COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM INTEGRATED WITH KANBAN FOR SPARE PARTS INVENTORY MANAGEMENT IN HOTEL FACILITIES

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Abstract. *Spare parts inventory management is a crucial part of the hotel maintenance sector. This study examines the suitability of a new inventory management system by combining two strategic techniques, the Computerised Maintenance Management System and Kanban, for Sri Lankan hotel facilities. The current spare parts inventory practices of three five-star hotel facilities were evaluated using a case study method. Data were collected from maintenance division heads through semi-structured interviews, and the gathered data were analysed using manual content analysis. The proposed system's feasibility and practicality were further assessed by exploring expert opinions to address operational gaps and inefficiencies. The origins of this study, which evaluates a Computerised Maintenance Management System and Kanban integrated system for spare parts management in the context of Sri Lankan hotels, reveal a previously undisclosed side of the Sri Lankan hotel sector. The outcomes illustrate that integrating the Computerised Maintenance Management System with Kanban improves many criteria of spare part inventory management, including tracking accuracy stabilize maintenance workflows. In conclusion, the study demonstrates valuable practices for the Sri Lankan hotel industry, addressing specific regional issues as well as industry needs.*

Keywords. *Computerised Maintenance Management System; Hotel Facilities; Kanban; Spare Parts Inventory Handling*

1. Introduction

Spare parts management is central to any type of asset and system maintenance, including corrective, preventive, or predictive maintenance, and spare parts inventory has been shown to account for a significant portion of maintenance costs, with this ranging from 50% to 80% (Guo and Yu, 2018). Therefore, having proper spare parts inventory management is mandatory for any organisation looking for the best operations without any disruptions (Abreu & Pinto, 2023). When it comes to five-star hotels in Sri Lanka, effective inventory management indirectly contributes to providing phenomenal hospitality to enhance customer satisfaction (Barabadi et al., 2021). In this context, delays in arranging repairs for faulty machinery due to inefficient inventory management can damage the hotel's image and lead to loss of customer trust, negative rumours and thoughts, and finally, financial losses (Shaheen & Németh, 2022).

Furthermore, spare part stock needs to be continuously monitored to avoid major financial losses (Moayedi et al., 2023). Zhang et al. (2021) stated that the total machine value, with the value of spare parts consumed annually to repair a part of the machinery with a lifespan of about 30 years, increases by nearly 2.5% of the original purchase price.

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Therefore, handling spare parts inventory is one of the most critical areas, which, in turn, encourages hotels to reap numerous benefits, including reducing equipment downtime (Achigbu & Diogu 2020). In recent decades, sustainable compatibility of the hotel operation process has become a trend in the Sri Lankan hotel sector (Koralage, 2023). According to Zhang et al. (2020), the use of lean manufacturing tools is one of the appropriate methods for adopting sustainability in maintenance activities, including spare parts inventory handling. Kanban is a concept that emerged from lean manufacturing practices and is used successfully for inventory management in the Japanese vehicle manufacturing sector (Puspitarani et al., 2024). Accordingly, since Kanban has been used for a very complex production process as an inventory control tool, it seems that Kanban is more suitable for the hotel's needs Dragone et al.(2021).

CMMS is the best solution worldwide for monitoring and controlling inventory levels, generating work orders, scheduling preventive maintenance, and so on. CMMS is essential for the hotel sector that aims to remain profitable, competitive, and efficient in the digital age (Gado et al., 2019). In the instance, Meira et al. (2020) showed that maintenance sector productivity in US and Canadian industries increased from 35% to 70-80%, and inventory costs decreased from 5% to 12% after CMMS implementation. Moreover, Gado (2022) mentioned that CMMS keeps a comprehensive database to record and track real-time data related to asset performance, future operations and planning, dates, supplies and inventory, and man-hours expended. Most previous global studies have observed inventory management practices for manufacturing facilities rather than hotel facilities (Mohamed, 2024), while others have focused on the Kanban system and CMMS separately (Priniotakis & Argyropoulos, 2018). Individually, the two methods have demonstrated proper inventory management system attributes such as inventory detail accuracy, inventory control, cost reduction, and operational efficiency. Accordingly, this research aims to propose the best spare parts inventory management practices by integrating the Kanban system and CMMS to enable better coordination between procurement & maintenance and enhancing overall organizational performance.

