Waste reducing efforts in the kitchen area of the hotel industry using lean management (a case study of XYZ hotel in Bogor)

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Abstract. In the hotel kitchen, the production activities, from preparing raw materials to serving dishes, potentially produce waste. This research investigated the application of lean management in the kitchen area of the hotel industry and to find out its suitability and the possibility to optimize resources. Lean Assessment, Value Stream Mapping (VSM) preparation, and priority selection of lean tools with Analytical Hierarchy Process (AHP) were used as the methods. Results revealed that the lean assessment on the production aspect, namely the multi-skill worker and 5S, have been implemented. Based on the VSM, breakfast dish products are processed in semi-finished form during the day and then left for a particular time to be re-processed before breakfast time. There are three lean tools priorities calculated using AHP, (1) the application of a pull system both in production and at suppliers, (2) forming a Kaizen team, (3) visual management, and four criteria weighted by pairwise comparisons, (1) Implementation costs, (2) Implementation Time, (3) Relating to Hotel KPI, and (4) Sustainability of results. The final values of the total alternative priorities show that the highest weight values are Kaizen team (0.643), visual management (0.283), and implementation of Kanban (0.074), consecutively.

1 Introduction

1.1 Background

Indonesia is a famous country destined for foreign and domestic tourists due to many attractive tourist places. Along with Indonesian tourism, the hotel industry is expanding and playing an essential role in the economy and society. Such progress can create a chain and distribution of income for the region. However, tourism and hospitality businesses face future challenges, significantly reducing costs and restructuring internal processes to be more efficient. This action is done because there is a lot of competition in the hotel industry, which tends to compete in price and service

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quality. Moreover, lately, the hotel industry has been negatively affected by the COVID-19 pandemic, which has affected its revenue.

The hospitality industry must adopt strategies or methods to improve service efficiency, such as reducing costs and time to win the competition. These challenges have been successfully met in other industrial sectors, especially the manufacturing industry, with a lean management approach. Unfortunately, this lean approach is not very popular in the hospitality industry, although some have implemented it [1]. A very dynamic/fluctuated customer demand and a partial implementation of the lean approach in this sector might influence this.

According to the lean service concept reported in the research of Andrés-López et al. [2], it explains that waste in the industry can be categorized into 7 types, namely excess, delay, unnecessary transportation and displacement, quality levels that are less than standardization, disruption in customer demand, and resources with low utility. Since these types of waste can also occur in the kitchen area of the hotel industry, implementing the lean approach in this part would benefit the hotel industry. Studies of the application of Lean in the hotel industry have begun with various tools and specific area objects of study, for example on warehouse hotel management using 5S [1], supply chain hotel using SIPOC Approach [3] and working process on hotel room using Eliminate, Combine, Rearrange, and Simplify (ECRS) tools [4]. However, not all of the selected tools of lean are suitable at all for the hospitality area. The influence of the managerial implications of lean on medium and small hotel scales has been conducted by Vlachos et al. [5]. However, not many are enhanced with prioritizing lean tools, especially by using the Analytical Hierarchy Process (AHP). The objective of this work is to investigate the potential application of Lean Management tools in the hotel area and to make prioritization using the AHP Methods. a case study of XYZ Hotel in Bogor, and to determine their suitability and the possibility to optimize resources, especially in the kitchen area.

1.2 Literature review

In the context of lean management, lean is essentially defined as being flexible, agile, and concise. Lean is a package of principles, methods, and actions for the productive configuration of the processing activity. The main goal of lean management is to create value without generating waste. Value is any action or process that customers are willing to pay. Furthermore, lean tools help to identify and eliminate waste so that quality is better, reduces costs and processes [6].

According to a book of Womack and Jones [7], the philosophy of lean management is based on the following 5 principles:

1. Identify specifically the value from the customer's point of view
2. Identify and map a value stream process by reviewing all stages of the value stream for each product or service to eliminate any processes that are not generating value
3. Create flow by designing sequential production processes to flow smoothly to customers.
4. Respond to customers with a pull system
5. Encourage perfection; the previous four philosophies are repeated, then continue until perfection is achieved.

