Journey Towards 5S: Tools to Organize a Workspace

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Abstract *– Being at the messy level, the only thing that is thought of is to perform the task in hand without giving importance of keeping an organized area. Things just go in a spot, in fact, any spot will do. Management decided to go on the great journey 5S has to offer, by developing a game plan to sustain the movements of goods and keeping the house clean. Establishing a kanban supermarket to accomplish their goals to sort and straighten everything in their rightful place. Having performed time study, revealing that it took an average of 55 minutes to set up a workstation, the laboratories got sorted out, set in order and shined. With the aid of different 5S tools, this project can rest assure that it will be sustained, thanks to its standardized metrics and guides.*

Key Terms *– 5S, Kanban, Organized Workstation, TIMWOOD Reduction.*

PROBLEM STATEMENT

Due to high demand, workstations within a diagnostic laboratory have been constantly in work mode. They are at a level where the only thing that is thought of is to perform the task in hand to deliver to the downstream customer. It has become a bit messy, where things just go in a spot, to be able to continue working on it on the following day. Associates know where everything goes, but the place they are located is a bit unapologetically unorganized. Each time a new process order drops in the shop-floor order, associates take an extra three hours to organize the items from inventory and equipment to get started. This provokes changes to the process "lead time" [1], not adding value to its value stream. The only value this add, is towards "TIMWOOD" waste, in which inventory is kept unorganized, there are lots of transport and movement of goods between workstations and some associates have delays in their process orders, waiting for goods to be available. The organization counts with two Information Technology (IT) software, one for inventory and the other for housekeeping periodic maintenance, but it hasn't been intended to keep track on actual "unorganized workstation" area. The target performance to be measured is by using both IT software to aid the sustain part of the 5S methodology. Hence the cause of the problem, 5S wasn't being maintained to keep the workstation organized. A while back, 5S got established in the biologics department, but was a "one hit wonder" and never kept under standards.

The main goal is to reconquer 5S [2] [3] by creating metrics to encourage it by using the inventory and housekeeping software, and to establish different kanban style supermarket to aid associates with inventory replenish, by eliminating delays. The game plan to accomplish this goal is to sort and straighten the workstations with the items that it needs to perform. As it gets shined and standardize, kanban spots will be put in place to aid the inventory software. The housekeeping software will help to aid the shine and straighten phases of 5S. It is expected that the outcome of this project will help the department in understanding how vital keeping a workstation organized, straighten and clean, to maintain workflow. A Kanban [4] [5] supermarket approach will be created to assist a place where common inventory can be kept in one common place, for the associate to feed off from. Instead of having each associate scrambling over the laboratory and into the shell space for equipment, we would have designated spots were inventory would be replenished by one associate. Both supermarkets would be sustained by the aid of kanban cards and the inventory IT software.

RESEARCH DESCRIPTION

The main focus would be having workstations with essential items related to the process order on the shop-floor order. No associates needs to have all of its equipment, around the room, when everything can be organized in one workstation. The idea is to identify value adding equipment and inventory and sort them with the flow of the process. An example would be similar as Subway prepares your sandwich, as you walk down the line, the server adds to your sandwich. Similar manner, the workstation would be planned to be sorted. Part of the project would be labeling the workstation to guide the associate with his process order. In addition, it is totally intended to set in order in a way that it would facilitate changeover and/or equipment clean up. The idea of having two supermarket locations is due to the actual place of the laboratory space with this shell space where the department stores its goods. Some items must be stored within a control of the International Organization for Standardization (ISO) area, and others would be the stage between the office space and labs, both are door to door, and there is a nice space to keep a supermarket location.

RESEARCH OBJECTIVE

To create a visually attractive environment, in a manner that quality and work efficiency improves [6]. By implementing key performance indicators, 5S would be sustained, maintaining inventory and workstation organized. With the metric to be placed, the organization will become more disciplined and structured, towards incrementing productivity. The associate, more aware in keeping workstation sorted and straighten, will promote a safer environment. In the end, a team spirit culture we start to bloom within the department, to achieve a long-lasting 5S atmosphere.

