

Operations Model based on Mixed Methodologies to Increase Customer Satisfaction in a Hotel Industry Company

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Abstract

This work focuses on building an operations model based on DDMRP methodologies, Supplier Management, and process standardization to enhance the hotel's NPS (Net Promoter Score). It was found that the critical process that needed optimization is "housekeeping" and the management of bed linen inventories. The contribution of this work to the literature lies in applying engineering improvement concepts to a service-oriented company, specifically a hotel, which is scarce in existing literature. The proposed model demonstrated the expected results in improving the housekeeping process and ensures an NPS higher than the sector's average of 38 points.

Keywords

NPS, Housekeeping process, Process Standardization, DDMRP, Provider Management

1. Introduction

The coronavirus pandemic adversely affected all productive sectors worldwide. Many of these sectors resorted to telecommuting to survive; however, the tourism sector, and more specifically, the hotel industry, did not have that option. The World Travel and Tourism Council (WTTC) reported that globally, 62 million jobs were lost in the Travel and Tourism sector due to Covid-19 (Ministry of Foreign Trade and Tourism - MINCETUR, 2022).

However, the pandemic led to a nearly 50% reduction in the tourism GDP, directly impacting the country's labor force. The article "National Strategy for the Economic Reactivation of the Tourism Sector" (MINCETUR, 2022) shows a slight recovery of the global GDP by 0.2% between 2020 and 2021, although it remains far below pre-Covid levels. According to the "National Strategy for the Reactivation of the Tourism Sector", the pillars for becoming more competitive in the face of competition are quality, facilitation, inclusion, and safety.

In the province of Lima, and more specifically in the district of Miraflores, there is intense competition in the hotel industry. Some consider this a positive aspect, as corporations are constantly evolving and adapting to customer needs.

However, there is an oversupply compared to demand, leading to continuously decreasing prices and reducing profit margins for hotels. This is particularly concerning given that the capital required to invest in the hotel sector is significantly higher compared to other industries.

The problem identified in the literature within the sector leads us to the case study of a hotel located in the district of Miraflores, in the city of Lima, Peru. Upon verifying that the company in question has a low level of customer satisfaction compared to industry standards, it was found that customers were dissatisfied with the "Housekeeping" area, which refers to internal cleaning and care. This process is often the core of the hotel's operations, as the guest's perception of the quality of service primarily relies on it. Within this process, we identify that the main problem lies in the delays caused primarily by poor inventory management and a lack of standardization in room cleaning protocols, as well as a deficiency in best practices with the laundry service provider. We acknowledge that DDMRP is an excellent tool for inventory management. In fact, it has been demonstrated through statistical models in real cases that DDMRP yields better results than MRP II and management tools based on Kanban/Lean models in two productive companies, displaying consistent inventory levels with almost non-existent stockouts or inventory disruptions (Miglio et al., 2019). Moreover, it has been demonstrated that companies in the retail sector can enhance and optimize inventory turnover by implementing Service Level Agreements (SLAs) (Chen, 2018). On the other hand, researchers Kusumawati et al. (2021) aimed to add greater economic value to coconut fiber, which is obtained as a byproduct when using coconut as fuel for cooking in Indonesia, highlighting the importance of standardizing production processes for the product to become viable.

1.1 Objectives

The main objective of this article is to propose an improvement operations model and put it into practice to increase customer satisfaction, represented by the Net Promoter Score. After identifying the main problem and root causes, engineering tools such as DDMRP, supplier management concepts, SLAs, and work standardization were employed to reduce the average room cleaning time, mitigate sudden stockouts, minimize expenses related to bed linen and towel losses, and enhance operations with suppliers. This research stands out as the first to analyze the impact of utilizing such tools in a hotel industry company.

The following scientific article is divided into eight important sections: abstract, introduction, diagnosis, state of the art, contribution, validation, discussion, and finally, conclusions.

For the next section of the work, research was conducted on the following topics related to the project, reviewing the literature to explore contributions from authors who have implemented the proposed tools.