Value stream describes the process from the beginning to finished product in one industry, either providing value (value-added) or not providing value (non-value added). Beforehand, lean management has shown its application to the service industry, including the tourism industry. However, there is still limited literature on the examples

of companies implementing lean management in the hospitality industry. A research by Rauch et al. [1] applied lean management at Hotel Yukai Resort. The results indicated that it is possible to provide the same standard of service to hotel guests, but at a cost that is half either high or low in hotel occupancy. Some of the things that have been done are (1) sharing all information regarding work assignments to all workers, (2) using buffet style for dinner and breakfast activities to reduce employee needs, (3) involving staff who are always active and involved in lean management or lean Kaizen, (4) implementing cross skill training so that in his spare time an employee will go to areas that need assistance, such as the kitchen or laundry.

A research of Rauch et al. [1] conducted at Hotel Apex applies lean management to find process activities that do not provide value by eliminating these activities and carrying out the process and organizational restructuring and workforce re-planning. The lean team has been able to save 5,728 man-hours per year. The application of lean methods saves money and significantly improves customer service and working conditions for hotel staff. A research of Pearlman and Chacko [8] conducted at Starwood Hotels has implemented Lean Six Sigma. As a result, the company received financial benefits in the form of an increase in revenue of up to 19% and an increase in the number of customers up to 12%. The food procurement process in the hotels follows procedures in the thriving food industry using Lean and Six Sigma principles.

Currently, there are many lean management methods and tools. Based on the fact that lean was born in the manufacturing industry, most tools came from the manufacturing sector. Through adaptation over time, lean can now be applied in various fields and not just for one particular type of industry. However. Not all available methods are suitable for every process. So there must be a qualified evaluation procedure to rank the most suitable lean methods in the hospitality industry [1]. Lean tools and methods are a set of technical options in lean that have been proven successful in improving performance. According to Rauch et al. [1], forty-seven lean tools may be applied in the hotel industry, and they can be classified into five clusters of methods, namely (1) Machinery and Equipment, (2) Organization and Staff, (3) Material flow and Layout, (4) Production Planning and Control, and (5) Quality.

However, it is more suitable for the Organization and Staff and Material flow and Layout clusters for the hotel industry. The Machinery and Equipment cluster is unsuitable due to the high cost and lengthy implementation time. In finding the most suitable lean method in the hotel industry, it is necessary to have a clear definition and weighting of the criteria. Four criteria have been defined and weighted to each criterion, namely (1) implementation costs, (2) implementation time, (3) impact on KPI (Key Performance Index), and (4) outcome sustainability and its implementation [1]. A criterion can have different weights compared to other criteria. In the case of the hospitality industry, the weighting is determined jointly by involving the hotel management. There are 4 best tools selected from the four criteria, namely Kaizen workshop, 5S implementation, visual management, and Poka-Yoke. This research refers to the latest journals or literature related to applying lean management in the hospitality industry. Research of Rauch et al. [1] and Kuaites et al. [9] become the primary reference.

A research of Kuaites et al. [4] used the flow process chart method to analyse work processes and the flow of materials, staff and equipment from the beginning to the end of the process. The technique used is ECRS (Eliminate, Combine, Rearrange and Simplify), which means that rearrangements are carried out in carrying out work or process efficiency as much as possible. Still, it would be better to be simplified, combined or eliminated. However, the study only focuses on housekeeping activities. Rauch et al. [1] describes the criteria for selecting the proper lean method for the hotel industry and weights these criteria to make it easier for hotel practitioners to apply it. However, the procedure for weighing

and quantitatively selecting criteria is not explained; the author directly determines the weights qualitatively based on his experience. The tools chosen to be applied to the case study were immediately selected, namely CIP (Continuous Improvement Process)-Workshops, FIFO Warehouse Management, implementation of 5S, and reduction of housekeeping movements.

