ISBN: 978-628-95207-8-1. ISSN: 2414-6390. Digital Object Identifier: 10.18687/LACCEI2024.1.1.141

Improving Service Levels in the Hotel Industry through a Lean Service Model: A Case Study

Ana Ampuero-Rodas, BSc[1], Jordana Palma-Farfan, BSc[1] and Juan Quiroz-Flores, Ph.D.[1]
[1] Faculty of Engineering, Industrial Engineering Career, Universidad de Lima, Perú
20190098@aloe.ulima.edu.pe, 20193204@aloe.ulima.edu.pe and jcquiroz@ulima.edu.pe

***Abstract* - Companies in the hotel sector aim to offer a high level of service to their customers. However, factors such as cleanliness and customer service make it challenging to obtain the expected results. For this reason, an operations model was developed that combines Lean tools such as 5S, Poka Yoke, and standardized work tools to increase customer satisfaction in a hotel in Cuzco, Peru. The results obtained from implementing the model through a pilot test and a simulation test using Arena software proved the model's performance since the Satisfaction Level increased from 78.48 to 80.13 and the Net Promoter Score from 24.22% to 33.22%. This research concludes that the proposal increases the satisfaction of the company's customers, which translates into higher revenues. It is also significant in providing valuable information for Peru's hotel and tourism sector, thus improving the industry's quality and competitiveness.**

Keywords-5S, Poka Yoke, Standardized Work, Customer Satisfaction, Lean Service

I. Introduction

In Peru, the tourism sector has positioned itself as a crucial economic force for growth. In 2022, it contributed 2.1% to the national GDP, and that same year, it received 3.2 million visitors [1], generating 980,000 jobs nationwide [2]. This sector has different economic activities, including lodging for visitors. This subsector has recently recovered from the impact of the COVID-19 pandemic, during which there was a decrease in income due to government restrictions; however, the level of service offered by some lodging facilities continues to deteriorate, reaching less than 80, which according to the Ministry of Foreign Trade and Tourism (MINCETUR) is the minimum for a good rating [3]. The leading causes of this problem are poor staff attention and service, lack of cleanliness and hygiene, inadequate infrastructure, and Internet, among others [4].

Another area for improvement in the hotel sector is achieving a high NPS (Net Promoter Score), which measures customer satisfaction in terms of their recommendation of the service offered to others. To achieve an excellent level of 50 or more, improvements must be made in customer service and attention, perfecting the user experience, and satisfying guests' needs. Unfortunately, this international standard has not been reached in Peru since our country has an NPS value of 38 [5].

For the reasons mentioned above, this study focused on identifying and improving the operational processes of a hotel located in Cusco, Peru, intending to increase its service indicators through a Lean Service model that combines 5S tools, standard work, and Poka Yoke. This benefits customer experience and satisfaction, as well as having a positive impact on the hotel's reputation and profitability. The research will also provide valuable information for other actors in the Peruvian hotel and tourism sector, contributing to improving the quality and competitiveness of the industry. The value proposition arises from the fact that it is uncommon to find applications of the Lean Service methodology in SMEs of the hotel sector. The hotel sector articles should have focused more on applications to small and medium enterprises.

This scientific article is structured in 6 blocks: introduction, literature review, contribution, validation, discussion, and conclusion.

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II. Literature Review

A. Satisfaction level and NPS in the hotel or similar sector

A crucial starting point for improving satisfaction in the hotel industry lies in actively valuing customer feedback. A Logit model, a statistical regression analysis, has revealed a positive association between satisfaction levels and customer recommendations [6]. This finding is based on evaluating customer reviews and ratings of hotel performance, which facilitates understanding their perceptions and opinions about the establishment [7]. These reviews constitute a considerable information source contributing to understanding customers' needs and expectations [8]. In addition, these metrics, particularly those linked to service quality, become invaluable in stimulating investment within the company [9]. Implementing the lean approach in the hotel environment provides notable advantages in terms of efficiency and quality, including cost reduction, increased productivity, improved customer satisfaction, and management optimization [10].

B. 5S in the hotel sector or similar sector

One of the most used methods within the lean manufacturing approach is the 5S. This method contributes to ensure an upgraded work environment and avoid process delays. [11]. A proper arrangement and organization of the elements necessary for the service is essential to achieve greater efficiency. Research has shown that incorporating the 5S

method into the hotel industry leads to a 20% increase in the number of rooms cleaned by employees within their regular working hours by organizing the pantry to meet the entire day's operational requirements, this eliminates the need for resupplying halfway through the day. [12]. Moreover, additional research shows that applying 5s can save about 25,000 EUR per year when it's applied to the hotel industry to achieve order and cleanliness [13]. Specific actions for effective inventory management through the 5S method include visual aids for item identification and labelling [14], which supports previous studies. Ultimately, all these contributions improve productivity scores, ranging from good to excellent, and reflect the positive impact of applying the 5s on workplace quality, staff morale, and safety [15].