2. Literature Review

Improvement of Service Level in the Hotel Sector and/or Similar Industries

For the hotel industry, being able to measure, interpret, and improve the level of service offered to customers is a fundamental aspect for business development, as it is an industry based on customer satisfaction. To achieve this, many studies rely on service improvement methods through the measurement of online customer satisfaction reviews. Some authors have developed a model that predicts customer satisfaction using a neuro-fuzzy system that collects data from current hotel reviews post-pandemic (Gang & Chenglin, 2021). Similarly, other researchers use online reviews as a way to dynamically measure and evaluate customer satisfaction in hotels by applying the DIPCA (Dynamic Iterative Principal Component Analysis) model through a case study (Ye et al., 2022). The IPMA model is also employed to extract valuable information for key service quality dimensions that predict customer satisfaction with each category of lodging establishments (Nunkoo et al., 2020). Additionally, some studies apply CRM and structural equation modeling to compare the environment provided by a hotel with the perceived customer satisfaction, specifically in themed hotels (Chen & Lin, 2022). Furthermore, other research applies CRM concepts across different nations to compare customer satisfaction levels, analyzing the differences in factors they consider and the outcomes observed in hotels (Palazzo et al., 2021).

In general, it is concluded that service quality attributes that influence customer satisfaction differ significantly among establishments with different star ratings (Nunkoo et al., 2020). Therefore, it is necessary to improve various processes according to the hotel's star rating.

It is evident, then, that to enhance the level of service in a hotel, an analysis of customer satisfaction is required to identify areas for improvement and optimize related processes to achieve favorable outcomes. However, there is a lack of studies providing detailed insights into the improvement of specific processes in hotels, with clear evidence of enhanced guest satisfaction. Therefore, it is necessary to demonstrate how directly enhancing a specific process in a hotel will lead to the improvement of customer satisfaction.

Supplier Management in the Hotel Sector and/or Similar Industries

Supplier management requires various tools and skills that promote good relationships and continuous improvement for both the company and the contracted supplier, as both parties should benefit. This proves to be a challenge for all industries, not just the hotel sector. In this case, we focus on research related to service outsourcing. The authors combine Transaction Cost Economics (TCE) with Organizational Performance Improvement Theory (OPIT), considering the nature of service subcontracting in the choice of governance mechanisms and empirically testing the simultaneous effects of contract specifications and monitoring of service outsourcing (Ye et al., 2022).

Others contribute to a better understanding of the implications of outsourcing at the operational planning function level in the pharmaceutical sector (Chen, 2018). On the other hand, many authors focus on improving Service Level Agreements (SLAs) for supplier management, both in the retail sector (Mubeen et al., 2018) and in the Internet of Things industry (Omar et al., 2020). SQM models are based on the SLAs established with suppliers. They utilize each factor in these agreements to develop a supplier evaluation platform through a mathematical model (Nilashi et al., 2021). They even propose contracts with suppliers where SLAs have restrictions and purchase options (Boulaksil & Fransoo, 2010).

Standardized Work in Hotel Sector Services

Some authors construct a morphological analysis framework that identifies the areas of work that need further investigation regarding Lean Six Sigma (LSS) and service companies (Sunder et al., 2018). Standardization is a familiar concept today that helps organizations achieve a better quality-price relationship. However, the implementation of design standardization in the capital projects sector has been scarce. The objective of this research is to identify the Critical Success Factors (CSFs) that lead to successful design standardization in capital project facilities and their associated enablers (Choi et al., 2020). The same author, a few years earlier, also delved into modularization, conducting a study aimed at developing a business case model for supporting decision-making processes in modularization. To achieve this goal, a model was developed based on the Construction Industry Institute's modularization business case process and industry practices (Choi et al., 2019). In tropical countries, it is common to use resources such as coconuts in daily life; in Indonesia, coconut is used as cooking fuel. However, researchers identified that the fibers from this material could be utilized to create natural dyes for Batik, but it couldn't be commercialized without standardizing the production process first (Kusumawati et al., 2021).