RESEARCH CONTRIBUTION

Being submerged in a new cultural experience with this project, the main contribution would be knowledge. Knowing what actually is needed to perform the given task in a much standardize manner, and discovering all the waste process produced, that got eliminated. In addition, to set the high importance of the value of using of key performance indicators to measure the outcome of the process. The contribution by implementing 5S methodology also guarantees, major cost reduction due to the absence of most waste eliminated and a process that flows through the value stream.

LITERATURE REVIEW

Just imagine the need Toyota had back in 1950 when Japan was trying to resurrect after World War II. The combination of different methods used, just to do more with less, at the same time bring up revenue. 5S methodology helped them to create the building block to promote a lean transformation cultural mindset, within the industry. It is as simple as keeping a clean, organized workstation, with the essential equipment to perform work. Trying to keep it in that manner, establishing a framework that will promote discipline and productivity by improving process quality with high efficiency but with a low cost to it. It was 1995 when Hiroyuki Hirano, wrote “5 Pillars of the Visual Workplace”, making reference to the benefits of having 5S implemented. This concept is simple and very simple to follow. The first phase is to sort out what it is necessary for the workplace and what's not. A common storage area is designated for materials, tools, and equipment that are not frequently used or only used once or twice, every other two weeks or so. Finally, for supplies that are hardly remembered when it was the last time it was used, should be eliminated o recycled. The second phase is to give a place to every item, that is easy to access, and everyone knows their location to return after use. Every single tool, material, and equipment, needs its proper storage location. The mindset to this phase is “the more you use it, the closer it needs to be to your workstation”, and with that in mind, defining their storage location should be easy.

The third phase is considered as the backbone of this method, for once you sorted and set in place, it must be kept as such. Keeping work areas clean and organize, will help to sustain the basics of 5S, plus will help to keep an eye out for inventory usage. This phase is not about pushing a mop, or shining countertops, it is about placing the workstation as it started, with every single item back in place. All the hard work will have its reward if the process gets standardize and it's able to be sustained. Of course, if and only if, people don't go back to their old work habits because it was familiar and comfortable. For that precise reason, for the third phase to happen, a work structure schedule need to be in place. Written standards, a step-to-step procedure to guide the practices, and scheduling tools like 5S checklist, job cycle charts and five minutes periods to support the new practices. A commitment to succeed is as important as following each phase by the book. Teamwork, spirited commitment, is needed to comply with the fifth 5S phase to sustain the change, by providing useful tools to maintain them.

As in life, we have friends that we consider our side-kick partner in crime, 5S has kanban to have its back. Birth as well during post-WWII Japan, by Toyota Just in time methodology, today know as Lean Manufacturing, help Toyota to achieve higher quality standard by matching quality with demand. Kanban system was conceived by the idea of a supermarket atmosphere. Mimicking how a store clerk restocked shelves by store needs and not by what was supplied. As for blood is to a beating heart, visual management is to kanban, extra essential. Having a very visual nature, kanban uses signals to alert workers that something needs to be done, to restock for inventory or to start/continue a process. Facilitating the team to have better communication skills, kanban gives tools to signal a specific task to be done. This helps in TIMWOOD waste reduction and magnify value, by standardizing cues in lead time. This is done by establishing any diagram that demonstrates how work flows through the system. This diagram will aid communication skills by pushing a collaborative team spirit. By cueing visual signals, an awareness for "work-in-process", helps in time reduction by following an item through the kanban system and having to prioritize task around. This acquired focus on flow will promote continuous improvements by optimizing the system to improve workflow. The collection of key point indicators to be able to analyze how work is done, by having indication on future issues. Having 5S and kanban, as part of a team, will, in fact, boost the ability to track flow and what is critical to quality. This tag team will establish the cornerstone to keeping on building a lean manufacturing mindset.