C. *Standardized work in the hotel sector or similar sector*

Another widely recognized tool within the context of lean manufacturing is standardized work. This approach involves breaking down a complex process into smaller, more manageable steps and thoroughly describing each step [16], ensuring a high level of service [17]. Implementing standardized work significantly improves the process flow since each worker acquires a detailed knowledge of the routes and the precise time to perform their tasks. In addition, it has been claimed that adopting standardized work reduces the total process cycle time [18], which translates into more excellent value for the customer and, consequently, increases the level of service offered. The results of its application have shown a significant increase in customer loyalty, reaching 60.81% [19].

D. *Poka Yoke in the hotel or similar sector*

Poka Yoke is a highly recommended tool for error prevention and improvement of operational efficiency [20]. Its application is oriented towards minimizing operator error [21]. It has been identified that significant delays in the intake process usually derive from "unintentional errors" generated by distractions or lack of concentration on tasks, being effectively addressed by error prevention strategies, such as the Poka-Yoke approach [22]. This tool proves to be a helpful resource when focused on identifying and eliminating activities that do not add value, as well as improving the quality and delivery time of the service [23]. In addition, its implementation reduces process variations, consequently improving an entity's productivity and overall performance [24]. Its application has been shown to optimise the operations in a medium-sized Hospital as it reduced the average process time, reflecting an 8% improvement [25].

III. Contribution

In the Peruvian hotel sector, it is observed that some companies exhibit considerably lower levels of service and NPS compared to other industries. The company under study is among those with these reduced levels. After an exhaustive analysis, it has been identified that delays in the room cleaning process and check-in procedure are the primary factors underlying this problem. For this reason, a proposed solution takes as a guide the steps, recommendations, and proposals for implemented tools previously applied by various researchers in the literature consulted. Table I lists the main articles addressing the same problems as the present research.

TABLE I
COMPARATIVE MATRIX OF THE OBJECTIVES OF THE PROBLEM VS. THE STATE OF THE ART

Scientific Articles	Causes or Objectives			
	Warehouse management	**Reduction of time waiting**	**Reduction of errors**	**Stabilizing the process**
[13]	5S	5S		
[14]	5S	5S		Standardized Work
[17]		Standardized Work		Business Process Management
[20]		Standardized Work and 5S	Analysis of the 5 why	Standardized Work
[21]	Preventive maintenance		Visual Help and Poka Yoke	
[22]		5S	Poka Yoke	
Proposal	**5S**	**Standardized Work**	**Poka Yoke**	**Standardized Work**

A model is proposed based on the application of engineering tools: 5s, standard work, and Poka Yoke, following the Lean Service methodology. Within the hotel industry, these tools have been minimally applied to solve problems related to customer satisfaction in MSEs. This investigation represents a contribution allowing companies in the same sector and size to improve this indicator using the proposed model. This model will be applied to mitigate the root causes found in the context of the studied company, increasing the satisfaction level. Fig. 1 represents the proposed model of operation based on Poka Yoke, 5s, and Standardized Work tools.

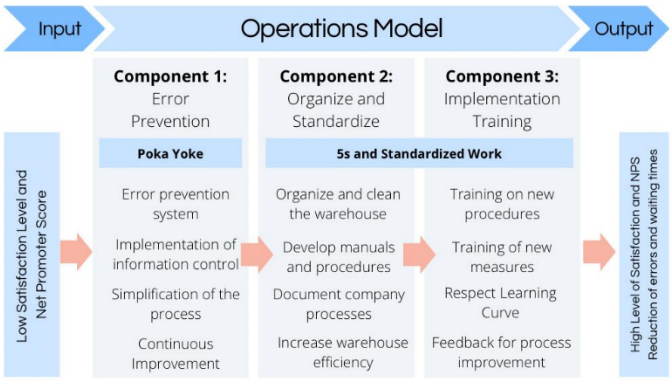

Fig. 1: Proposed Operating Model

A. Components of the model

The proposed model has three components: error prevention, organization and standardization, and implementation and training. The first component includes applying the Poka Yoke tool through the implementation of visual controls that will reduce the errors made during this process. The second component applies the 5s tools and standardized work, allowing less time to be spent on the processes. Finally, the third component also contains a part of 5s and standardized work, but they are later stages of learning and continuous improvement.

Phase 1: Error prevention

The diagnosis found that errors cause delays in the guest admission process and so-called check-in. During phase 1, the Poka Yoke tool, adapted to the case study, will be implemented.

Phase 2: Organize and standardize.

The 5s and standard work tools adapted to the case study are applied in this stage. First, the first 4s, Seiri, Seiton, Seiso, and Seiketsu, will be implemented to create a system of organization and cleaning of the warehouse to reduce the time spent searching for items.

Likewise, the standard work tool will be applied, increasing the efficiency of the processes by standardizing them and establishing a working model used by all workers performing the same process. Implementing a defined sequence of activities for the cleaning and guest registration processes will help to reduce time and stabilize both processes.