2.Literature Review

2.1 SPARE PARTS INVENTORY MANAGEMENT IN HOTEL FACILITY

The level of spare parts requirements for emergencies should be considered when purchasing, storing, and using them and in addition, the quality and cost of the spare parts are key factors to consider (Munyaka & Yadavalli, 2022). It is proven that organisations allocate a 5%-10% budget for purchasing spare part inventory. Therefore, having proper spare parts inventory management is extremely important to make this investment worthwhile and improve the operational capacity and performance of hotel services (Haidar & Pratama, 2024). Nowadays, hotels tend to turn to technologically advanced systems that help them record spare parts consumption, control spare parts inventory, and determine reorder points to limit inconvenience caused by stockouts (Accorsi et al. 2019). In addition, it helps maintain a proper inventory level within the hotel, allowing repairs and preventive maintenance to be carried out within the shortest time without delays caused by the lack of necessary components (Chen et al., 2019). It leads to the

functioning of hotel layouts, reducing the chances of discomfort and hazards to the guests (Campilho et al., 2026).

2.2 CURRENT SPARE PARTS INVENTORY MANAGEMENT PRACTICES

Spare parts inventory management is currently in an intermediate stage between manual handling and virtual mode use, and it seems to be improving technologically day by day. However, past tools, methods, and techniques provide the foundation for it. As an instance, many organisations around the world, including retail, manufacturing, and healthcare, use nearly half-century-old lean philosophies such as Just-In-Time (JIT) inventory, Kaizen, Kanban, and Total Productive Maintenance (TPM) as inventory control

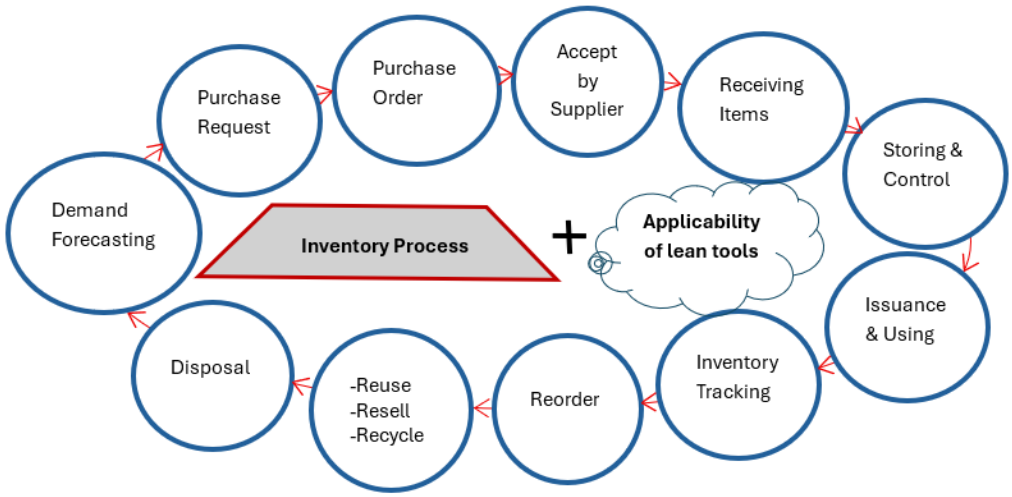

Figure 1, Applicability of Lean Manufacturing Tools for Inventory Process

and handling mechanisms (Mor et al., 2021).

According to Figure 1, any lean tool can be successfully applied to the organisation's entire inventory handling process. However, Kanban appears to be significant among these due to its ease of use, visualisation, relatively low implementation time, and cost. In terms of its ability to quickly adapt, visual control, and user-friendliness, Kanban is the most effective and practical lean tool compared to other lean tools used in inventory management (Vallon et al., 2019). Furthermore, it is also known as the pull system, which helps to minimise overproduction and waste by ensuring that inventory is closely aligned with actual demand. In addition to that, Kanban became a famous inventory control concept at the Toyota Motor Corporation as a world-leading organisation because it leads to reducing production complexity by ensuring that required spare parts are produced at low cost, in the required quantity, and at the required time to face targeted market demand (Damayanti & Sukmono, 2024).

