mixto Anticuchero	4	1	5
Pulpo Anticuchero	5	1	6
Lomo Saltado	6	1	7

The following are the current indicator results. Data was collected on a Saturday, considered the restaurant's busiest day for orders. This information provided a baseline for evaluating the impact of the proposed improvements on productivity and service quality:

- Cancelled Orders (%): $\frac{Cancelled\ Orders}{Total\ Orders}\ x\ 100 = 11.11\ \%$
- Average Waiting Time: $\frac{Total\ Waiting\ Time}{Number\ of\ Customers} = 32\ minutes$
- Productivity: $\frac{Dishes\ Ordered}{Man{-}Hours} = 1.656\ units/H - H$
- Overall Cycle Time: $\frac{Total\ Time\ Inside\ the\ Restaurant}{Number\ of\ Customers} = 57\ minutes$

5. Results and discussion

After the implementation of the proposed improvements, a significant reduction was observed in the average customer wait time, which decreased from 32 minutes to 21 minutes, representing a savings of 11 minutes. This reduction has facilitated more efficient service, enhancing the overall customer experience at the restaurant. These results are supported by previous studies that demonstrate the effectiveness of Lean practices in reducing wait times (Hasugian et al., 2020; Xue & Zhang, 2022). Similarly, the overall cycle time experienced a reduction from 57 minutes to 46 minutes, representing an improvement of 11 minutes. This optimization has increased operational efficiency, allowing the restaurant to process more orders in less time, thus improving its capacity and productivity. This aligns with findings from research indicating that Lean techniques can significantly improve process efficiency in the service sector (Somphanpae & Boonsiri, 2016; Polas et al., 2018). In terms of customer satisfaction, the percentage of dissatisfied customers decreased from 59.875% to 33.91%, representing a reduction of 25.965%. This improvement reflects a significant increase in customer comfort and satisfaction during their visit, supporting the importance of customer comfort for loyalty, as highlighted in other studies on the topic (Lahap et al., 2018; De Vries et al., 2018). Additionally, the issue of order cancellations, which previously accounted for 11.11% of all orders, was completely eliminated. This improvement has not only reduced revenue losses but has also improved the restaurant's reliability and efficiency perception. Research shows that cancellations can be minimized through the implementation of Lean management techniques (Xun et al., 2014; Mao et al., 2019). As a result of these improvements, a substantial increase in the restaurant's economic benefits is anticipated. The number of customers served daily increased from 29 to 47, representing an additional 18 customers. This growth has led to an 11% increase in sales. These projections serve as the basis for a detailed three-year economic analysis,

evaluating the long-term feasibility and sustainability of the implemented strategies and their impact on the restaurant's financial performance.
Below is the simulation of the improved situation (Figure 3, Figure 4, Figure 5):