METHODOLOGY

A Six Sigma DMAIC [7] [8] method is planned to be used to approach a 5S/Kanban project, to address the problem in hand. This method helps to create a useful roadmap to solve process improvement type scenarios. Organizations are starting to adapt towards this method, when an existing process is actually not meeting with demands, nor complying with procedures implemented or associates are having defect associated with the process. Likewise, it's highly useful, when customers' specification is not being met, and upper management would devote time to know what has happened. In first, an opportunity is spotted and it gets specific attention to it as a whole. With it, a problem is defined upon it and a way to solve it comes to mind. For this research, continuous improvement tools like SIPOC [9] (Supplier, Input, Process, Output, Customer) and a Voice of Customer (VOC) are going to be used to define what the actual customer wants, and how the actual process flows. SIPOC diagram will help the team to identify everything that goes in a process, giving scope. The VOC will help the team to capture any feedback needed from our internal customer, to deliver what he or she needs as the same time complying with the project goals. Clearly defining what is critical to quality, and what is "non-value added" to the process. Needs of the customer always translate into issues and

specifications. This will give an idea towards the direction the 5S/Kanban project will go. As mentioned before, the main focus of this project is the unorganized look, the different workstation has. Associates may know, or have a general idea of where each item are, but it is a task just to get an idea where they supposed to be and have inventory control. Under that topic, inventory control hardly exists. There is a software that aids inventory, but it is only used to control quantity used versus quantity supplied from the vendor. Also, there is no ownership of it as well, anyone who remembers or is willing to fetch something would do so. Their shell space is really messy, where the items are stored at the first available spot. The goal is to use the combination of 5S with the kanban system to have an organized area to store inventory and make it easy to replenish upon what is needed. Likewise, it offers the benefit to the associates to keep flow with their workstation, by giving them the awareness of the items needed and where to place them when not needed. Additionally, the kanban system offers a supermarket style common area to keep essential items, and by ownership, an associate will be aware of the kanban cards to know exactly the quantity to bring to replenish.

SIPOC, an excellent six sigma tool to map out the process, will be used to view how material, tools, and equipment move through the process. This will give a perfect idea of exactly what items add value to the process. Upon this scope, a list of the items that actually used would be compared to the items determines in the SIPOC. A new found understanding will help rearrange the list by order of priority to know what to red tag during the 5S first phase of sorting. A value stream map, with a spaghetti diagram, will accompany the SIPOC, to define the lead time of movements of goods. SAP software will help to measure the actual time from point A, an item ran out, to point B, item gets replenish. An additional point, like time spent looking where the item is located and time spent to find a place for it, will also be taken into consideration as part of this study. After initial time study has been completed, several other will be done, finding the quicks efficient way to replenish an item. During each modification of the time study, a Voice of the Customer will be done, have the different perspective of the associate performing this task. This "time study" will be also performed for when associates are performing their given task, to measure the time it takes them to locate, use and place back an item.

Once the actual process has been measured, all variation of the data will be analyzed to determine the exact root cause. The root cause of the defects found will help to identify what adds value, what does not, and the different sources of variation. This data will give a clearer understanding when planning to perform the sort and set in order phases of 5S. Subsequently, this will help to map out the supermarket areas and what item should be stored. Formerly having the game plan, knowing how to reduce time and variability defects, the actual 5S method would be placed. From all the data collected, the first phase of sorting will start by red tagging all non-essential items, and items that are rarely used, out. To comply with the Set in Order principle, “a place for everything and everything in its place, with everything properly identified and labeled”, the kanban locations and cards, will be established. The SAP software will help by creating virtual locations to keep track of inventory, when it gets used, when should be replenished. The kanban cards will visually aid to signal that the SAP software needs to be verified to replenish a bin location.

The idea of kanban location is as follows: one "bin location" in each room, with the items needed on a daily basis, another common bin location, will be the first supermarket location to replenish basic items from each room and to store medium priority items that are used once per week. Having the second bin location located within an ISO grade room, it is easier to have a third bin as a second supermarket in the outside of the laboratory area. The flow would be: Bin one feeds from bin two, and bin two from bin three. The second supermarket (third bin location) is the one that is going to get replenished, and will be the same

location where the kanban cards will be placed. This will facilitated with a laboratory assistant not be "gowning" up to verify or replenishing a bin location when an associate can give a helping hand. Associates that work within the ISO grade labs with use the first and second bin and the lab aid will replenish the third bin, as needed, from the shell space. The shell space will also get a 5S/kanban makeover, to make the replenishing more efficient. The frequently of use will determine the closeness of the item, with the workstation. All items will be labeled with their respected shelf location within their proper storage location. A 5S mapping tool will help create a diagram that would administer a synopsis of the workstation, providing a visual aid in identifying the storage areas locations.