- **Gaps & inefficiencies of spare parts inventory management practices**

Most of the existing inventory management practices encounter various gaps and inefficiencies. They can list down as shown in Table 1 with their consequences.

Table 1, Gaps & inefficiencies of Current Systems

Gaps & inefficiencies	**Description**	**Consequences**
Improper key performance indicators (KPI)s	Establishing inventory-related KPIs is indirectly essential for business continuity. According to that, inventory availability & control, Cost, supplier performance, and procurement planning are the main pillars to consider (Singh et al., 2020).	-Unable to achieve business goals and objectives
Poor integration with other maintenance activities	All efficient maintenance activities, such as preventive maintenance, corrective maintenance, allocation of personnel and equipment, and issuing work orders, are interrelated, and when inventory management is taken as one of the maintenance activities, it helps in carrying out other maintenance activities properly (Matse et al., 2022).	-Increased wastage to complete other maintenance tasks
Improper balancing of spare parts stock and obsolescence	This situation occurs due to failure to record the certain items purchase date or a lack of clear and accurate records of old or outdated items (Montmeat et al., 2020).	-Financial loss -Inaccurate inventory balance
Inefficiency in reordering and procurement processes	This gap & inefficiency are caused by poor coordination with vendors and an inability to understand the reordering point (Pedroso et al., 2024).	-High inventory holding cost -Operational delays

2.3 MODERN TECHNOLOGICAL TRENDS FOR OPTIMIZING SPARE PARTS INVENTORIES IN MAINTENANCE OPERATIONS

It is necessary to design and develop a good inventory management system in hotels that can help the maintenance team easily locate and find the required items and improve the financial performance of the services (Tripathi & Tiwari, 2014). Raw material inventory management is an area that shows great bond for improving productivity. In traditional processes, work-in-progress inventories of raw materials and spare parts were maintained as a buffer against the possibility of running out of required materials. Nevertheless, large buffer inventories consumed valuable resources and created high inventory costs (Sagar, 2018).

The implementation of advanced spare inventory management practices has a positive impact on production performance related to the hospitality industry (Munyao et al., 2015). Inventory control deals with a decision-making strategy to identify the time, quantity, and optimum stock that should be maintained, so that purchase cost and storage costs are minimised (Panigrahi R. et al., 2019). Among modern practices, numerous organisations use automation for the ease of their maintenance activities, including spare

part management. CMMS is the best software for it and covers the overall maintenance scope (Jamkhaneh et al., 2018).

2.4 INTEGRATION OF CMMS WITH KANBAN FOR SPARE PARTS MANAGEMENT

Machine processes are changing innovatively with spare parts management CMMS are linked to lean manufacturing practices such as Kanban methods. To implement this in practice, various spare parts must be separated and grouped through some kind of multi-criteria classification between maintenance and supplies as a support method for spare parts inventory management (Teixeira et al., 2018). Considerable recovery has been offered by adopting CMMS modules, it allows for managing an inventory of spare parts where variable demands and lead times are both found to be irregular (Sellitto, 2018). It can, therefore, bring production-waste reduction and improve the efficiency of organisations through non-value-adding activities elimination in spare parts dismissal processes (Hamdan & Hossain, 2022). The maintenance spare parts ordering process is optimised with CMMS software, resulting in minimal costly downtime of equipment by performing accurate ABC calculations with timely entered counts. However, full staff training and proper ground rules are very important in implementing an effective CMMS-based inventory management system (Bravo-Zuazo et al., 2024). CMMS does not belong to the category of complex systems; it is user-friendly and can be easily adapted by anyone. The field of sustainable maintenance requires various tools, including lean; this purpose is enabled when deploying a CMMS, but it must be under the administration of the proper staff (Abbass, 2024).