A research of Ahmed [10] adopted a quantitative approach to obtain the objective of identifying lean methods that hotels have applied. However, it does not apply significantly to improve the hotel's performance. The research investigated using a series of questionnaires for what hotel managers have done concerning lean in Egypt. A research of Indrawati et al. [11] adopted lean management and applied it to fast food restaurants with an integrated approach between Six Sigma and the TRIZ (Theory of Inventive Problem-Solving) method to get creative ideas to overcome the problems faced. The result of the study is the identification of waste that occurs, namely the delay in the flavouring process from the total time. The improvement strategy is to reduce the setup time for changing flavours and implementing 5S.

Al-Aomar et al. [3] assessed the application of lean management techniques in hotel supply chains that have identified potential waste in hotel management with the SIPOC (Supplier, Input, Process, Output and Customer) approach. Besides determining the type of waste, it has identified lean techniques that have been carried out by the hotel and methods that may be used to improve hotel performance in the future. Al-Aomar et al. [12] developed a framework for identifying, categorizing, and prioritizing the choice of lean techniques to be adopted by the hospitality industry. The methodology used is a survey of hotels in the United Arab Emirates with a SIPOC based design to find lean techniques that have been used by hotel management. Then it used the AHP method to prioritize the existing techniques by considering various criteria. The results show that there are 6 main categories of lean techniques and 19 lean techniques relevant to the hospitality industry. The main categories are JIT, Kaizen, Quality, Inventory, Maintenance and Standardization.

2 Method

This study was conducted at Hotel XYZ through observation for one month in October 2020. The observations consisted of three kinds: direct observation on the hotel kitchen floor by looking at the production process, breakfast and a *la carte*, how the operator works, work procedures, environmental conditions, and production floor layouts. The two interviews were with several workers in the procurement department and Food and Beverage Manager to operators in hotel kitchens, such as cook helpers and head chefs. It needs to do documentation of the process and the required data. The data can be in the form of photos, production data, and processing time. The research flow chart can be seen in Figure 1. The diagram includes the activities performed in sequential research steps.

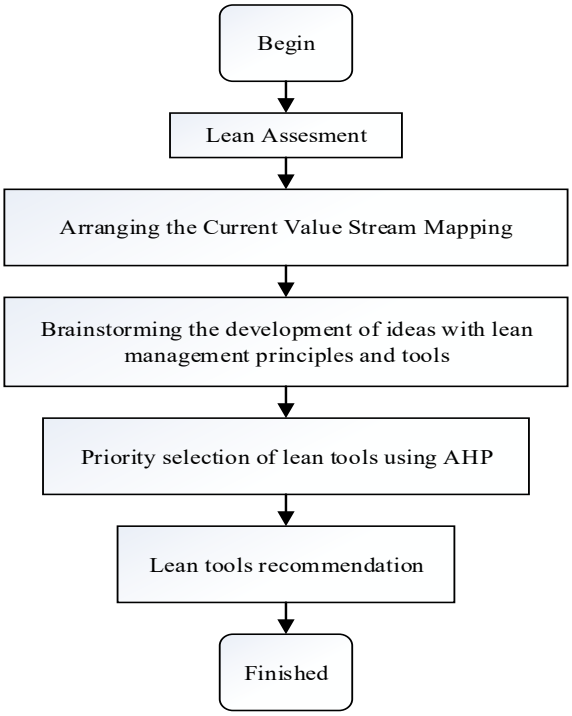


Fig. 1. Research flow chart

2.1 Lean assessment

The research begins by conducting a lean assessment that assesses how lean a hotel kitchen is based on principles and indicators. Assessment is carried out to determine the lean implementation plan to be more appropriate to the company's conditions. The procedure for conducting a lean assessment using a checklist [13]. The people who are the focus of lean assessment are a Food and Beverage manager and the head chef of Hotel XYZ.