For the Control phase of DMAIC, the final three phases, 5S will have defined in them a monitoring and control system. By the usage of a Housekeeping software known as Maximo, the shining phase will be done weekly. For the whole program to be standardized and sustained, during the shine phase, tools like checklists, job cycle charts and "five-minute" periods would be implemented, each time the housekeeping got completed. Key performance indicators like: "Time kanban card was placed vs its delivery", "time out of stock", and "time in stock". These metrics will help give the actual idea of how movement occurs, and to sustain the 5S program by keeping everything in its place.

RESULTS AND DISCUSSION

Open de following, DMAIC method was used as a simple five step approach structure in solving the problem in hand. Starting with the desire to accomplish our goals and objectives, towards the implementation of tools for an organized workstation.

Define Phase

Things, items, materials, equipment, you name it, and it is left the last placed it was used, as it was used. Heartless care goes in keeping equipment up to date and is thrown in the first available corner. Be warned, they know where everything is, or that is what they will make you think. For not being organized has become the pet peeve, the new reason over time is needed to get a sense of the work needed to be done. On a rough busy shift, someone decided to start a 5S project, but lazy enough only found a way to set the mess in a different order. No time was dedicated to standardizing the work, to sustain how the shined the workstation as supposed to be.

Table 1
Project Charter

Objective:	Reconquer 5S by creating metrics to sustain it by using the inventory and housekeeping software, and to establish different kanban style supermarket to aid associates with inventory replenish, by eliminating delays.	
Goals:	Help the department in understanding how vital keeping a workstation organized, straighten and clean, to keep workflow.	
	Have a kanban supermarket approach will be created to sustain a place where common inventory can be kept in one common place.	
Roles and Responsibilities:		
	Manager:	Provide the tools and space needed to accomplish goals
	Associates:	Accountability during the project execution
	5S Champion:	Ensure that tools created promotes 5S with out adding "Non-value activities"
	Inventory Champion:	Ensure that tools created promotes Kanban supermarket with out adding "Non-value activities"

As proposed in table 1, it is desired to perform a 5S project, with the aid of a kanban supermarket, to eliminate most of the TIMWOOD related waste from the process. In addition, it is highly expected that it is seen an increase in "lead-time," due to the reduction in "Non-Value adding" activity. The benefactor will be the expected average of 20% in efficiency gains, within the initial phase of implementing 5S and kanban supermarket. Another observable benefactor would be the reduction in the "TIMWOOD" waste by removing all but the necessary items in a workstation. Implementing key performance indicators related to time will aid in maintaining a healthy optimize lead time.

Measure Phase

During a Kaizen meeting, the team started to analyze the different process and identified the top

defect, as presented in table 2, to address with in this project.

Table 2
Defects

1	The time it takes to go from the third floor Senior Suite Labs to Shelf space in the first floor.
2	Items spread throught the lab
3	Unorganized workstations.

Having the big picture in how to drive this project in the most optimal manner, the actual problem has promoted a clear view in defining objective goals for our data collection plan. Stating that the main goal is to understand the actual average time it takes to move from point A towards point B. This understanding will promote the objective in organizing the movement of items in a more parallel format, to promote the kanban supermarket area.

Table 3
Data Collection Plan

Pre-data collection steps	
1	Clearly define the goals and objectives of the data collection
2	Reach understanding and agreement on operational definitions and methodology for the data collection plan
3	Ensure data collection (and measurement) repeatability, reproducibility, accuracy and stability
4	Follow through with the data collection process
5	Follow through with the results
Description	
	Identifing and sorting value adding equipment and inventory with the flow of the process by having workstations with essential items related to the process order on the shop-floor order.
Data Needed	
1	Time it takes to set-up
2	Time it takes to get X item
3	Time it takes to look for X item in shelf space
4	Time it takes to look for X item in Lab

By using the SAP software, IT design similar codes used to track product thaw methods to measure the time it takes to move Item A from location 1 to location 2, as shown in table 4.