Rather than using expensive tools like JIT, integrating a simple, low-cost tool like Kanban with a CMMS further enhances the existing efficiency of the CMMS and allows users to easily use and manipulate it without language barriers. Also, since both methods

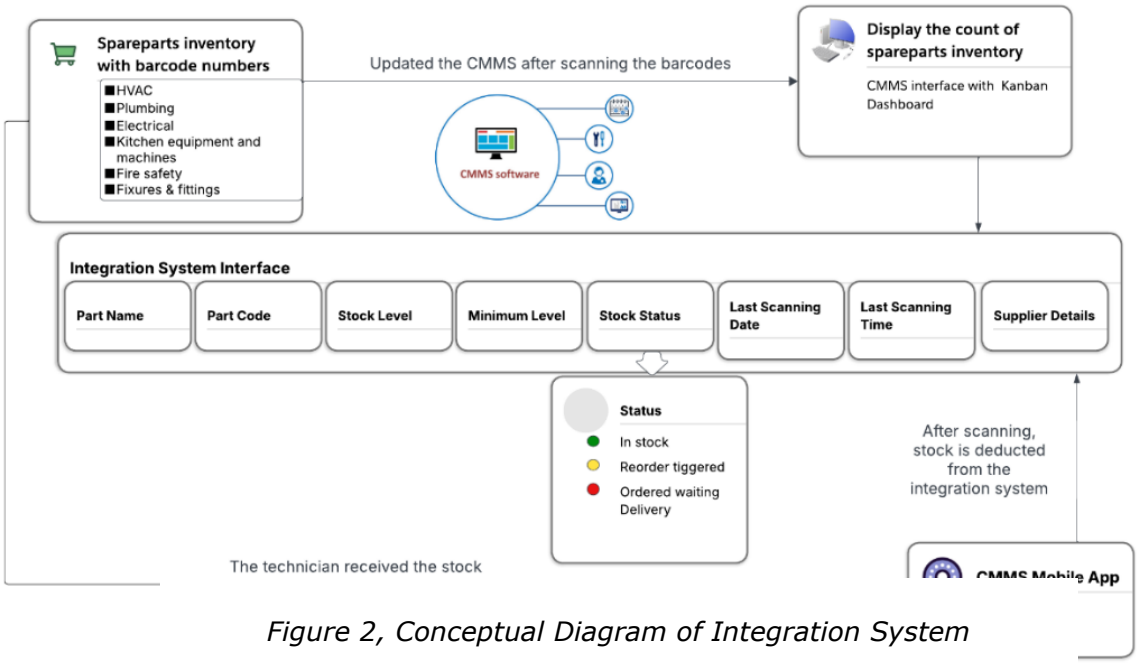

Figure 2, Conceptual Diagram of Integration System

are used for inventory management, inconsistencies are reduced, which contributes to greater efficiency. The other later advantage is the scalability of integrating with other managerial systems: A clear sign that the board has identified CMMS as a key driver of business benefit is the rise in the use of a wide range of CMMS integration in large business equipment (Almomani et al., 2021). Figure 2 illustrates how the spare part inventory process flows from the hotel's warehouse to its maintenance team through the conceptual integration system after scanning the barcode of each item. This system shows real-time inventory updates, stock level, automated reordering, and so on.

3.Research Methodology

This research aims to investigate the suitability of a new inventory management system by combining two strategic techniques, CMMS and Kanban, in the Sri Lankan hotel sector. In here, this data collection was conducted in two stages. Stage I was the case study for identifying current spare part inventory management, gaps and inefficiencies. Three (03) five-star hotels in the city centre of Colombo were selected for study using a selection method that considered hotels already using technically advanced tools, including CMMS, or a structured spare parts management system. Selected hotels' maintenance division Heads presented their intention and experience in semi-structured interviews on how the spare parts inventory process is carried out, the problems and challenges faced by the hotel

The selected hotel facilities and classification of respondents are provided in Table 1.