2.2 Value Stream Mapping (VSM)

The value stream is used to describe the process from the beginning (raw materials) to finished products in the form of dishes in a hotel kitchen, either providing value (value-added) or not providing value (non-value added). VSM is divided into two, namely current and future VSM. The initial stage of VSM current is carried out by direct observation of the dish production process in the kitchen area for one week.

VSM future is structured to map improvement ideas based on the lean method that has been selected, while the way of compiling is the same as VSM current, but includes ideas such as supermarket, pull, flow, heijunka, and so on. The VSM future will be a reference for gradual implementation. How to prepare VSM Future is done by sharing data from the previous stages, namely lean assessment, VSM current, brainstorming improvement ideas. The parties involved are the research team, FBM, and chef to the waitress for breakfast preparation.

2.3 Choosing the right lean method

Of the many proposed tools, prioritization of the methods to be used by the hotel is carried out. The initial stage is the weighting of the criteria in choosing the right lean tools priority. The criteria refer to the research of Rauch et al. [1], namely implementation costs, implementation time, impact on Hotel KPI and the sustainability of their application. The data obtained from the questionnaire were processed using pairwise comparison and then calculated using the AHP.

3 Results and discussion

3.1 Lean assessment

Lean assessment refers to the research of Laoha and Sukto [14] for production and Tortorella et al. [15] for procurement. It is rated from 1 to 5 for each aspect of the lean. The lean production aspects are presented in Table 1.

Table 1. Lean assessment on production aspect

Aspect	Implemented?	Assessment
Kanban/Pull System	Yes	2
Visual management	Yes	2
5S (Concise, Neat, Clean, Care, Diligent)	Yes	4
Operation base layout	Yes	3
Quick changeover	Yes	3
Multi skill is workers	Yes	5
Standard operation procedure	Yes	3
Poka-Yoke	Yes	3
Total preventive maintenance	Yes	2
Awareness of 7 waste	Yes	3
Kaizen Production	Yes	1

The Kanban and pull system aspects are given a value of 2 to identify that the number of occupied rooms is known and is updated every hour as a reference Kanban signal for the production of when and how many breakfast dishes for the following day. However, this information is sometimes not conveyed to the kitchen. In addition, some dishes have been prepared from noon D-1 breakfast with a predetermined amount based on experience. For example, fried chicken that has been provided ranges from 25 kg on weekends and 10-15 kg on weekdays. This system shows that there is a tendency to apply a push rather than a pull system so that the impact is that there is an excess or less potential that can cause the waste or reduce the value of satisfaction desired by customers.

However, for the activity of providing meals for meetings and weddings, a checker is assigned to update the condition and number of remaining dishes at any time to the Food and Beverage Manager (FBM) so that an FBM can determine what, when, and how many more dishes to cook properly. For example, meeting activities have been booked for 40

guests; 40 are made indirectly, but with smaller lots and gradually increasing according to data from the checker. This action aligns with the principle of lean management, namely producing small lot sizes or small batches [16]. The hotel has implemented it in the visual management aspect but is given a score of 2. Signs/pictures and indicators indicate this action to make it easier for management to make decisions, for example, via smartphones capable of sharing the latest data on room occupancy to all managers. However, there is no display in the kitchen regarding the number of rooms. In addition, based on observations regarding inventory, it is not visible to see the current stock condition to determine the types and quantities available. Chefs must check and open their refrigerators, which can result in a potential shortage or excess of raw materials.

In applying 5S, cooking utensils and ingredients have been placed neatly in their place. The chef periodically cleans cooking utensils with a chamois and removes water on the floor. Trash cans have been provided with easy-to-reach locations, and the size is also quite large. Dirty dishes and cooking utensils do not stay in the dishwasher for too long because multitasking assistants are provided who can also serve as a stewardess. However, it showed a leaking water pipe from above the ceiling, causing the floor always to be slippery and the chef potentially slipping so that the chance of wasting food would occur when the chef was transporting the dish. The application of 5S in the kitchen refrigerator found that there were no labels for storing ingredients. There was a potential for an error in the location of storing ingredients in the fridge so that the next chef shift needed time to look for it.