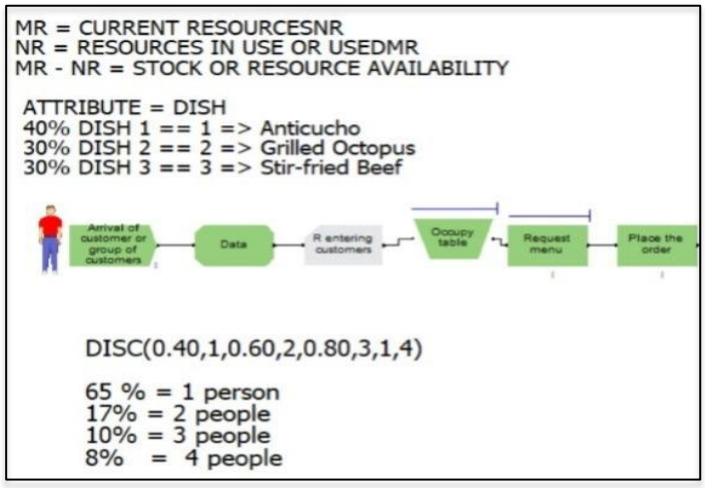

Figure 3. Average incoming clientele to the restaurant

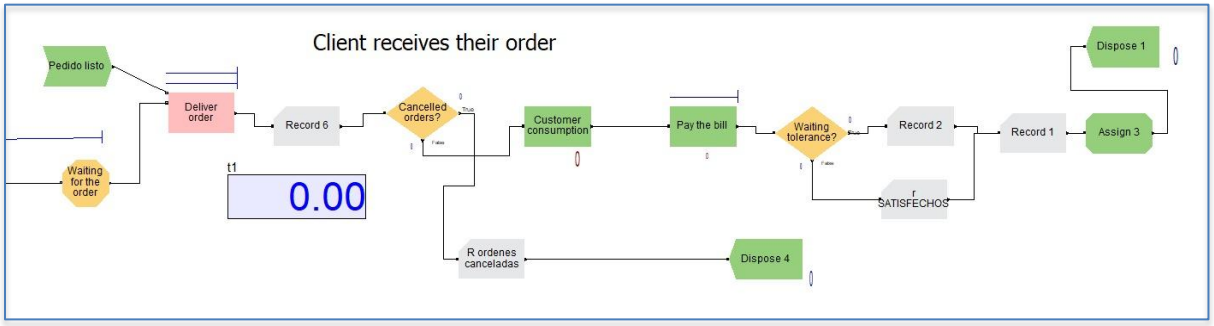

Figure 4. Food preparation processes

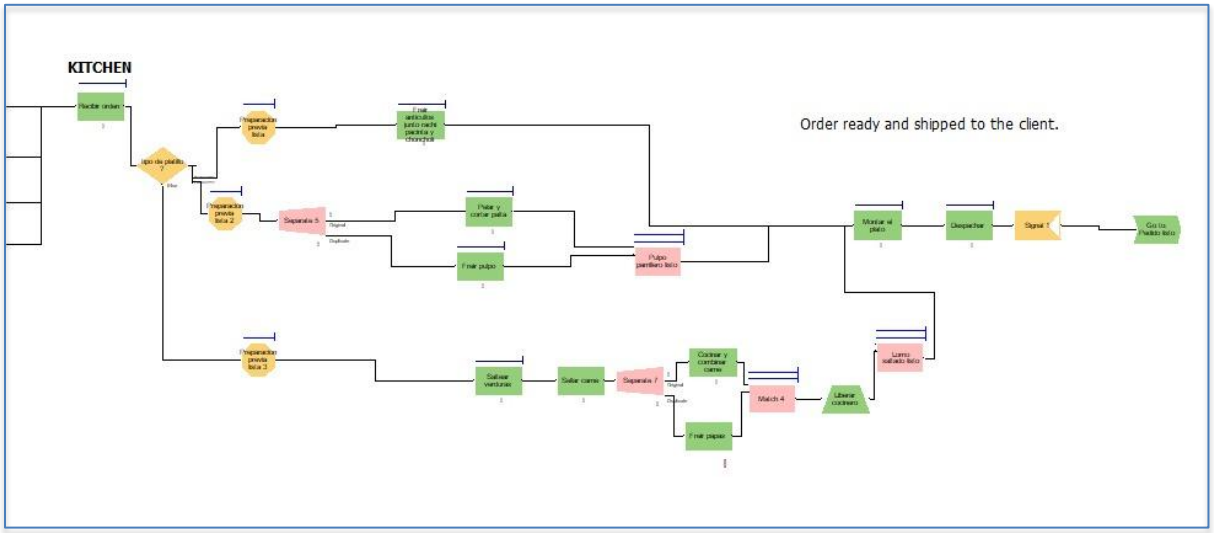

Figure 5. Customer receives their order

5.1. Numerical Results

The indicators after the implementation of the improvements are as follows, considering that for the order fulfillment level, the average of attended and unattended demand during the improvement implementation period was used:

$$Customer\ wait\ time: = \frac{Sum\ of\ wait\ times}{Number\ of\ customers} = 21\ minutes$$

$$Overall\ cycle\ time: = \frac{Sum\ of\ times\ within\ the\ restaurant}{Number\ of\ customers} = 46\ \ minutes$$

$$Productivity: = \frac{Dishes\ ordered}{H-H} = 1.875 \text{units/ H-H}$$

$$\%\ of\ canceled\ orders: = \frac{Canceled\ orders}{Total\ orders} * 100\% = 0\%$$

5.2. Graphical Result

In this section, the results obtained after the implementation of Lean Service tools at the restaurant Anticuchera Angelita Grill are presented, using SMED, standardized work, and Kaizen over a period of three weeks. The results are shown in relation to the key performance indicators (KPIs) associated with wait times, canceled orders, and operational productivity.