Table 2, Classification of Respondents and Hotel Facilities

Case	**Classification of respondents and hotel facilities**			
	Description	***Designation***	***Work experience***	***Awareness of the CMMS and Kanban tools***
Case 1 (C_1M)	33 floors with 800 rooms	Director of the assistant engineer	17 years	Aware only CMMS
Case 2 (C_2M)	32 floors with 500 rooms	Maintenance Manager	10 years	Not aware of both tools
Case 3 (C_3M)	21 floors with around 400 rooms	Maintenance Manager	13 years	Aware only CMMS

Accordingly, by identifying the existing spare parts inventory management practices in the maintenance sector of the hotel industry in the Colombo area and based on those practices, specific gaps and inefficiencies in hotel spare parts inventory management procedures compared to modern technology were discovered.

Stage II focused on the lean and CMMS experts' opinions on new system benefits for hotels. Experts varied in different areas, including skilled personnel in maintenance management, inventory knowledge, lean systems, and other related areas, expressing their experiences on how CMMS works with the Kanban lean tool in hotel facilities. Furthermore, this method allows for the acquisition of rich data that points to best practices regarding CMMS and Kanban integration to align with operational constraints and user needs. Also, experts had real-world experience in how to overcome identified challenges and gaps, along with a practical sense of inventory control and lean tools. The profiles of experts are provided in Table 2.

Table 3, Profiles of Experts

Respondents	**Profiles of experts**	
	Designation	***Experience period***
Expert 1 (EC1)	Facilities Manager	5 years
Expert 2(EC2)	Facilities Manager	5 years
Expert 3(EC3)	Director of Facilities	11 years
Expert 4(EL1)	Senior Lecturer	12 years
Expert 5(EL2)	Senior executive	5 years

Accordingly, the lean management practitioners' expertise in applying lean methodologies, including the Kanban system, is in service industries like hospitality, with a minimum of 5 to 15 years of experience in any industry. When considering the CMMS experts, they have experience in preventive and predictive maintenance strategies using CMMS for tracking, scheduling, and optimising maintenance activities, and knowledge of spare parts used in hotel assets and services, with more than 5 years of experience in CMMS operations. Data analysis was performed using the manual contextual method after the data collection procedure.

4.Research Findings and Discussion

4.1.EXISTING SPARE PARTS INVENTORY MANAGEMENT PRACTICES

According to three respondent parties, they keep a minimum reorder point in the digitalised system based on quantity and time for each type of spare part, triggered when spare parts arrive at a minimum level. However, not all hotels use the same spare parts system, it varies based on each hotel's operational behaviour from its initiation to current condition, complexity, and respective life cycles of the systems and machinery. In terms of case 1, C_1M implies that "*There is no specific system for managing inventory: we handle it through SAP."* Basically, SAP is used as the solution to streamline the whole business

process, and it is not limited to handling inventories. Inventory handling is one part of it, and in addition, SAP automates and integrates other functions such as finance, human resources, etc. Also, he argues that "*It is a multitasked system; an organisation can easily plan, direct, and control the spare parts, but sometimes it may be a challenge to handle due to the system's complexity.*"_Here, they try to indicate that inventory system complexity can happen because of technological advancement. However, problems related to data loss and data inconsistency during inventory handling and purchasing can be reduced to some extent through SAP. When it comes to case 2, C_2M mentioned, "*we have a separate system for inventory storing and inventory procurement; according to the criticality of spare part requirements, minimum ordering quantity can differ*". To classify based on criticality, hotels often use VED analysis. However, VED analysis is not suitable for hotels that have recently commenced operations due to its complexity. According to case 3, C_3M "*the inventory purchasing department directly contacts suppliers to purchase relevant spare parts and then checks prices, and we maintain separate records of purchased inventory according to various systems*". In terms of case 2 and case 3, the inventory management process has been broken down into two departments, and responsibility has been assigned to those separate departments for ease among departments. In terms of that, spare parts management systems are complex in their own. Systems should be user-friendly, easy to handle, and have a minimal workload for the people working with them. Considering all three respondents, it is proven that many hotels do not have appropriate spare parts management systems. Because of that, hotels maintain a minimum constant quantity for each type of spare part based on the historical spare part consumption pattern. This can lead to stacking or shortages of spare parts.