Phase 3: Implementation Training

This last stage is intended to be an educational and training process designed to provide employees with the skills, knowledge, and competencies necessary to implement the new system successfully in the organization. This training focuses on ensuring that employees are prepared and empowered to implement the required changes and take full advantage of the implementation. Likewise, self-evaluations will be carried out to check the model's functioning and identify areas for improvement. Fig. 2 shows the flow chart with the steps to implement the proposed model.

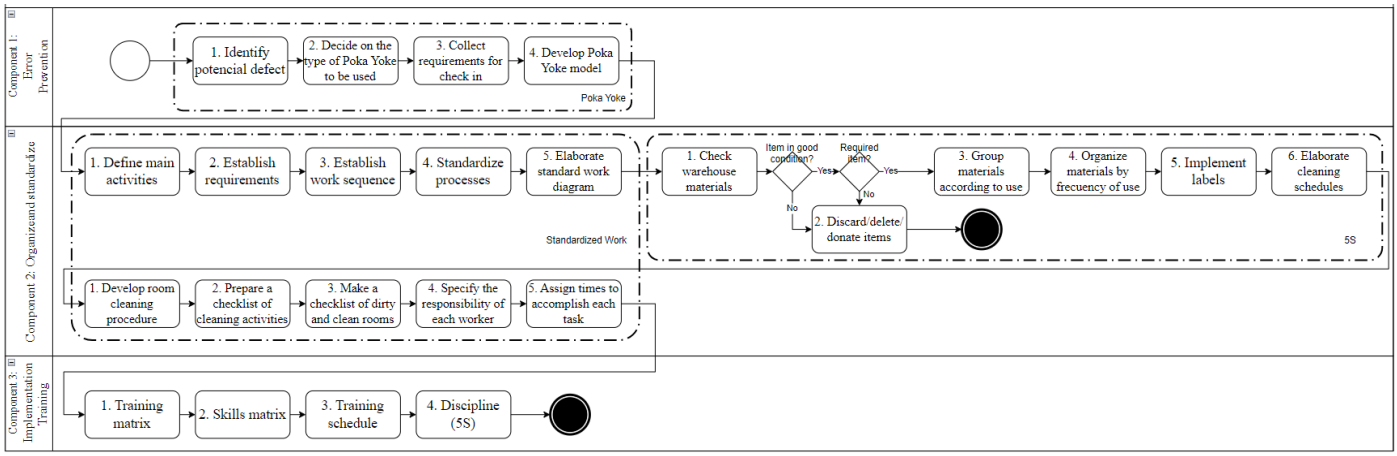

Fig. 2: Operations model flowchart

B. Model indicators

A. Level of satisfaction: Customer satisfaction refers to a measure that indicates the degree to which consumers are satisfied with the service offered by the company. Initially, this value was 78.

$$Level\ of\ satisfaction = Average\ user\ ratings\ x\ 10$$

B. NPS: Indicator that measures clients' probability of recommending the service to others. At the beginning, this value was 24.22%.

$$NPS = \%Promoters - \%Detractors$$

C. Cleaning time per room: This indicator measures the total time used to clean a room, from when the tools are collected from the storage room. The initial value is 50 minutes.

$$Total\ cleaning\ time = Average\ cleaning\ time$$

D. Check-in time per customer: This indicator measures the total time spent to perform customer check-in during check-in. The initial value is 20 minutes.

$$Total\ register\ time = Average\ register\ time$$

E. Percentage of error: Allows identifying the percentage of records made with errors. The initial value is 10.5%.

$$Error = \frac{(1 - N\ registered\ customers)}{Total\ registered\ customers} x100$$

IV. Validation

A. *Initial diagnosis*

The initial analysis revealed the presence of technical gaps concerning Satisfaction Level and Net Promoter Score. According to information from the Ministry of Foreign Trade and Tourism, the national average for the Satisfaction Level is 83.1 points [5]. In contrast, the company registered a score of 78.08, which indicates an opportunity for improvement of 4.62 points in this indicator. Similarly, the report states that the industry average for the Net Promoter Score is 38% [5], while the company reported 24.22%, showing an opportunity for improvement of 13.78%. The technical gaps generate an estimated opportunity cost of S/62,350, equivalent to a 30.15% economic impact on annual revenues.

The Pareto diagram analysis identified two predominant root causes: delays in the registration process (40.34%) and room cleaning (33.61%). Subsequently, after a time study and the application of the TIS technique (Problem Identification Technique), it was determined that these delays are mainly caused by errors in the collection of information (14.12%), inadequate organization of the cleaning warehouse (20.17%) and lack of standardization in the corresponding processes (65.71%). Thus, it was determined that the correct tools would be Poka Yoke and Standardized Work for the guest check-in process and 5S and Standardized Work for the room cleaning process. Fig. 3 and Fig. 5 present the current system model of the guest registration process and the current system model of the room cleaning process, respectively. While Fig. 4 and Fig. 6 show both systems improved.

