A Case of Eliminating Wastes using 5S for a Household Electrical Appliance Warehouse

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Abstract
Aggressive competitions in today's global market have forced enterprises to consider the efficiency in their industry's routines. One way to enhance efficiency is through eliminating wastes in all its shapes. Lean concept appears to be a universal management tool. Fortunately, lean management is now widespread across industries and it is a unique way for waste management, due to its core values and positive impact on companies' overall performance. This paper is focusing on implementing 5S lean methodology in household electrical appliance warehouses. The purpose of this paper is to present a case study of the implementation of 5S technique in a household electrical appliance warehouse located in Jeddah, Saudi Arabia. Results shows significant improvements to safety, productivity, efficiency and housekeeping. The company were able to reduce inventory cost by 20%, and reducing loading and unloading time of containers by 30%.

Keywords: Lean Management, 5S, Waste Management.

1. Introduction
Strategies and structure of a business are deep-seated as the business began to establish. It is hard to change when it is rooted in the right policies and conduct. As the business began operation, problems start appearing. The more problem a company is able to solve, the more it became successful and sustain. Any decision that is not well studied, will affect the company process. However, a good decision maker is the one who is able to keep the company with the same progress, at the same time finding a new ways that keep the company modern. Satisfying customer is vital, that is what companies are aiming for. This sometimes may makes companies concentrate on things and forget about others requirements that are initial and important. Draw backs could occur in processes that the company is doing, where problems accuse and no one get attention to it until it affects the company profit. Those problems hidden inside the company, such as a problem within the supply chain, manufacturing, or inventory. Wastes could appear here, due to unnecessary step in the supply chain or in production that reflect negatively on the inventory. There have been numerous studies that aim to reduce inventory cost and related uncertainties (Bahebshi & Almaktoom 2019, Mufti & Almaktoom 2018, Christopher & Peck 2004, Alsaadi et al. 2016, Alsobhi et al. 2018). For instance, Otto and Kotzab (2003), described system dynamics, operations research, logistics, marketing, organization and strategy as correlative techniques to measure the performance of a SCN. Unorganized inventory could lead to waste that causes a huge financial consequences and impacts company success. This forces managers to work on solutions and using systems and tools to element wastes. Some tools discovered for long years, but not applied yet or correctly. Lean methodology or Toyota production system is a developed since the eighties, but few companies in Saudi Arabia apply lean concept. The major problem for a company is to change the strategy of the company, which would make them lose the business. However, a company may not know about the benefit they might get, to solve their major problems due to lack of expertise on basic lean management tools. As lean system reduces the waste and improves the quality simultaneously. The 5S system is one of the most suitable tools to implement for a company whose inventory needs improvement. The purpose of this research is to eliminate waste in household electrical appliance warehouse using the 5S system, and highlight its benefit in enhancing efficiency and

responsiveness. The article organized as follows. Section 2 provides a brief review of current state-of-the-art literature on lean manufacturing. Section 3 details the applied 5S system. Section 4 describes the case study. Section 5 includes steps of implementing 5S system and discuss results. Finally, conclusions, and recommendations presented in section 6.

2. Literature review

Lean manufacturing, Lean production, or Toyota Production System are all synonyms for lean methodology. In details, Lean methodology is a Japanese methodology used for 100 years. Lean defined as "A systematic approach to identifying and eliminating waste through continuous improvement, flowing the product at the pull of the customer in pursuit of perfection" (Kilpatrick, 2003). As lean has become important in business and used in many applications, Hettler (2008) said "lean has helped to simplify our strategic planning process and, more importantly, lean has given us the principles to guide our strategy, and the tools and techniques to deliver on it". Notably, Lean could be applied not just on a manufacturing industry, but also on the entire organization (Mehok, 2012). In another point of view Beauvallet, and Houy (2009), studied the lean management from the Human Resources Management (HRM) sight. In their study, they identified the main characteristics of HRM in lean. Likewise, Cuatrecasas (2004), had implemented the lean management method in the service management. Moreover, Shekari and Fallahian (2007), had integrated the lean management tool with the value engineering, aiming to increase the overall performance by getting the maximum benefits of each technique. Further, Fathollah and Shafia (2006), had suggested that applying the principles of lean thinking through a common platform strategy. Lean management has number of tools such as, Value-Stream Mapping, Kanban, Kizen, 5S, and more (Shaikh and Aqib 2016), (Rahman et al., 2013), (Paul Brunet & New, 2003). There could be also some tools that considered under lean such as, FIFO stands for first in first out.