Handling spare parts inventory may not seem easy. Observations have shown that hotels face several challenges. In this case, C_1M, stated that "*due to the human errors, consumable spare parts can deteriorate quickly"*. This degradation was not only due to incorrect stock updates and data entry issues, but also due to disruptions in the GRN process. When it comes to case 2, C_2M mentioned, "*We are heavily dependent on imports because the spare parts we need are not available in the local market."* As a solution, the hotel has kept backups for critical facilities and has limited unnecessary stock. However, it is a challenge because they have to maintain backups, which is an additional expense for the hotel. Case 3, C_3M declared, "*Currently, the hotel inventory system faces a challenge with the inventory price increment due to spare parts scarcity"*. Because of that, they keep limited stores. Increasing inventory costs is a challenge any hotel faces, but if hotels plan to limit inventory to address this, it could lead to a long-term backlog. According to the respondents' perspectives, the top management level should engage directly to allocate a considerable budget for spare parts.

The identified challenges are mainly due to the inappropriate inventory management systems. In addition, optimising the use of critical imported spare parts and promoting supplier partnership policies can be implemented to avoid spare parts import problems.

4.2 GAPS & INEFFICIENCIES OF EXISTING SPARE PARTS INVENTORY MANAGEMENT PROCESS AND SYSTEM

This section discusses the gaps and inefficiencies in existing spare parts inventory management systems for comparison with modern spare parts inventory management systems. In the literature review section, researchers have generally discussed what the gaps and inefficiencies are in spare parts inventory management practices. When it comes to real-world inventory management examples in the hotel sector, it presents many inefficiencies and identifies gaps between expected levels. Table 3 below represents the nature of identified gaps and inefficiencies faced by three hotels.

Here, although some of the gaps and inefficiencies identified in the literature review may not exist in the real world, many of them were identified in the findings, which highlights the situations faced due to the lack of a proper inventory system.

4.3 EXPERT'S VISION OF THE ABILITY TO ADDRESS GAPS AND INEFFICIENCIES IN CURRENT INVENTORY SYSTEMS

System accessibility

System accessibility is critical to concerned organisations. In terms of the EC1 respondent, "*The system accessibility gap can be efficiently achieved through this integrated system that allows for all levels of maintenance staff to be engaged in system operation according to their job role*". In here, top management needs to know the analytical data of the entire system operation for administrative purposes, establish strategic goals and stabilise the business continuity. Other than top management, facilities managers should be highly concerned about the systems operating smoothly. Therefore, those two parties should have proper training in handling CMMS. Furthermore, hotels should train their technicians and subordinate staff to upload photos as evidence to CMMS after completing the work orders. Also, this system helps the users gain a deeper understanding of the workflow from the sending of work orders to the work orders completion by the worker. EC2 stated that "*Based on company policy, priority, and requirement, integration system access can be customised and delegated to specific departments, such as management, maintenance, and finance departments*". Proper spare part software for the maintenance team is a mandatory requirement for any organisation. This integration system is not a static one; it allows organisations to change it according to their preference. EC3 mentioned that "*If the hotel implements the suggested system, it helps maintenance staff to record real-time data and histories, quickly monitor inventory levels, and reduce paperwork*". This system is easy to use and operate at any employee level, as all details are recorded automatically, while preventing any misplaced documents. Therefore, the system's accessibility restrictions are lower.

EL1 explained that "*Due to the system's accessibility and the involvement of all employee levels, there is no opportunity for misleading, theft, fraudulent activities, or corruption to occur*". Once an organization implements an integrated system, it can achieve system accessibility for all employee levels. Consequently, the information flow

can change, allowing all staff members to see what is happening. This helps to reduce misleading activities, cheating, and corruption. However, staff resistance may arise due to the system change. From the system's perspective, there are no negative impacts or drastic dynamic changes; rather, it encourages positive improvements. According to EL2, "*At the commencement of the integration system, some people may encounter challenges when handling the system due to unfamiliarity*". Accordingly, system accessibility is an essential requirement that should be met at all levels, but sometimes users face problems due to near misses in scheduling task allocation for each worker. This allows the employee to ignore their job task.