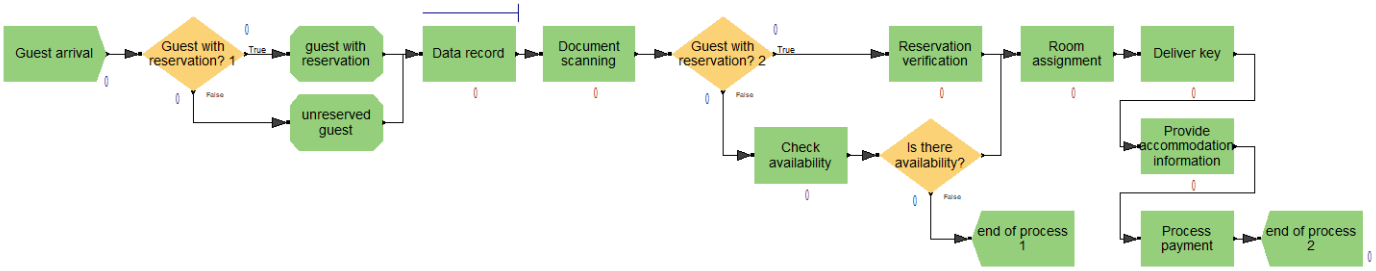

Fig. 3: Current system model of the guest registration process

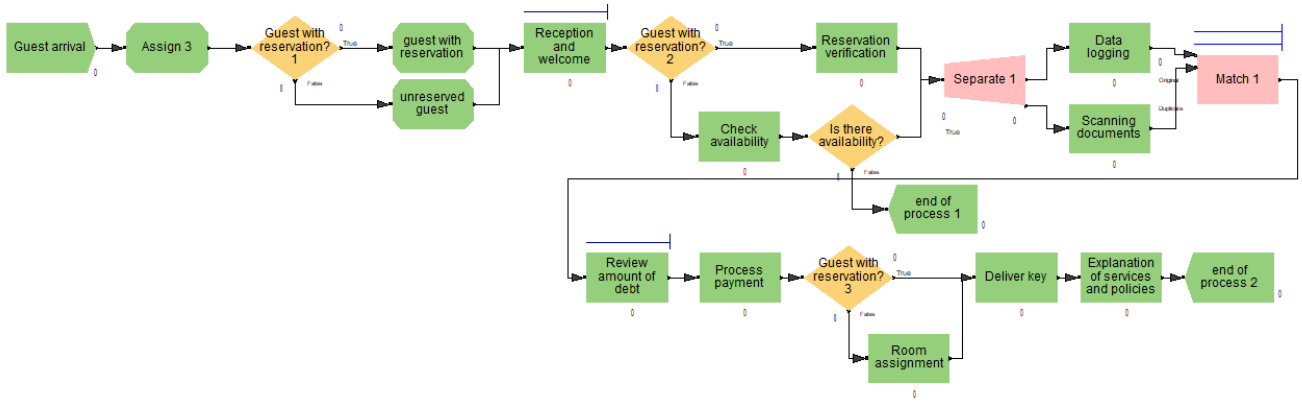

Fig.4: Improved system model of the guest registration process

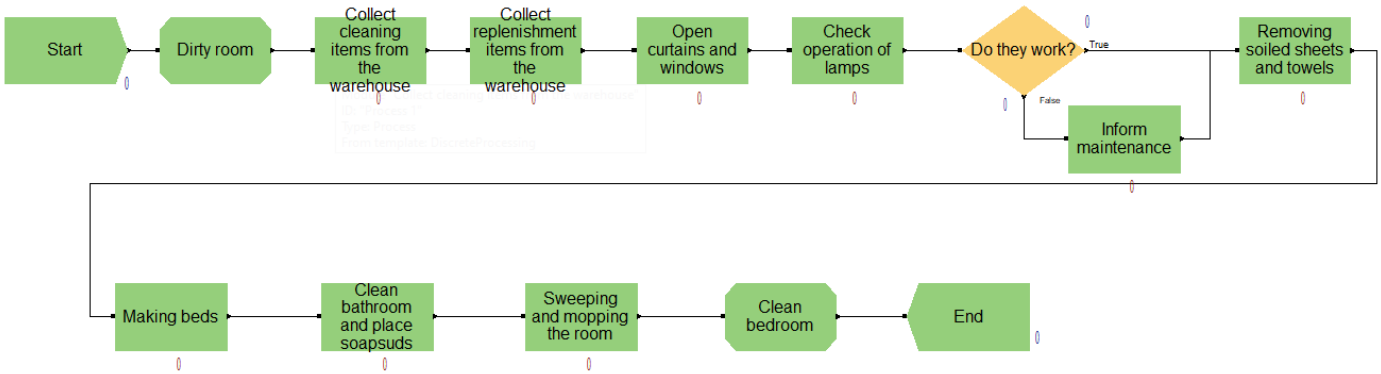

Fig. 5: Current system model of the room cleaning process

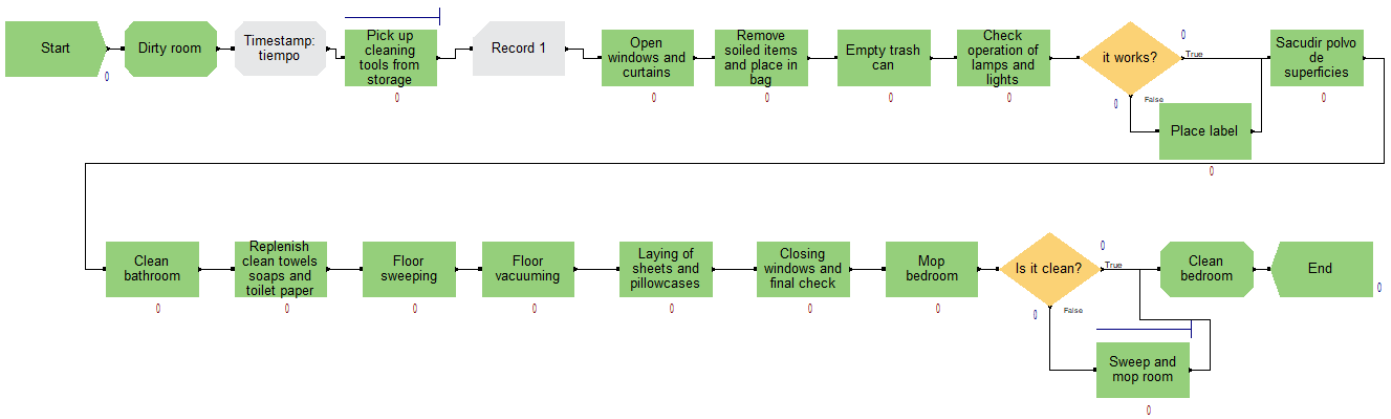

Fig.6: Improved system model of the room cleaning process

B. *Validation scenario*

Two different techniques were used to demonstrate the effectiveness of the applied tools. First, the processes were simulated using Arena software. In addition, a pilot test was carried out over 45 days. Both methods were applied independently to the new guest check-in and dirty room cleaning processes.

The Arena simulation software designed the sequence of the current process and the improved process. First, the scope of the problem was established, defining the check-in process from the guest's arrival at the reception to the completion of the regularization of the documents. The scope also covered the cleaning process, from identifying a dirty room to cleaning it completely.

Subsequently, each system's input variables, entities, and resources were defined. The same formula was used to calculate the sample size. In both cases, we defined an error of 10% and a Confidence Level of 90. We had 363 observations for the registration process and 225 for the cleaning process. Applying the formula shown below, the sample size was determined, estimating 140 and 47 samples for each process.

$$n = \frac{N\sigma^2 Z^2}{(N-1)e^2 + \sigma^2 Z^2}$$

$$n_1 = \frac{363 * 0.9145^2 * 1.641^2}{(363-1) * 0.1^2 + 0.9145^2 * 1.641^2} = 139.22 \approx 140$$

$$n_2 = \frac{225 * 0.465^2 * 1.641^2}{(225-1) * 0.1^2 + 0.465^2 * 1.641^2} = 46.42 \approx 47$$