Table 4
Time Study

1	Time it takes to set-up 45 - 65 min; 55 min avg
2	Time it takes to get X Item, from Senior Suite to Shelf Space 40 - 50 min; 45 min avg
3	Time it takes to look for X item in Shelf Space 3 - 7 min; 5 min avg
4	Time it takes to look for X item in Laboratory suite. 2 - 6 min; 4 min avg

Analyze Phase

During a brainstorm session, a "5 why's" exercise was performed to down point the root cause of each.

Table 5
5 Why for Defect 1

Defect 1	The time it takes to go from the third floor Senior Suite Labs to shelf space in the first floor.
Why:	Shelf space is distanced from Senior Suite
Why:	Building original design as so.
Why:	Originaly the building was used as a laboratory and not intended for up-scale manufacturing.
Root Cause:	It takes the time it takes, due to having the Shelf space placed at the first floor.
Solution:	Creating a common space at the third floor, approximately 5 minutes from Senior Suite labs entrnace.

Table 6
5 Why for Defect 2

Defect 2	Items are spread throughout suite laboratory.
Why:	Laboratory was set in that matter
Why:	At the time, no lean culture existed
Why:	Wasn't invisioned with the team as a goal to pursue
Why:	Upper management did not invisioned it an actual benefit for the department
Root Cause:	5S metodology wasn't invisioned nor pursued as a way to reduce waste, and keeping an organize work area.
Solution:	Start promoting a "Lean Culture" and the importance of having 5S implemented.

Table 7
5 Why for Defect 3

Defect 3	Unorganized workstations
Why:	Each associate sets up as he or she favors
Why:	No standardize guide to have the same set up
Why:	No persepcion of a error could be cause from having an unorganized workstation.
Root Cause:	Absence of a standardize guide to set up assemblies
Solution:	Implementing a 5S map to create error prevention awareness through an organized workstation

The time study was performed with nine (9) associates asked to perform certain tasked to see the amount of time it will take them to do so. From the first study performed, it was obtained that it took the associates an average of fifty-five (55) minutes to get an Item from the farthest location from the third floor to the shelf space on the first floor. Quickest associate performed the task in forty-five (45) minutes and the slowest performed the task in sixty-five (65) minutes. For the second study performed, it was obtained that it took the associates an average of forty-five (45) minutes to set-up their workstation. Quickest associate performed the task in forty (40) minutes and the slowest performed the task in fifty (50) minutes. The third study had a goal to measure the time it took the associates to search for the item asked for. In average, it took five (5) minutes to look for the item in the shelf space. Quickest associate performed the task in three (3) minutes and the slowest performed the task in Seven (7) minutes. The final study measured how much it took to look for an item with their laboratory. The average time was performed in four (4) minutes, the quickest associate performed the task in two (2) minutes and the slowest performed the task in six (6) minutes. Comparing the results of the time study, the following areas of opportunities were proposed in table 8.

Table 8
Opportunities

1	Available space to set common areas for stocking items
2	Everything needed for a process in one station
3	Implementing 5S and Kanban
4	5S Map
5	The use of visual management to label locations

Improve Phase

Having Upper Management and Project Team, submerged in a new mindset, unique cultural experience acquired by the nature of working with DMAIC, now knows what is actually needed to benefit from a shorter lead time, and still keep the quality of what is done. By been able to identify the defects of the process, many TIMWOOD related waste was discovered and thought of, to eliminate them. Enthusiastically to start with 5S, an initial inventory took place for the Seiri phase (sort). Items got divided into three categories. Highly essential for all tools, equipment, and materials that were used on daily basis. Items that were used only every other day, or at least twice in a week, categorized as mid-essential. Non-essential was the category used to know which items were going to be red tag out. These items were evaluated, for their frequencies to determine where to store them. This first phase actually inspired fellow associates to improve their workstations, by having the initiative to learn the how to eliminate TIMWOOD, defect that promotes downtime and avoiding work-in-process inventory. Once a list of items was created, also divided by its category of frequencies of usage, the team used table 3 and figure 1 as a guide for analyzing it. In addition, it was very helpful to establish starting guidelines for the creation of the kanban bins for the supermarket. The main objective behind the kanban supermarket is to have common areas to stock items and materials in a more controlled area.