Complexity and manual workload of the purchasing process

EC1 mentioned that " *The integration system performs timely, automated order requests to receive orders from the vendors.*" This helps to ensure that the entire spare parts handling process is carried out correctly. Thus, ensuring proper spare parts stock balance and reordering only when needed results in less complexity, shorter delivery times, and minimal manual workload. EC2 stated that, "*This new system tracks and visualises inventory level status; therefore, a hotel maintenance team can plan needs and reduce unnecessary paperwork*". In addition to displaying information about all parts, the three colours red, yellow, and green indicate whether the parts are currently in stock, backordered, or awaiting restocking. This is the applicability of Kanban to CMMS software, which supports visual understanding for all labour levels. EC3 had agreed with both EC1 and EC2, and further EC3 declared that "*This new system allows integration with selected vendor official systems to send orders automatically and monitor vendors' progress in the whole process".*

According to EL1, "*Utilising Kanban within a CMMS structure allows for standardisation of the retrieval inventory of spare parts to lessen complexity in the procurement system and ensure real-time spare parts*". This shows that Kanban with CMMS contributes to the handling of spare parts inventory properly as a successful lean tool. In terms of EL2, "*Reducing both excessive order approvals and the need for manual capacity is a reason to streamline the spare parts inventory management.*" Thus, the integration of Lean Kanban principles with CMMS removes wastage such as time and cost generated from the entire inventory handling process.

Quotation delaying

EC1 implies his perspective as, "*The integration system reduces the time it takes to obtain price lists for spare parts because RFQs are sent instantly when inventory reaches a certain level*". Accordingly, the CMMS leads to automating supplier communication by allowing suppliers to access order information and respond to the request quickly. The supplier can notify customers over the system if relevant spare parts are not available. EC2 stated that, "*This integrated system provides a centralised vendor database and automates price tracking and triggering vendors to notifications*". This expands the fact that CMMS can quickly predict potential issues with a vendor's suitability and availability to source quality spare parts. EC3 had agreed with both EC1 and EC2, and

further EC3 implied that, "*New system streamlining the quotation process while still allowing vendors to respond within their vendor 'portal' and significantly reducing constant follow-up and speeding up approvals*". This can also help hotels achieve other goals. Recently, many hotels have been trending towards ISO certification for their operational procedure, which is a great advantage as it reduces the significant manual work involved. According to EL1 perception, "*Implementing principle-based Kanban practices within CMMS can create a pull-based procurement model*". Due to the criticality of some systems, many hotels only request spare parts quotes from the supplier when needed. Here, the integration system ensures proper workflow management while increasing transparency in the entire procurement process. The end result is that hotels can experience system reliability and reduce unnecessary work and waiting time. EL2 had agreed with other respondents and stated that, "*Integrating Lean Kanban with CMMS eliminates waste in the pricing process*". This perspective confirms that the integration system helps to monitor supplier response times and reduces delays by automating procurement processes.

4.4 BEST PRACTICES RECOMMENDED FOR IMPROVING THE INTEGRATED SYSTEM

- According to EC1 recommendations, "*Some hotels are reluctant to change their existing system to another one; At that point, CMMS software allows them to modify their CMMS according to the hotel management's customisation by using API*".

If the hotel plans to implement an integration system, it already has a system for inventory management. There can be a data mismatch between the two system formats. To prevent that, software developers have to create links between formats using an API (application programming interface) as a converter. Since the hotel cannot take that model as is, they need to modify the whole system according to the CMMS model. By using the API, the hotel can reduce manual data entry, operational redundancy, data inconsistency, etc. When converting the system to a multi-purpose monitoring system, it is important to consider scalability and allow for future system additions or upgrades with minimal disruption, through APIs, and those integrations can be done without disturbing the core operation of the hotel. However, integrating a CMMS with Kanban can be considered a cost-effective approach when compared with integrating the system with other alternative platforms. Since Kanban is already widely accepted as a reliable inventory control method, it can support maintenance inventory activities efficiently. In this integration, the CMMS dashboard can function similarly to a digital signboard, allowing maintenance and inventory information to be displayed in a simple and user-friendly manner, as shown in Figure 2.