Next, the simulation model was created. The models corresponding to the host registration process are represented in Fig. 3 and 4, respectively, showing the initial and final situation. Fig. 4 reflects the model with the Poka Yoke and Standardized Work implementation improvements.

Similarly, the room cleaning process models are presented in Fig. 5 and 6. Fig. 6 shows the improvements achieved by implementing 5S and Standardized Work. Finally, the number of replications for each process was 515 and 127, respectively. This approach ensured representative and reliable results were obtained in the simulation study.

C. *Application of proposed model in the case*

1. Implementation of the Poka Yoke

This tool was deployed in the registration process by implementing a form. The form was designed to be completed by the guests and is intended to replace the previous manual registration. Access to it will be given by scanning a QR code. By delegating data registration to the guest, the receptionist can take advantage of the time to move on to other aspects of the process, significantly reducing the time spent on registration. For the development of the virtual form, unnecessary or redundant information that used to be requested was eliminated. In addition, the fields were configured so they do not admit incorrect values, thus minimizing possible errors. The initial guest registration form and the proposed one are presented in Fig. 7 and Fig. 8, respectively.

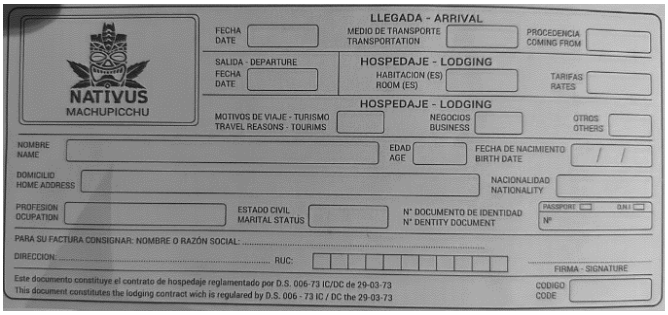

Fig. 7: Initial guest registration form

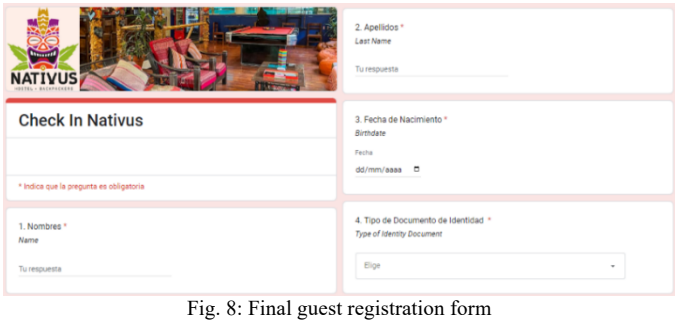

Fig. 8: Final guest registration form

To address the delay in the process, registration times were recorded during the days of the pilot test. Over the 45 days of data collection, 363 people's registration times were recorded.