Lean methodology benefits the operational, as well as the administrative, and strategic improvements. It reduces the cycle time, work-in-process inventory, and improve the quality of the operational category while reducing the paperwork and reducing error in order processing, and is under the administrative category. Applieng lean system help in increasing labor output, shorten cycle time, minimize inventory, increase the capability without adding cost, reduce waste, and improve customer services. As wastes consume money and energy, reducing wastes will improve the process, quality, and speed. In terms of customer's satisfaction, as long as the customer is satisfied, the company will always be successful. To keep customers satisfied, the company should provide a high quality of goods and services. Symmetrical with Kilpatrick (2003) and Wilson (2010) defining Lean by connecting it with Toyota Production System, as they both agreed. Lean system could help companies to be more flexibility and responsiveness (Wilson, 2010). Another study discussed the seven wastes and suggest methods to reduce waste through using lean management techniques. Types of wastes are; Overproduction, Waiting, Transporting, Non-Added-Processing, Excess inventory, Defects, and Excess Motion. Therefore, different tools could be applied to eliminate these wastes, depending on the company waste (Kilpatrick, 2003; Almaktoom, 2019). Although, according to Michalska and Szewieczek (2007) they explained the 5S and how it could be implemented in a certain company. They ensured that Lean methodology is always proceeding for counties improvement, which is the concept of the Total Quality Management. There are many tools of Total Quality Management. One of the most important tool is the 5S system that consists of sorting, setting in order, shining, standard, and sustain. These 5Ss would benefit organizations in term of quality, effectiveness, and, responsiveness. Efficient performance is the aim of any manufacturing or distributing industry. These industries could face a decline in their business cycle, which will need a process or tool to survive from this decline. Michalska and Szewieczek (2007) explained the use of each term of the 5S starting with sorting, that is used to sort materials or tools by keeping only necessary items into consideration in the storage. Second, is set in order of tools or equipment in its place. Third, is shining where cleaning comes here. The focus of shine is to keep the workplace always clean and remove wastes. The role of shining is to force the two previous rules sorting and set in order to implemented, while shining. Forth, is standardize where a fixed process is followed, rules for the organization, it used to control. All employees and participant will follow certain procedures, activities, or process that is more considered as a routine process. Last rule is sustain, where all the previews S's must be continuously implemented. Maintain cleaning, organized, standardize, and being consists within what the company is doing, in the workplace. Redesign storage as well as improving the

organization by workspace systems, in order to maximize the usage of space. 5S system can be implemented by labeling the materials and tools, or color- coded storage location. Another example of using the 5S system is when Lewis (2011) applied the 5S in the warehouse, in order to organize it, improve his business, and reduce its wastes. Also (Al-Aomar, 2011) had implemented the 5S lean technique to a production facility. Similarly, Bullington (2003) applied the 5S tool in Supply Chain Management in order to maintain a lean material supply chain. Another study had implemented the 5S management for obtaining a lean healthcare at a health center in Senegal (Kanamori et al., 2015). Glover (2012) And Michalska and Szewieczek (2007) are both corresponded that standards and sustain work under the sorting, set in order, and shining in order to apply it continuously. On the other hand, Danford (2016) mentioned that the 5S used to "computerized, point- of-use storage and dispensing systems help a certain shop target waste that is difficult to measure and often labor-intensive to eliminate". To know if the 5S is applied well, tools, materials, packing, and maintenance should be identified and labeled. Putting tools next to its machines use bar-codes, store tools in cabinets or drawer will lead to minimizing wastes.