Standardized work, as the name suggests, allows for the standardization of any type of process. Sometimes, we may not realize it, but we standardize many processes ourselves in our daily lives. In the service sector, it is crucial to implement this tool, especially in the hotel industry. It ranges from the simplest tasks, such as making a bed, to more complex ones, like dealing with an arrogant customer. If the service provided is not consistent for all customers within the same category, it could result in losing the customer and, consequently, a decrease in the company's revenue. As important as this tool is, it can be laborious. Constant evaluation and updating of processes are required, always striving to enhance quality and meet the standards that customers expect.

DDMRP and Resource Management in Hotel Sector Services and/or Similar Industries

When it comes to inventory management, the most common tool used by companies is MRP II. However, many authors suggest that Demand Driven MRP (DDMRP) can be much more convenient and accurate. Several authors have conducted comparisons between both tools, including comparisons in later studies between DDMRP and Kanban/Lean production concepts through simulation experiments (Miclo et al., 2016). Other authors collected information from a case study based on a multinational manufacturing company to implement DDMRP methodology and analyze its results (Velasco Acosta et al., 2019). They even apply simulation models generated with characteristics of a complex manufacturing environment in terms of BOM levels and 14-buffer positioning to analyze the impact of its production complexity on DDMRP (Miclo et al., 2019).

The results are highly significant, as some authors found that when implementing DDMRP in real companies, it resulted in a 52.53% reduction in inventory while material consumption increased by 8.7% in a multinational

manufacturing company (Velasco Acosta et al., 2019). Even in simulated environments that were more complex than usual, customer satisfaction levels improved by 41%, and the average available stock decreased by 18% (Miclo et al., 2019). When implementing MRPII, the distribution tends to be quite flat, with a high probability of having excess inventory at some points and stockouts at other times. However, the distribution is not bimodal as suggested. On the contrary, with DDMRP, the trend is much more centralized, and in most scenarios, stock does not reach danger zones (Miclo et al., 2016).

3. Methods

This research is based on a mixed-methods operations model aimed at increasing customer satisfaction in a hotel industry company. The objective is to align the hotel's standards with current customer expectations, meeting their needs, and consequently, enhancing the company's productivity and profitability. The study proposes the use of relevant typologies, such as improving service levels in the sector, including the neuro-fuzzy system that predicts customer satisfaction by gathering information from current hotel reviews post-pandemic (Gang & Chenglin, 2021). Another aspect addressed is supplier homologation, where many authors focus on improving Service Level Agreements (SLAs) for supplier management (Chen, 2018). Finally, typologies like DDMRP (Velasco Acosta et al., 2019) and standardized work in conjunction with Lean Six Sigma (Sunder et al., 2018) were used in Table 1.

Table 1. Comparison Matrix of Proposed Components vs State of the Art

Components	Supplier Management	Standardization of Work	DDMRP
Vijaya Sunder et al, 2017	Lean Six Sigma	Lean Six Sigma	Demand Driven Material Requirements Planning (DDMRP) and Lean Six Sigma
Chun-Miin Chen, 2018	Service Level Agreements (SLAs).	Standardized work, Service Level Agreements (SLAs)	Demand Driven Material Requirements Planning (DDMRP) and Service Level Agreements (SLAs)
Alaitz Kortabarria et al, 2018	Demand Driven Material Requirements Planning (DDMRP)	Demand Driven Material Requirements Planning (DDMRP)	Demand Driven Material Requirements Planning (DDMRP), Customer satisfaction and Reduction in average available stock.
Proposal	Service Level Agreements (SLA), Demand Driven Material Requirements Planning (DDMRP) and inventory management	Standardized work and inventory management of supplies.	Demand Driven Material Requirements Planning (DDMRP) and inventory management.