2. Implementation of the Standardized work

The first step in implementing the tool in the guest registration process was to define and prioritize the fundamental and necessary activities. This approach enabled establishing a clear structure, eliminating ambiguities, and reducing unnecessary variations in the process. Subsequently, the correct sequence of activities was established, the result of which is illustrated in Fig. 9.

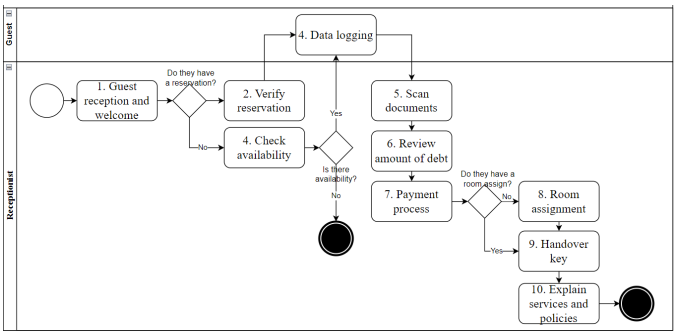

Fig. 9: Flowchart of guest registration process

Next, the time dedicated to each activity was standardized. This standardization reduced the total process time, which will be discussed later. Finally, a standard work diagram was drawn up, shown in Fig. 10. This tool visually represents the flowchart previously described. It is a clear and detailed guide, facilitating the constant monitoring of the established work method.

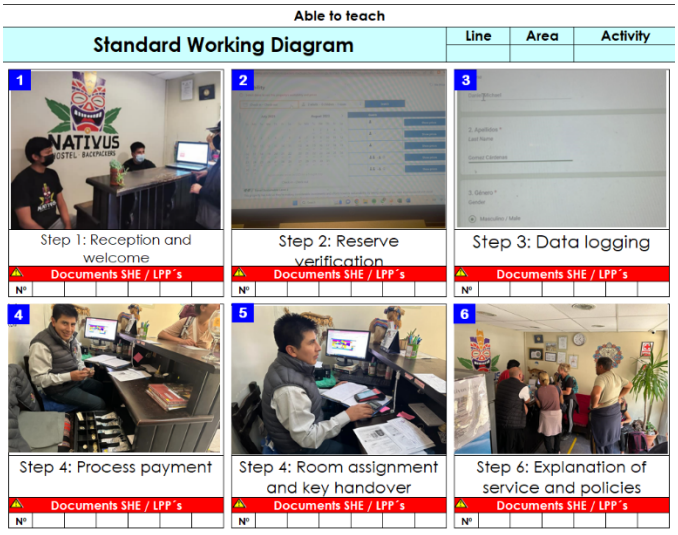

Fig. 10: Standard work diagram of the guest check-in process

The exact process was established for the room cleaning process, which the workers will carry out in an orderly, fast, and efficient manner.

A time study was carried out to examine cleaning a matrimonial room. After measuring the cleaning process performed by a worker, an average total time of approximately 50 minutes per room was obtained, considering that this process did not initially follow a specific sequence since each worker performs the sequence of activities that seems most effective.

For this reason, the activities that make up the cleaning process and add value to it were defined to achieve the desired order and reduce time using specific work instructions. This flow is shown in Fig. 11. Also, as shown in Fig. 12, a standard work diagram was drawn.

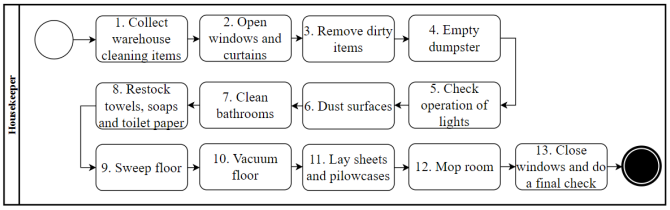

Fig. 11: Flow chart of the cleaning process

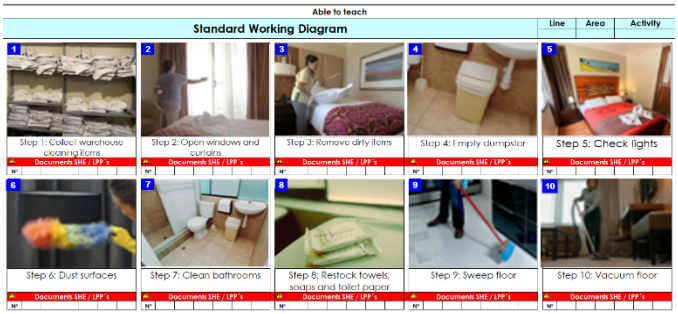

Fig. 12: Standard work diagram of the cleaning process

Secondly, it was verified that this new sequence and procedures would help improve efficiency, so a new study of standardized operation times was carried out. This new study was done based on the work of employees with average experience in the company in charge of cleaning rooms to measure the performance of an average employee. This process confirmed that the new work sequence reduced the total time from 50 to 30 minutes.