Moving on, more specifically about waste appear in inventory, Sowards (2015) is more concerned about inventory wastes. He defines inventory as any unused materials or settled in the inventory. Also, the overproduction is considered as inventory waste, where space is needed for those extra items or materials. As a solution, Sowards (2015) have mentioned that in order to reduce the inventory wastes using a flow. Having a continuous Flow begins with the concept of "FIFO", which means "First In First Out", whatever entered the inventory first, must be used first. Even production should not start producing another item until the first one is ready to use. It is not right to produce as much as possible and store it for the sake of emergency. In addition to another study conducted by Bokhorst and Slomp (2010), they applied first-in-first-out philosophy for controlling the order of departing jobs, and takt time to monitor the timing of departing jobs in a parts manufacturing unit (Bokhorst & Slomp, 2010). Gergova (2010) signed about improving of the raw materials based the improvement of the warehouse or the inventory. If materials flow's function is going optimized, this means the inventory is going into a great function. To recognize the waste in the inventory, it can be easy using non-value add technique to make it more visible as Capital (2004) have mentioned. Applying lean system may not satisfy the company to success alone, as long as a certain lean tool is applied; it will accomplish a great result for the company.

3. Methodology

Comparing two types of research (qualitative and quantitative), quantitative research is more structured than qualitative research, due to the formulas the researcher may use while collecting data. Numbers of a participant in each type of research are different. The qualitative research involves more participant than the qualitative research; it is easier to collect data by the word-of- mouth, than doing quantitative measurement. Choosing which method to use, depend on the researcher objective. Moving on what is the 5S system is, it is an approach to organize, order, clean, standardize and continuously improve a work area. The practice of 5S aims to embed the values of organization, neatness, cleaning, standardization, and discipline into the workplace (Osada, 1991), "In Japan, the 5S practice was initiated in the manufacturing sector and then extended to other industries and services sector" (Agrahari et al., 2015). The 5S system is also can be applied into a distributing company as it will be applying in the case study of this paper. Applying the 5S will require understanding what each S means in a household electrical appliance warehouse.

Moving through the 5S in details, where sorting is the first S, that is essentially needed to start implementing the system. Sorting is removing any tools or materials that are unnecessary for the operation or the process of loading or unloading appliances. This will be required employees to know what parts or tools need to keep and get rid of is not needed, which will also need from the employees to understand the reason behind each tool. Some tools will be always used and some will be temporary, in this case, the use of sign or colors is helpful, it will better in access those tools and able to distinguish them easily. Set in order is the second S, wherein this step tools and materials stalled in a way that motivates the employees to have everything while working next to them. It will make the tools easy to access, as well as clearly shown the function of each tool. "Arrange the work in such a manner that missteps can be easily identified and corrected which is one of the main reasons why the implementation of visual controls is encouraged during this step" (Agrahari, et al., 2015). It all about organizing to reduce time, instead of looking for missing things or its places. For example, marking the workplace with

pants, taps, or sign in the floor that will make it easy to access those tools or materials. For example, materials that are the most used could be set in the shelf, where it is close and in the range of hands, or in case of high weight equipment, height is taken under consideration. Warehouses size, walking distance, and frequency of using each equipment must be considered while implementing 5S in a warehouse. Then, comes the step of shining, where cleaning and sweeping, after sorting and seeing tools in order. This will eliminate darts and damages in the workplace, making sure of the cleanness of equipment, pipes, lines, and lights. "The objective of this phase is to identify and eliminate the root cause of waste, dirt, and damage as well as clean up the workstation" (Agrahari, et al., 2015). Employees help is important in this step, where they need to inform about what things need to be clean and when to clean. If materials or tools need to be clean in fixed time, such as shelfs and left fork, a schedule is important. After sorting, setting in order, and shining. The standardizing comes next, where all the previous S's are maintained as they began. If the breviouse 3Ss are maintained, the step of standardizing will keep improving. "That's why organization develops standardized procedures, rules, and expectations for maintaining continuous activity in all of the areas shift by shift and crew." (Agrahari, et al., 2015) In this step, the previous 3S are applied as agreed on, and employees are always doing the same, standardized is achieved. The last step is sustaining after all the previous S's are achieved, maintained, powerful, visual and easily measured. If sustainable is not achieved, the rest of the S's will not be achieved as well. Discipline is what does sustain do within the system and between the previous S's. All the S's depends on sustainability as it is the most important step in this system because of its motivation all S's.