The U-shaped layout makes it easier for chefs to pick up and cook with minimal movement. Even in the middle of the room, a plating table is not far away. The size of the room is appropriate, not too big and not too narrow. However, it is necessary to adjust the placement of cooking utensils periodically, considering the hotel occupancy rate is constantly changing. Layout U can already represent lean production [17]. Change over time shows the setup time from one dish to another is quite fast, especially for a *la carte* dishes. For example, the same kettle is used for two different dishes, but the chef can quickly arrange and clean the kettle. This action is because the frying area is provided with a water faucet to clean the kettle soon. The best change over achieves SMED (Single Minute Exchange Dies), reducing downtime and increasing output quantity [18]. Multi-skill workers have been implemented. Very multi-skill workers, a service or waitress can do several chef activities. A stewardess, who is in charge of washing dishes, can work as a cashier and checker. And a chef can cook a variety of Chinese, European, and Indonesian dishes. However, cross-training has not been seen to be implemented by the hotel. Lean production tends to apply cross-training to achieve Just in Time to eliminate waste [19].

The implementation of the Standard Operation Procedure (SOP) has been carried out well by the Hotel, but this has not been seen because it has been used by experience. However, Poka-Yoke is recommended to minimize errors made by the operator [20], based on observations that the microwave has been equipped with a countdown timer that will sound when it is finished cooking. Based on the observations, Total Preventive Maintenance has not been carried out properly. It can be seen that some cooking utensils are damaged but are still stored in the kitchen for a long time. The refrigerator is used as a temperature indicator to identify if the fridge is damaged. There needs to be a maintenance schedule for cooking utensils to prevent sudden damage when it is needed.

The Food and Beverage Manager (FBM) concerns for the 7 types of waste is good; this is indicated by the efforts to reduce waste that has been achieved, such as the target of raw material costs of 20% of sales. Besides, FBM is efficient in determining the number of the kitchen staff. Inventory is constantly monitored every month, and there are almost no food defects. Overproduction of dishes has been minimized by deep-frying. However, other potential wastes such as delay and lead time need further improvement. Kaizen Production

in this hotel has not yet formed a formal Kaizen team. However, continuous improvement activities are always there, as can be seen from the changes in the breakfast banquet system for new regular changes.

Aspects of lean implementation in the hotel supply chain are reviewed with an assessment of 1-5 in detail, which are presented in Table 2.

Table 2. Lean assessment on supply chain aspects

No	Aspect	Assessment
1	Collaborative relationship based on mutual trust and commitment	4
2	Not many main suppliers	3
3	Small batch size and high delivery frequency	3
4	Kanban with supplier/pull	2
5	Supplier selection criteria based on capacity, added value and historical background	4
6	Build communication and information	4
7	Supplier adopts quality techniques	4
8	Cooperation with suppliers in solving problems in the hotel kitchen	2