Finally, with the information gathered, a standard work diagram was drawn up, which contains a visual summary of the activities to be carried out, the list of elements required, and the ideal time to perform each activity.

The corresponding training was conducted for the registration and cleaning processes to ensure the new procedures were correctly applied according to the established guidelines. In addition, supervisors were trained so that after the training, they could follow up with employees to verify compliance with the standards.

3. Implementation of the 5S

Seiri (Sort): The first "S" refers to identifying the elements inside the warehouse to classify them and eliminate all those that are not important or in bad condition. During the inspection, expired cleaning utensils, brooms, and mops in poor condition, empty product bottles, and all unnecessary items for

the cleaning process and take up space in the warehouse should be recorded.

To prevent these unnecessary items from accumulating, a monthly inventory review was planned, where all materials were classified according to 3 categories: damaged but recoverable is an item that is damaged but can be repaired; obsolete is an item that the cleaning staff will no longer require; useless are products in terrible condition, expired, deteriorated, in other words, items that can no longer be recovered. The identification cards used are shown in Fig. 13.

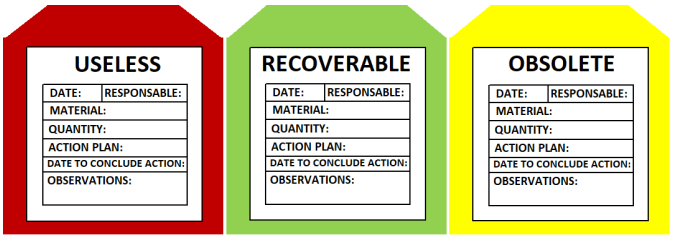

Fig. 13: Element identification cards

Later, a survey was conducted by the workers to classify the elements they considered unnecessary in the warehouse according to the above criteria. This survey was also used to decide on the action plan to be followed and the item's destination.

Seiton (Organize): For the organizing stage, designated locations were established for each cleaning material and supply type. Also, as shown in Fig.14, products were logically organized and clearly labeled for easy identification and access.

Fig. 14: Before and after implementation 5s

Seiso (Clean): SEISO thoroughly cleans the warehouse's work area. This step is crucial because it helps maintain the company's sanitation since some of these items are taken to the rooms and come into direct contact with the guests. A cleaning plan was drawn to keep the area in optimal condition. This plan, presented in Fig. 15, will be filled out weekly by the cleaning supervisor, assigning each employee a specific task and the time at which it should be carried out.

Cleaning area	Items/objects to be cleaned	Source of contamination	CLEANING PLAN							
			Schedule: 7:00-7:30 am			Approved by:			Start date:	Finish date
			Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Responsible
Shelves and shelving	Cleaning products, supplies	Polvo, derrames								
Floor	Floor surfaces	Polvo, manchas, residuos								
Storage area	Shelves, cabinets	Polvo, desorden								
Labels and signaling	Labels, signs	Desgaste, suciedad								
Containers and accessories	Buckets, garbage bags	Residuos, derrames								

Fig. 15: Cleaning plan

Seiketsu (Standardize): The objective is for the improvements that have been implemented to be maintained and become a standard to continue the work efficiently. Personnel were trained to follow the established procedures and to maintain order.

Instructions were created that include the improvements implemented, allowing employees access to the necessary information that can be easily applied in their daily work.

Shitsuke (Disciplinary): Internal audits were conducted to monitor the progress of implementing 5s in the management of the cleaning warehouse. In addition, 20-minute daily employee trainings were conducted to explain these changes and share knowledge about 5s in case they were unaware.

A 5s panel was implemented, where documents reflecting the actions taken for improvements, before and after photographs, self-evaluation forms, action plans, cleaning plans, and all the necessary information to educate workers can be seen. Finally, as presented in Fig 16, a final 5s audit was conducted to measure and compare the results with the initial situation. The audit results indicate an 80% improvement in the 5s score.

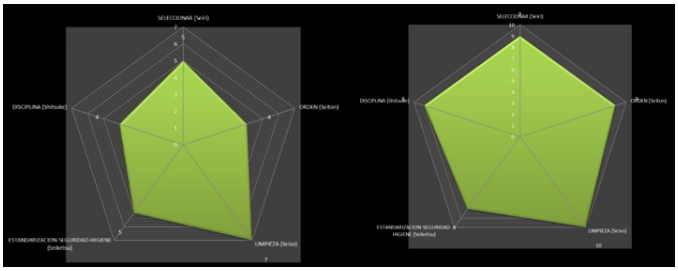

Fig. 16: 5s Audit before and after

D. Results of the application of proposed model

After implementing the previously developed tools, the results are presented in Table II and will be developed by components.