The model presented below will be applied to the case study company mentioned. Based on the diagnosis conducted, it was possible to identify that the company exhibits a low level of customer satisfaction, as evidenced by the calculated Net Promoter Score (NPS) below the average. This is primarily caused by delays and inefficiencies in the hotel's "housekeeping" process, for which a detailed analysis was developed to identify the root causes of the problem. As a result, the following root causes were identified: Errors in defining the service level by the supplier, resulting in 18.6% of orders being delivered with delays; poor inventory management, leading to an average of 8.2% stockouts per year; and a non-standardized room cleaning and bedding replenishment process, causing the studied hotel's cleaning to take 79.27% more time than the industry standard for the sector, resulting in an average of approximately 12 more rooms cleaned per 8-hour shift compared to other hotels. The model is showed in Figure 1.

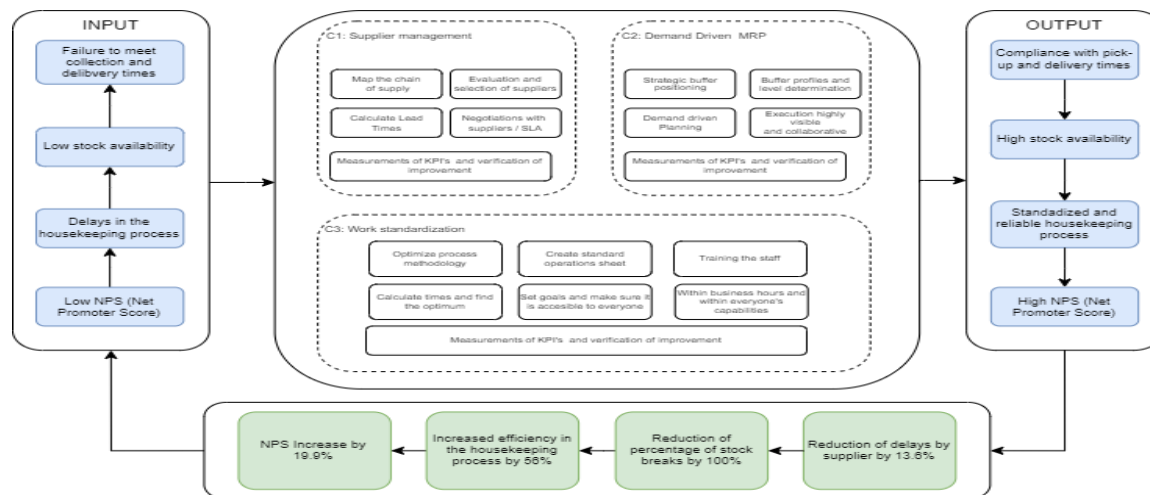


Figure 1. Mixed-methods based Operations Model to Increase Customer Satisfaction Level in a Hotel Industry Company.

The first component involves Supplier Management, aiming to establish an optimal level of service agreement that not only ensures stable and measurable delivery times but also enhances the overall business relationship and fosters continuous improvement. To achieve this, a detailed mapping of the laundry service supply chain is required to identify critical points that impact the performance of the service provided by the supplier.

The second component involves the implementation of Demand Driven MRP (DDMRP), which requires clear SLAs with the supplier, ensuring confirmed delivery times or lead time for the laundry service provider. The application of this component begins with the strategic positioning of inventory, ensuring that bed linens and towels are in an environment that allows for flexibility in movement and ease of storage. It also involves defining the buffer profiles and determining the appropriate level for each inventory item, considering their respective lead times.

Finally, the third component is the standardization of the process. As the name suggests, the main goal is to standardize all processes in such a way that any operator or employee of the company can repeat it and achieve the same or a similar result. The primary focus is on optimizing time without compromising the quality of the final product, while always ensuring to meet all customer needs. The objective is to streamline processes without compromising the final product's quality.

4. Data Collection

To test the effectiveness of the proposed improvements, it is necessary to collect data and measure them through indicators.