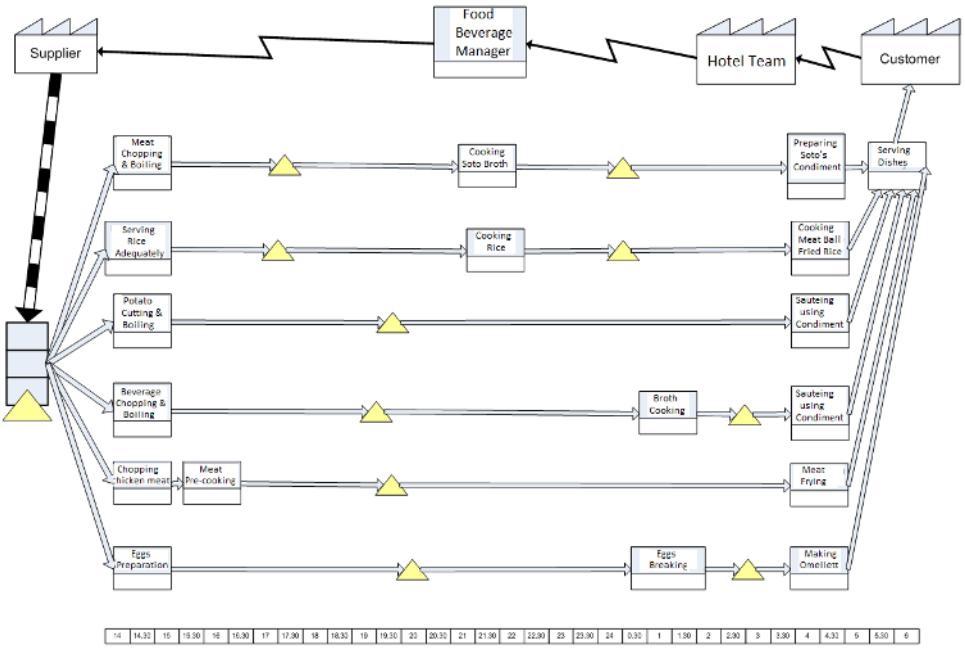
Based on the observations, suppliers are made a strategic part by the hotel, which is indicated by the existence of a long-term cooperation agreement. Hotels are trusted to make payments after 1-month of running, and suppliers are guaranteed to supply regularly to the hotel within a certain time. The hotel is also not easy to change suppliers, so they tend to choose not many suppliers for the same type of goods [21]. For the small batch category with frequent deliveries, the hotel has applied it to delivering raw material for dishes. It shows that deliveries are carried out regularly on a scheduled basis with different quantities depending on the estimated hotel room occupancy rate; however, the hotel needs to request that it be sent more frequently with fewer quantities to ensure the freshness of the raw materials.

The hotel prefers to choose a flexible supplier. For example, if it is known that there are unripe papayas that are still sticky, the supplier can flexibly change the type of papaya that the hotel needs. With the capacity owned by the supplier, hotel demand that wants a fixed price for a particular time can be fulfilled by the supplier, although in terms of quantity, it can vary. To build good communication with suppliers, the hotel always holds regular meetings to discuss the supply of raw materials for dishes. However, it has not made a joint performance measure between hotels and suppliers, and it only evaluated on a 6-month or 1-year basis.

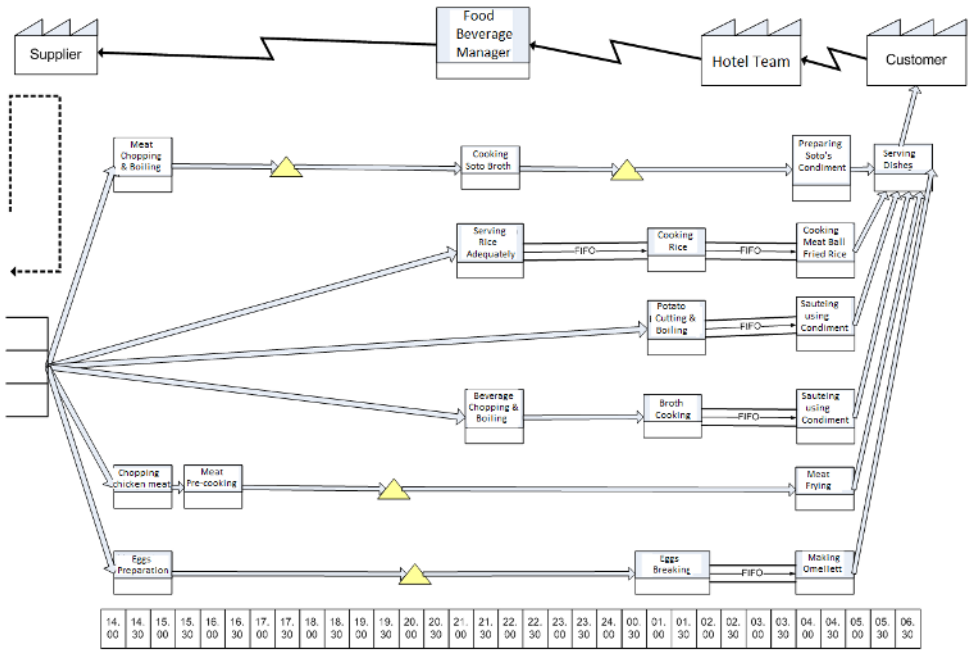
3.2 Value Stream Mapping (VSM)