This research uses the 5S lean tool, in order in sort, set in order, shine, standard, and sustain the inventory equipment, tools, and materials of the inventory of the Home Appliances Company. Observing of current inventory system of the warehouse helped in deeply understanding of the nature of their inventory and analyzing problems that the company has. The case study discusses issues the warehouse has, and explain how can be solved using lean. Aiming to provide them suitable solutions that is realistic and applicable. Data collection of the case study obtained by observations and face-to-face interviews with workers and managers.

4. Case Study

A Saudi company for home appliances established in the1950s, where the company has started with a small shop of radios. Now a day, the company is one of the leading Home Appliances Co. in Saudi Arabia dealing in various types of electric appliances. They have a wild number of networks of showrooms, service centers, spare parts outlets, distribution centers, and about 20 branches all around the kingdom. Specials in air-conditions, washing-machines, ovens, vacuums, TVs, refrigerators and freezers. As the company field is within the distribution sector, it will mainly need an inventory as the main element in their business. To store appliances, materials, and maintenance tools, this will need to communicate with numbers of suppliers, provide a place to receive orders, and store it effectively the warehouse. The Ministry of Commerce for those kinds of business to spare parts for each appliance, within two years as a guaranty for the customers, in case of any damages. For example, a washing machine that is launched 2018, the company must have its inside and outside part of this machine. That will serve a customer in term of maintenance. Some of those machines spend more than two years in the market, which lead the company to keep having those parts in their warehouse. The company keep unnecessary parts in their inventory, and later they included as waste. It is not in their interest make a continues orders for raw material or part of all machines or appliances, because it is a loss for the company to overstored and not use the part, it all depends on customers need for parts.

Moreover, with the company issues with raw materials and parts that customers sometimes have an old model of appliances, and it needs certain maintenance. Finding parts that it is needed for the maintenance, it hard for the company as it is an old model and the company may have got rid of the parts that became waste for the company. In this case, the company is forced to help the customer, by using a part from other machines that have the same function, but a machine that is valid to use, this will lead to giving up on a machine, in order to fix the customer machine. The other machine that has been taking the part from will be considered as waste, as long as no one is able to use it with the missing part.

Going deeper on where the raw materials, tools, parts, and brand of the appliances are stored. The inventory's area is between 1600m and 3000m, where every related part of the appliances is stored there, from the smallest part to the biggest part. The issue here is the company inventory, where spaces are not exploited well, parts are not stellated at the right place, and there is no standard for arranging the inventory as shown in figure 1 and 2

Figure 1. Inventory before applying the 5S

Figure 2. Inventory before applying the 5S

5. Implementation of 5S and Results

The issues that the company have faced, such as storing materials for the required guaranty years, and the fixing machines that is no longer in the market, that makes the company uses parts from a new machine. After analyzing those problems, they need to get rid of those wastes by deal with recycling companies that are responsible to work on wastes, dismantle the machine into part and sell the parts individually; this will provide the company with another source of income. Sometimes if the dismantle part are where not able to be sold, that company can use these parts as a safety stock. However, the company also could join an auction to sell those separated parts. Thus, the company will be able to sell the parts from inside appliances, like iron, copper, and plastic. Also, they will have another source of income if they sell those parts.

After visiting the company and interviewed numbers of participants in the company and seeing their inventory. It was found that the inventory was their major problem, and they are not able to arrange their inventory in an effective way. That helps them set the machines in terms of size, weight, brand, or the type of the machine. As well as setting the parts of each machine next to it, and setting small tools for maintenance to be easy to access.