- 1) *Percentage of orders received late. The objective is to get 5%.*

$$\frac{\text{N}^{\circ} \text{ of orders recieved late}}{\text{N}^{\circ} \text{ of orders taken}} \times 100$$

- 2) *Average stock outs. The objective is to get 0%.*

$$\frac{\text{Supplied quantity}}{\text{Requested amount}} \times 100$$

- 3) *Efficiency of the Housekeeping process. The objective is to increase by 50%.*

$$\frac{\text{Real activity time}}{\text{Average activity time in the industry}} \times 100$$

- 4) *Net Promoter Score (NPS). The objective is to reach a NPS of 38 points minimum.*

$$(\% \text{ of promoters} - \% \text{ of detractors}) \times 100$$

5. Results and Discussion

The following results and process of the pilot test is presented:

Standardization of Work

The implementation of work standardization in the hotel's housekeeping process resulted in significant achievements. There was a substantial reduction in the average time required to complete the cleaning and restocking of rooms, decreasing by over 50% compared to the initial time. This systematic approach and the training of staff under the supervision of Nelson Aguilar, the Housekeeping Supervisor, allowed for the standardization of activities, ensuring that the entire team adhered to the established standards and performed tasks efficiently. As a result, most guests found their rooms in optimal conditions upon their return, positively impacting customer satisfaction and increasing the likelihood of their return to the hotel.

Furthermore, the implementation of quality and safety standards ensured that the process was carried out properly, protecting both the workers and the guests. This culture of continuous improvement strengthened the hotel's reputation and contributed to greater customer loyalty. Overall, work standardization proved to be a successful strategy for enhancing the efficiency and quality of the housekeeping process, with potential benefits for other hotels and service-oriented companies seeking to optimize their processes and services.

Supplier Management

The focus on supplier management for the appropriate selection of bed linen and towels has resulted in significant achievements for the hotel. Using the factor ranking, key criteria such as product quality, delivery reliability, experience in the hotel industry, and costs were identified and evaluated. After a rigorous evaluation process, it was determined that the current supplier is the most suitable for the hotel, ensuring a consistent and quality supply to meet the guests' needs.

The establishment of a solid service agreement with the selected supplier ensures a successful and mutually beneficial business relationship. This agreement is based on the prioritized criteria determined through the factor ranking, ensuring that quality, cost, and service standards are met.

Additionally, periodic performance evaluations will monitor and analyze the supplier's performance in key aspects, such as the quality of delivered products and adherence to agreed-upon timelines. The close collaboration between the hotel and the owned laundry facility ensures effective communication and timely supply of bed linen and towels to provide quality service to guests.

In conclusion, the implementation of this pilot plan has significantly improved the hotel's supplier management, ensuring exceptional experience for guests and establishing a solid foundation for more effective supplier management in the future. The hotel will continue to seek continuous improvement in this process to ensure its long-term success. In addition to the pilot test, a simulation was conducted to analyze the results of implementing DDMRP.

5.1 Numerical Results

These results leave us with the following indicators, considering the pilot test and the simulation, showed in Table 2:

Table 2. As Is / To Be Indicators

Components	Indicators	As Is	To Be	Variations
Stamdarization of work	Process Efficiency in Housekeeping	32	17.85 ± 1 min	56%
DDMRP	Average Stockouts	8.2%	0%	-8.2%
Supplier Management	Percentage of Stock Supply Orders Fulfilled with Delay.	18.6%	5%	-13.6%

5.2 Graphical Results

The simulation was conducted using Arena software to analyze the impact of implementing DDMRP. The scope of the system was determined, including the optimal size of runs, entities, and resources.

As this simulation focuses on inventory levels, the system scope begins with the hotel at maximum capacity, considering the use of all 70 rooms over a period of 1 year, where the usage of beddings and towels is constantly reflected, including their daily change per room, the laundering process, and replenishment.

The times for all activities involved in the cycle of beddings and towels usage were recorded, including the laundry service. The controllable and uncontrollable variables of the model are shown in Table 3.

Table 3. Variables of the Beddings and Towels Usage Cycle in the Hotel

Controllable Variables	Uncontrollable Variables
Quantity of beddings and towels	Loss of beddings and towels
Supply Quantity	
Usage and laundry times	

The entities of the current system were determined, which will be modeled as each of the components of the room, that is, each of the types of towels and beddings specific to each room type. The attributes used serve specifically for the cloning and respective grouping of entities when transferring between the areas of towel and bedding usage within the system. As it is not a production process involving machinery, no resources were utilized in the model. The improved version of the simulation is showed in Figure 2, considering the cycle of runs is equivalent to one year from start to finish.