- In terms of recommendations by EC2, "*Establish suitable KPIs to monitor the integration system's performance and encourage changes in staff habits and behaviours because older, mature employees may not like working with new technology.*"

KPIs help to oversee the system's progress from the implementation stage to the operation stage. This helps to quickly identify system-related issues and inefficiencies and

implement strategies to prevent problems. Therefore, this is an important practice on the systems side to quantify and inform maintenance efficiency and cost control. In addition, employees should also contribute to improving the system. The transition toward this system is unlikely to create major resistance among employees because similar manual signboard methods have already been practised in many workplaces. Therefore, the proposed approach mainly replaces the traditional manual process with a digital interface while maintaining a familiar operational concept for users.

- EC3 stated that, "*First, we need to identify the weaknesses of the integration system, and then, we can develop strategies to improve it; In particular, hotels do not take full advantage of the ability to integrate other maintenance activities, even though they have it*".

This allows CMMS users to quickly obtain location-related information if there is any repair incident, problem, or cause in the hotel, making it easier to attend. After completing a work order using spare parts, CMMS balances the inventory stock level by easily deducting the used spare parts inventory. The core purpose of a CMMS is to facilitate and coordinate maintenance-related activities within an organisation. As a result, maintenance operations become more organised, leading to improved employee productivity and operational efficiency. When combined with Kanban principles, the distribution and usage of spare parts can also be controlled more effectively, reducing unnecessary consumption, waste, and inventory-related losses.

- EL1 declared that "*If an organisation does not wish to integrate the system digitally, organisations can implement a three-colour code system linked to the CMMS*".

This integration system recommends executing software and automation-based methods, but if the hotel is not willing to integrate, this method can be used as a manual method. In here, staff only need to press the relevant button to indicate the signal. Then it assists in monitoring the inventory level through the CMMS interface. However, this creates some problems, such as redundancy of button pressing and human error. And also, modern organisations increasingly depend on digital solutions to meet demanding business objectives and operational speed. In addition, younger employees, particularly those belonging to Generation Z, are generally more comfortable with digital technologies, making the adoption of such systems more practical and sustainable in the long term.

- EL2 mentioned that "*If spare parts from one system that are QR or barcoded are suitable for another system, there should be an identification method to use common spare parts for them in the event that a situation arises that requires repairs to that system*".

Through the use of QR-code-based inventory data, organisations can monitor spare part availability across multiple systems in a more systematic manner. Because replenishment activities are managed within planned timeframes, stock shortages can be

reduced significantly. Although spare parts may sometimes be exchanged between systems due to unavoidable operational requirements, such practices can still be managed effectively when technical knowledge is available. Furthermore, organisations can identify and display commonly shared spare parts among several systems. Components such as bearings, for instance, may be used across kitchen exhaust fans, water pumps, and laundry machines, allowing for better standardisation and inventory coordination.

- EL3 stated that "*FIFO (First in First Out): It is one of the best additional tools an organisation can add to the Kanban tool to balance time and quality of inventory*".

Applying the First-In, First-Out (FIFO) inventory methodology to all consumable spare parts and non-consumable spare parts leads to preventing waste, obsolescence of parts, and maintaining inventory accuracy. FIFO can be assisted by physical location, labelling policy, and CMMS configuration to trigger the usage of the oldest stock first.

5. Conclusion

This study examined the application of a CMMS combined with the Kanban Lean tool to improve spare parts inventory management for hotel facilities in Sri Lanka. The study originated as a review of current inventory management practices in local hotels and uncovered a strong dependence on manual and semi-digital systems, which provided minimal visibility and coordination. It then highlighted key challenges, including reorder delays, lack of real-time tracking, and absence of data-driven forecasting, which led to identified gaps and inefficiencies. In this study, the existing spare parts management methods and their gaps and irregularities were identified through a literature review. However, they were found to conflict with real-world practices. By examining the perspectives of experts along with the literature, this study proposes a new CMMS and Kanban integration practice for five-star hotels in Sri Lanka. The study suggested that a CMMS and Kanban system should be used together as the best way to speed up inventory processes, increase operational visibility, and ensure prompt delivery of critical spare parts. This research fills a key knowledge gap in hotel maintenance management in Sri Lanka and applies it practically by providing a flexible solution that fits the operating environment of the local hotel sector.

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