In the beginning, the situation needs a visit to the inventory, to study and understand the nature of the place. In this part understanding the size and weight of the appliances was important, also the number of machines that the company is receiving. The same thing was done by the other parts, tools, and materials, such as irons, pipes, driller's tools, and coppers. As mentioned by one of the participants, the inventory received from 20 to 25 appliances in one container, that take 25 to 30 minutes to load the container with appliances and unload it in the inventory. Raw materials come with each appliance as usual and sometimes ordered as required. After knowing what ways the company uses to move appliances from the containers when they received them, to settle them in the inventory. Using forklift to move appliances from one place to another and map to divide the inventory, considering a way for the forklift to be able to move into the inventory. Dividing the inventory was among the following, considering large items and small items, sensitive and normal. The inventory was divided to be as two inventories inside each other. Their names became the "inside inventory" and "outside inventory".

5.1 Inside Inventory:

Starting with the inside area that it is about 1600m, where this area most needed to be rearranged, and

implementing the 5S there. Implementing the 5S system was not hard in the inventory, because it was clear based on the size and weight of the items and tools. Staring with sorting that took time while processing it, due to any type of tools the company needs, in order to do maintenance. In this area of the inventory, shelves were stalled, that after sorting the raw materials there was an empty space for other staff, that was stalled everywhere. Nails, screwdrivers, hammers, and electrical and drillings tools where all needed to sort through what is most useful, and most needed. Unnecessary tools where marked with red, and the needed one where marked with green. So, employees will be able to distinguish between them.

Then, setting the green tools in order, by putting them in a place where it is next to the inventory entrance that will facilitate and reduce the time for the labor, instead of going deep inside in the inventory to grape the tool in case of going to maintenance. Each shelf needs to have a sign, where liters were in the begging of each shelf entrance. Based on the liter each brand will set its tool, materials, and equipment. For example, a brand of TVs named Hisense could have the liter "H" to represent the shelf that all this brand stuff have. Setting in order is essential in this situation where weights of the appliance must be taken into consideration. As it is a standard from the mother company in China, each item of the appliance has a limitation of machines that can be settled above each other. For example, a washing machine would bear two more washing machines above each other.

Third, all tools, equipment, shelves, and uncovered items need to be always clean. In order to maintain the function of the tools, and find them ready to use each time. This is shining, where it is important for the inventory to be clean, lighted, and refreshed with a cooling system inside the inventory. Sometimes equipment needs to be at a room temperature while keeping it in a hot place is not good for the equipment. The hot weather our country has could change the shape of the plastic form outside, or the appearance of the equipment. Also, it may lose it function from inside; in this case, the temperature is important. As it hard to open the appliances from its box to clean it, it will be better to keep it in a good condition.

Forth, is standard where the previous S's sorting, setting in order, and shining will be continuously done if they follow the standard of each S. In standardizing it will make the company apply the 5S from something new to habit. Where creating schedules, direction, and instruction became a usual activity. In each shelf entrance, there is a schedule that has a detailed distribution on when it was the latest cleaning off the shelves, how many tools is settled, and based on what these tools are set in order.

Last, is maintaining the 5S to be ongoing procedures. It referees to keep doing the 5S smoothly, as well as making the whole company from managers to employees involved in this system. When reaching sustain, it means for the company a long-term goal. If the company is not able to reach sustain, this will turn down all the work they have started. The following (Table 1) is summarizing the result out of applying the 5S system in the Home Appliances Company and how each term of the 5S was implemented.

Table 1 Summrize the result of applying the 5S system in the company

5S	Summary of implementing 5S
Sort	Nails, screwdrivers, hammers, and electrical and drillings tools is sorted through what is most useful, and most needed. Unnecessary tools where marked with red, and the needed one where marked with green.
Set in order	Each shelf has an alphabetical sign that represent the brand name. Setting the green tools and tools of each brand in its shelf, where it is easy to access.
Shine	Creating a schedule setting the days and times to clean, maintenance, and check tools functions.
Standardize	Maintain the orders of the appliances, tools, cleaning of the shelfs, and the floor. Apply these processes as a routine of the work.
Sustain	Involve all managers and employees to be part of this system. Make the system as long-term goal in the company plan.