TABLE II
INDICATORS INITIAL SCENARIO VS. IMPROVEMENT PROJECT

Indicator	Initial Situation	Improvement	Δ%
Satisfaction Level	78.48	80.13	2.10%
Net Promoter Score	24.22%	33.22%	37.16%
Registration time	20.56 min	14.56 min	30%
Room cleaning time	50 min	30 min	40%

V. Discussion

A. Initial vs. final scenario

1. Component 1: Error prevention

Regarding implementing error prevention strategies before implementation, an approximate error rate of 10.15% was calculated for guest registration. Employees previously performed this activity, representing a waste of time and a significant risk of error.

The reduction in the number of errors is because, in the pilot test, the users themselves were the ones who registered their data. The fields containing information such as dates or only numbers were delimited, so it was impossible to enter data that did not correspond. Additionally, implementing the virtual form reduces the partial time of the activity by 41%, which helps to reduce the total time of the process. Comparing these values with the literature, similar values could be found in a commercial SME, where the use of Poka Yoke helped to reduce 35.64% of the errors [26]. Table III shows that these results improved by 24.83% over what was expected.

TABLE III
Comparison Of As Is Vs. To Be Indicators

Tool	Indicador	Unit	As Is	To Be	Δ%
Poka Yoke	% error	%	10.5%	4.15%	-60.47%

2. Component 2: Organize and standardize

For the second component, process standardization and 5S tools were implemented. The results are shown in Table IV.

TABLE IV
Indicators Initial Scenario Vs. Improvement Project

Tool	Indicador	Unit	As Is	To Be	Δ%
Standardized work (registration)	Registration time per customer	Minutes	20.56	14.56	-29.18%
Standardized work (cleaning)	Cleaning time per room	Minutes	50	30	40%

First, the registration process had an initial total time of 20.56 minutes. After implementing the tools described throughout the research, the average registration delay decreased to 14.56 minutes. The resulting indicator achieves an improvement of 29.18%, 3.94% less than that achieved in a commercial SME, whereby implementing Standard Work the process time was reduced by 33.12% [26].

Secondly, for the room cleaning process, the literature mentioned that the average cleaning time per room should be 30 minutes [20]. After the implementation of 5S and standardized work, the time was reduced from 50 to 30 minutes, achieving the initial objective.

3. Component 3: Implementation Training

Component 3 included employee training on the tools applied and new procedures. Initially, a 5s audit was performed in which 25 points were obtained, meaning a low work environment performance. After the implemented improvement, it was increased to a score of 45, which represented a variation of 80%, this was due to the new cleaning and order parameters proposed, managing to comply with the proposed standards more effectively than in the initial situation. However, this does not exceed what was proposed by the authors [13] since, in their study, they managed to increase the score to 46 points. These results are presented in Table V.

TABLE V
Indicators Initial Scenario Vs. Improvement Project

Tool	Indicador	Unit	As Is	To Be	Δ%
5S	5s Audit	Points	25	45	80%

B. Future work

The closure of this research, aimed at improving service and customer satisfaction in the hotel industry by adopting engineering tools such as 5S, Poka-Yoke, and Standardized Work, opens new horizons for future studies. It is proposed to explore integrating innovative technological tools, such as Process Automation, to optimize the management of reservations and registrations and personalize the guest experience.

In addition, research into real-time tracking technologies and data analytics to improve room cleaning and everyday area management efficiency is being considered. These future research efforts aim to drive the cutting edge of hotel service delivery, maintaining a constant focus on excellence and customer satisfaction as the cornerstones of the industry.

VI. Conclusions

In conclusion, implementing Lean Service techniques resulted in significant improvements in operational processes, validated through experience in a company in the hotel sector in Cusco, Peru. The selected strategies, such as 5S, Poka Yoke, and Process Standardization, were suitable for addressing the root causes identified in the company. It is relevant to highlight the scarcity of specific literature focused on implementing these tools in service sectors, mainly the hotel and tourism industries.

The application of the proposed model, supported by Lean Service tools, demonstrated notable improvements in the hotel's service indicators. These improvements are evidenced by an increase in the Net Promoter Score (NPS) from 24% to 33% and an increase in the level of satisfaction from 78 to 80 points. These improvements were primarily attributed to reduced guest check-in and room cleaning times.

The specific implementation of Poka Yoke and Standardized Work resulted in a 30% decrease in check-in time and an error rate of less than 5%. On the other hand, incorporating 5S and Standardized Work in the room cleaning process achieved a 40% reduction in total process time.

It is essential to emphasize that these results are based on a study focused on a single company in the sector, limiting the findings' generalizability. Therefore, implementing similar techniques in other entities of the same industry is encouraged to enrich further research and validate the universal applicability of these tools in the service sector.

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