Current Value Stream Mapping and Future Value Stream Mapping are presented in Figures 2a and 2b. Based on the observations, many breakfast products are still in the semi-finished form, which are processed during the day and then left for a particular time to be reprocessed before breakfast time, which begin in the early morning at 3 a.m. This action is done for labour efficiency so that the daytime shift workers H-1 are not unemployed. However, the impact is that the freshness is reduced. The role of the refrigerator is crucial

in this regard. In addition, there are still some raw materials that are stored for quite a long time because the procurement system pushes a scheduled system.



(a)



(b)

Fig.2. Current Value Stream Mapping (a) and Future Value Stream Mapping (b)

3.3 Selection of lean tools with AHP

Based on the results of the lean assessment, the preparation of the VSM current and discussions with several related parties, seven activity plans that need to be prioritized to be implemented are prepared. Table 3 shows these seven activities plans.

Table 3. Lean tool alternatives

No	Aspect	Lean method alternative plan
1	Kanban/Pull System	Application updates the number of rooms filled in the kitchen screen as Kanban
2	Visual management	Using colours that are easy to see immediately as an indicator of a display on the number of rooms and room service orders so that lead times are short. Visual colours describe the number of stocks of various products
3	Poka-Yoke	Increase Poka-Yoke for every process that tends to have human error
4	Total Preventive maintenance	Implementing preventive maintenance, make maintenance schedules and autonomous maintenance
5	Kaizen Production	Creating a specific improvement team that is assessed by top management
6	Small batch with often frequency	Applying heijunka and milk-run process
7	Kanban with supplier/pull	Changing the system for certain raw materials that are still being pushed into a pull system to suppliers

Three plans were chosen to be prioritized for implementation from these seven plans. Based on an in-depth discussion, the plans are (1) implementing a pull system both in production and at suppliers, (2) forming a Kaizen team, and (3) visual management. Determination of the order of the tools can be carried out based on 4 criteria weighted by pairwise comparison, as follows (Figure 3):

1. Implementation costs,
2. Implementation time,
3. Impact on Hotel KPI,
4. Sustainability of outcomes and their implementation.