5.2 Outside Inventory:

Moving on with the outside inventory that is about 4000m where other parts are stored there. For example, irons, pipes, and coppers. Those part bear the hard condition, like the hot weather. The 5S where not needed in the outside inventory as much as the inside inventory, due to the number of stuff where stored theirs. Applying the concept of "FIFO", first in first out helped the inventory to be always organized. By making orders from what is first received and what came last will be set for the next order. This way will keep the inventory arranged as zones were created; each zone represents something related to the order. Where zone 1 is all appliances is stalled, zone 2 is where the order is starting to get ready, using the forklift to be placed inside the container, as well as checking the data about the order comparing it with the items stated in the zone.

The last zone which is zone 3, where from this zone containers are filled with appliances, and then distributed to the branches and showrooms. In the end, the inventory has been organized successfully in organizing as shown in figure 3, 4 and 5. The company was able to eliminate the waste after applying the 5S and they have estimated that their percentage wastes will be more eliminated if they keep applying this system and be sustainable.

Figure 3 Inventory after applying the 5S

Figure 4 Inventory after applying the 5S

Figure 5 Inventory after applying the 5S

5.3 Results

After applying the 5S, cost and time have been reduces. Zones have been created and shelves are settled and arranged. There was a clean comparison before applying the 5S and after, in terms of the two variables, inventory cost and time consuming. Before applying the 5S the company was spending about 15,000 approximately as inventory management cost, due to the wastes the company is coming out of the company, in

terms of tools and parts of the appliance. After applying the 5S system, the company is able know to save 20% of inventory cost. Therefore, they are able to save about 3000 of inventory cost.

Before, labors where able to load and unload a container with full appliances; in 25 to 30 minutes. Appliances where not settled in a place that could be moved early, specially using the forklift to move easily inside the inventory. The 5S have placed the appliances to be moved easily by the sequence of zones have created Then, a container is now able to be loaded or unloaded within 15 minutes, with the same numbers of appliance which is about 20 to 30 item in one container.

Moving on with setting the order in zones based on the order list, each branch or showroom has its own standard of numbers of appliances to be received. Inside the inventory, as mentioned before order is settled in the zone 2. Appliances are settled within about 5 minutes in the area or the zone of orders. After arranging the inventory appliances now are settled within 2 to 3 minutes. Cost and time where the two factor or variables that most change in applying the 5S, that decreases the cost of inventory about 20%, and reduces the time of movement inside the inventory, time of loading and unloading**.** In order to get the best benefit the 5S, the 5S philosophy should be published among the work place and regularly revised by the team to insure the continuous improvement. It is also necessary to standardize this audit schedule.

6. Conclusion

This research scope is to find a company in Saudi Arabia, analyzes the company wastes, focus on a certain waste, and apply the needed tool to reduce this waste. A company for Home Appliances is the where the 5S was implemented. The 5S was applied on the warehouses of the company, to improve their inventory system and be more responsive and efficient. Where sorting tools into needed tools and unneeded, setting those tools in order to be easier to access, shine the place, make these steps as a standard, and sustain these steps to be as a long term goal for the company. By this change the company was able to reduce inventory cost by 20%, and reducing loading and unloading time of containers by 30%. With continues applying of the 5S system, that company will be able to save more of the inventory cost.

Finally, as the research aims to eliminate waste using Lean system, understanding how Lean is important in industries. Different points of view of researchers have agreed on, that lean is a methodology or expression of reducing waste to improve the quality of the work and having a continuous improvement with reducing the cost. Companies these days are more consist about lean, as the benefit of it can be by applying one of lean's tool. Moving over with the sequence of the research, about implementing the lean system and how it works for industries, the manufacturing and the distributing industry. Lean system could work in warhorses and inventories, in addition to where storing and distributing the product. Definitely, each business has different scenario in waste management. It depends on the type of waste such as, overproduction, inventory, waiting, or unnecessary movement waste. Therefore, various techniques can be applied according to the type of waste.

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