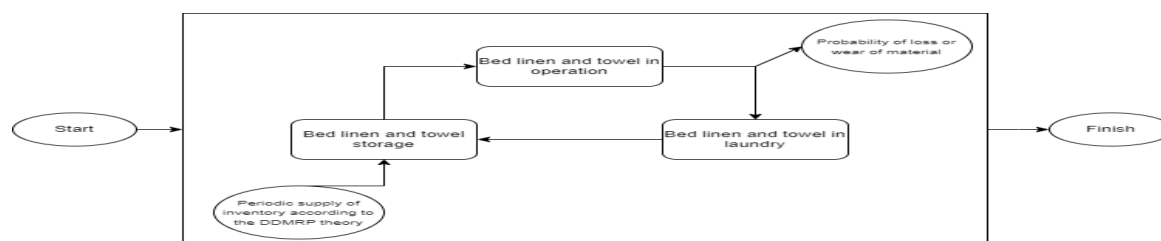


Figure 2. Simulation Model of the Improved System

To calculate the optimal number of replications for this simulation, a preliminary sample of 30 replications was considered. A desired half width of 5.96 was established, and 2 runs were performed. In the first run of the simulation, a half width of 13.66 was achieved, and it was used in the following formula, resulting in 158 replications. After taking the 158 replications, it is considered the optimal number as it gives us a desired half width of 5.21 and a confidence interval of (52.56; 62.98) at a 95% confidence level.

5.3 Proposed Improvements

For this section, three new scenarios were proposed for the simulation section of our project. Due to the nature of the project, it is only possible to propose new scenarios for discussion in the simulation, as the other components were validated through a pilot test, as shown earlier.

This point focuses on the application of DDMRP for the management of inventory of bed linens and towels. Since the conducted simulation considered a regular year of operations, the following three scenarios are proposed for years 2, 3, and 4. The results of the proposed scenarios can be observed in Table 4.

5.4 Validation

It is normal to observe no differences in the results of the scenarios as they reflect the effectiveness of implementing DDMRP in a simple inventory supply management, such as that of a hotel. By accurately calculating inventory movements and correctly determining buffer profiles, considering delivery times and variations, it is possible to avoid stockouts by 100%.

Table 4. Percentage Difference in Different Scenarios

Components	Indicators	Scenario 1	Scenario 2	Scenario 3
DDMRP	Average Stockout	0%	0%	0%

Regarding the economic impact, the model allowed us to quantify the lost inventory in the current model, delimited by the variable "times not filled (entity)". This enabled us to calculate the number of times that the demanded rooms were not supplied throughout the year, resulting in an opportunity cost of \$16,872, considering an average ticket price of \$112.48. This means that, considering the 4 years of new scenarios, the hotel managed to avoid a cumulative opportunity cost of \$67,488.

6. Conclusion

It is important to note that all the scenarios have a significant limitation since the simulation conducted spans a one-year period, assuming the hotel is at 100% capacity with no variation in room occupancy. This implies that the usage of beddings and towels would remain constant across the different scenarios, and the losses calculated by the Arena 16 software are merely based on a probability percentage.

To accurately demonstrate the improvement in guest satisfaction, it is recommended to conduct a large-scale survey with a sample of real hotel customers after one year of implementation. This survey will help determine whether the process improvement indeed increased the Net Promoter Score (NPS) to the expected levels.

In conclusion, the proposed operations model, based on mixed methodologies and focused on supplier management, presents a comprehensive and systematic approach to address operational challenges in the hotel sector. By identifying root causes of issues such as delays and inefficiencies in the housekeeping process, a solid framework is established to enhance customer satisfaction and increase company productivity. The implementation of components such as supplier management, Demand Driven MRP, and process standardization provides effective tools to optimize

operational performance and ensure service quality. This approach, supported by empirical evidence and best practices in operations management, has the potential to yield positive results and contribute to advancing knowledge in both academic and business domains.

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