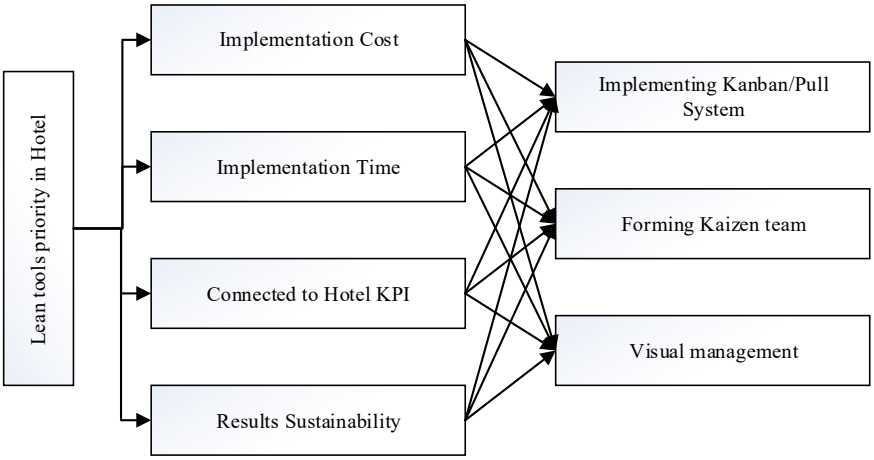


Fig. 3. Lean tools priority in hotel

The cost of investment and the use of resources should be as low as possible to guarantee returns to the shortest possible period [22]. The less time it takes to see the improved results, the better the lean method is applied. However, the failure of implementing lean tools is often caused by the desire to get results in the short term. KPI has a significant influence on choosing the proper lean method by hotel management and help decide on the sustainability, expansion and limitation or even termination of a lean management implementation project. Lean thinking is a long-term benefit for a company. Changes in people's mindsets do not occur daily but require a longer time. Therefore sustainability criteria are essential in choosing the proper method.

Table 4. Pairwise comparison criteria

	Cost	**Time**	**KPI**	**Sustainability**
Cost	1	3	0.25	0.33
Time	0.33	1	0.33	0.5
KPI	4	3	1	1
Sustainability	3	2	1	1

From the pairwise comparison, the consistency was observed, after which the weight was calculated (Table 4).

Table 5. Comparative matrix design

Criteria	**Weight**	
Cost	5.565	0.167
Time	4.110	0.114
KPI	4.013	0.388
Sustainability	3.746	0.311
Total	17.433	1.000

The results of the level 1 weighting show the highest value in the sequence, starting from the criteria of KPI, sustainability, cost, and time (Table 5).

Table 6. Pairwise comparison alternatives

	Implementing Kanban	**Forming Kaizen team**	**Visual Management**
Implementing Kanban	1	1/7	1/5
Forming Kaizen team	7	1	3
Visual Management	5	1/3	1
Total	13.000	1.476	4.200

From the above pairwise comparison alternatives (Table 6), the consistency was observed, after which the weight was calculated.

Table 7. Comparative matrix results

Criteria	**Weight**	
Implementing Kanban	2.877	0.074
Forming Kaizen team	2.849	0.643
Visual Management	3.564	0.283
Total	9.290	1.000

From the comparative matrix results above (Table 7), forming Kaizen team, visual management, and implementing Kanban weights 0.643; 0.283; and 0.074, respectively. Thus, the formation of the Kaizen team has the highest weight value.

Table 8. Results of prioritizing alternatives

Criteria	**Weight**	**Alternative weight for each criteria**		
		Implementing Kanban	**Forming Kaizen team**	**Visual Management**
Cost	0.167	0.074	0.643	0.283
Time	0.114	0.074	0.643	0.283
KPI	0.388	0.074	0.643	0.283
Sustainability	0.331	0.074	0.643	0.283

Determination of each final value for each alternative is calculated by multiplying the weight of each criterion by each alternative weight and then adding up for the entire criteria as many as 4 indicators so that the results can be seen as follows (Table 8 – 9, Eq. 1): [4]

The final value for each alternative

$$= \sum_{i=1}^{4} Criteria\ weight\ i\ x\ Alternative\ value \quad (1)$$

Table 9. Final value of total alternative priority

No	Alternative	End value
1	Kanban implementation	0.074
2	Forming Kaizen team	0.643
3	Visual Management	0.283

Based on the final value of the total alternative priorities, the highest weight values consecutively are forming a Kaizen team, visual management, and implementing Kanban.

4 Conclusion

Competitiveness in this modern era is essential for a company to survive. It also prevails in the hotel industry. Based on this study, waste elimination is a crucial part of increasing the competitiveness of the hotel industry. The proper method to eliminate waste is to do a lean assessment to describe how lean the XYZ Hotel's kitchen is, which is then visualized through the VSM current and given improvement through the VSM future. Further, it should determine the lean tools and use the AHP method to specify which lean tools would be applied first. Based on the AHP calculations, the competitiveness of Hotel XYZ can be increased by forming a Kaizen team.

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