For Seiton phase (set-in-order), the kanban map of the area was used to guide the Seiton phase (set-in-order). Several bins were defined to support the different process, for example, a four-level decker cart was used as a shadow box, to store items, tools, and materials for a specific set-up. With this cart, a 5S checklist was included for the end of shift to assure everything was back in it's placed. In addition, the carts have a designated location to be stored when not in use. These locations are very helpful, to facilitate a preventive maintenance when it is needed to be performed. In each lab, a gondola shelf was set in place to feed the equipment carts. When the cart runs out of a specific item, associates will feed off of it. When drawing the map of the different areas, one room was identified as empty and not in use. This room was organized with various gondola shelves, to

function as one of the kanban supermarkets to supply the lab gondola when one item has finished. The lab counts with an associate that is dedicated to restocking each lab as demanded. Another space, by the office area, was identified as not in use, and available to restock with gondolas the items to stock the first supermarket. Is intended that the lab associates feed of this second supermarket, to avoid the hassle of going down the shelf space to restock. This second supermarket will feed on the shelf space, and the lab assistant will be responsible for keeping it restock, per demand. Kanban cards will be planned to be used to signal when one of the supermarkets needs to be restocked. These cards are visual indicators that some action needs to take place and they hold specific instruction in what is needed to be done. Taking advantage that everything got started to get moved around, the whole laboratory got cleaned, having everything in its place, assuring that there was a place for everything.

Control Phase

After all the hard work put in place, the team implemented a set of tools to avoid that the accomplished condition from Sort, Set in Order and Shine, didn't get deteriorated. For the Seiketsu and shitsuke phase (standardize and sustain), SAP and Maximo software were used. All the shelves were labeled with signs to identify what items goes where. For each cart and laboratory, a 5S checklist was designed as a guide to assure everything was set in place at the end of every shift.

A "Job cycle chart" was also included with specific dates and owners, to clean the areas, and to make sure nothing unnecessary is with the labs. At end of shift, the team will perform a "Last minute 5S period" to assure that everything was returned, cleaned and organized. As a visual reminder, a display board will be set up with general 5S guidelines, a friendly reminder if any item, tool, material and/or equipment wasn't set back it is placed, and to post any 5S kaizen initiative. Upper management has decided to include in each associate annual evaluation if he or she has kept a good 5S attitude, and a weekly 5S report. In addition to, management will give to training group a special module, as a 5S refresher every three months. Per the Maximo software, shine phase will be performed using the 5S checklist tools as a guide. Finally, management will perform a bi-monthly audit to grade 5S performance. For the kanban supermarkets, a guideline was created to ensure proper use of it. Anyone that needs to restock, needs to do so as stated in the card. Nothing could be moved or changed from a place, without any kanban specifications. This will also have its own checklist and will be audited as same as 5S.

CONCLUSIONS

As we have mentioned, establishing 5S, with the aid of a kanban style supermarket showed an average of 20% of efficiency gains. It also created a team that always keeping an eye on the area for any improvements. The karts and checklist have been really successful during its first week of use. Associate fell more confident as they work, trusting in what they are doing. With the metrics in placed, the team has become more disciplined and organized, towards increment of productivity. Having a safer work environment, associates have been aware in keeping everything sorted and straighten during, and at the end, of every shift. Such team spirit has been lifted, that everyone watches for each other, maintaining the new culture to achieve a sustained 5S atmosphere. Removing all but the necessary items during the first phase, it got much easier to look for an item and TIMWOOD waste of waiting and motion got drastically reduced. The shadow boxes placed with the kanban carts eliminated many of the other TIMWOOD waste. Items, tools, and equipment became obviously clear to grab and use. It seemed that other defects and malfunctions were masked with the clutter and mess they have become more obvious. Thanks to 5S, team members are really responsive to take action in preventing delays or greater downtimes. Thanks the company's

standards, delays, defects and other wasteful occurrences started to be prevented. Upper management became content with the outcome, due to the visual management aspect 5S and kanban bare. Anyone could easily spot if anything gets misplaced or gets missing. Hoping that when we first perform a 5S audit, anything that gets spotted is because of its new occurrences, and not because things started to go back as it was. The team is compromised to follow each tool are set in place, to comply with this project. Enjoying all the pleasant benefits a more visual and organize environment offers.

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