The preparation process for Mixto Anticuchero was optimized by combining activities that were previously done independently, such as cooking anticuchos with rachi, pancita, and choncholí. Through the SMED (Single-Minute Exchange of Dies) methodology, tasks that could be done outside of customer service hours were identified, allowing for a reduction in cooking time without compromising the dish's quality. This not only sped up preparation but also allowed for more efficient allocation of the cook's time. On the other hand, the standardization of the plating process also contributed to improving time, as there is now a clear and precise procedure for plating, eliminating variability between different operators and reducing the risk of errors. This ensured that the time spent on each dish was consistent, thus optimizing workflow in the kitchen. The results of these improvements in the Mixto Anticuchero preparation process are presented in Table 5.

Table 5. Elimination of Unnecessary Activities for "Mixto Anticuchero" After the Improvement

No	Operation	Standard Time before the upgrade	Responsible
1	Fry anticuchos with rachi, pancita, and choncholí	8 minutes	Cook
2	Plate the dish	2 minutes	Cook

For Pulpo Anticuchero, the reduction in time spent peeling and cutting avocado was achieved by reorganizing tasks in the kitchen. Using SMED, certain activities, such as preparing ingredients that do not need to be directly involved in the service, were brought forward, allowing the kitchen to continue operating during peak hours. This reorganization eliminated downtime and reduced unnecessary effort from the staff. Additionally, the standardization of the plating process also favored the reduction of times. With an established process, work overload was avoided, and time efficiency was optimized for getting each dish ready to be served to the customer. These improvements in preparation and plating times for Pulpo Anticuchero are detailed in Table 6.

Table 6. Elimination of Unnecessary Activities for "Pulpo Anticuchero" After the Improvement

No	Operation	Standard Time before the upgrade	Responsible
1	Fry ingredients	12 minutes	Cook
2	Peel and cut avocado	2 minutes	Assistant
3	Plate the dish	2 minutes	Cook

Lomo Saltado is one of the most demanded dishes and, therefore, a key area for time improvement. Thanks to the implementation of SMED, preparation times were reduced, especially in the stages of searing meat and cooking and combining the meat, two activities that traditionally consumed more time during preparation. The implementation of continuous flow techniques and the use of appropriate cooking equipment allowed for the reduction of these times without affecting the quality of the dish. On the other hand, the standardization of the

plating process also helped speed up the final stage of service. By having a clear procedure for each step, variability in preparation and plating was eliminated, significantly reducing times in the process. The specific time reductions achieved for Lomo Saltado are summarized in Table 7.

Table 7. Elimination of Unnecessary Activities for "Lomo Saltado" After the Improvement

No	Operation	Standard Time before the upgrade	Responsible
1	Sauté vegetables	3 minutes	Cook
2	Sear meat	6 minutes	Cook
3	Cook and combine meat	1 minute	Cook
4	Plate the dish	3 minutes	Cook

5.3 Validation

The proposed model was validated after the implementation of the SMED and standardized work tools. Below are the results obtained after the application of the improvements. The outcomes of the model validation process are consolidated in Table 8.

Table 8. Comparison of indicators between scenarios

Indicator	Initial Situation	Improved Situation
Customer wait time (min)	32 minutes	21 minutes
Overall cycle time (min)	57 minutes	46 minutes
Productivity	1.656 units/ H-H	1.875 units/ H-H
% Canceled orders	11.11%	0%

The wait time was reduced from 32 minutes to 21 minutes, achieving an improvement of 11 minutes. This contributes to faster service and a better experience for customers. The overall cycle time decreased from 57 minutes to 46 minutes, optimizing the restaurant's operational capacity. The percentage of canceled orders reduced from 11.11% to 0%, indicating an improvement in the efficiency of the ordering processes. With these results, it is confirmed that the proposed model has met the established objectives, and if it continues to be implemented, further improvements are expected in the future.

6. Conclusion

It is concluded that the implementation of the proposed model, based on Lean Service tools, led to a significant improvement in the company's operational indicators. Specifically, the average waiting time was reduced from 32 to 21 minutes, the overall cycle time decreased from 57 to 46 minutes, and productivity increased from 1.656 to 1.875 dishes per man-hour. Additionally, all order cancellations were completely eliminated, reflecting greater efficiency in customer service.

These improvements demonstrate the effectiveness of the proposed model in optimizing processes and enhancing competitiveness in the restaurant sector. It is essential to have historical data and accurate records of operational times in order to strengthen indicator analysis, reduce errors, and facilitate decision-making aimed at continuous improvement.

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