Barriers that lead to 5S failure in manufacturing

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Abstract

Abstract

5S is a lean tool that is utilized to reduce waste and maximize efficiency. 5S implementation can be beneficial to an organization in terms or improved quality, reduced costs, standardizing work processes and financial gains. Manufacturing has been linked as the origination of 5S. 5S developed in Japan, combines workplace organization through the use of efficiency, effectiveness and safety [1]. It has evolved to other sectors such as healthcare, service and office settings.

The intent of discovering 5S manufacturing failure connects to other industries that share the same concerns of reducing costs, standardizing processes and improved quality. 5S is beneficial when it is successfully implemented and sustainable. When 5S fails the barriers that cause the failure must be determined to understand the failure of 5S in a manufacturing workplace. The barriers can occur at any of the 5S stages and thus the outcome of a failed 5S project needs direction on what stage it fails and what actions are needed following a failed 5S project. Identification of barriers that lead to 5S project failure will determine the effectiveness of the 5S stages.

Definition of 5S as a success or failure

5S failure requires a definition of what a failed project is. To understand what a failed project is, a successful 5S project should be defined. There are many cases of successful results of 5S. The Bureau of Economic Analysis conducted a study in 2011 on the value added dollar of manufacturing represented 12.2 percent of industries in the U.S. In 2015 the Center for Automotive Research released a report that revealed 5S tools and lean continuous improvement methods contributed to $500 billion annual compensation of 1.5 million automotive jobs. [2]. Financial drivers are the underlining focus of many 5S projects.

5S success has led to incorporation of adding Safety as the 6S. A case study on Medium and Micro-Small enterprises created a paperless system and a sustainable waste recycling program making the outcomes of the project a success. Process improvements and addressing safety were main concerns for utilizing 5S. This study eliminated waste processes and also introduced safety factors such as better hygienic conditions, eco-friendly waste disposal practice and improved housekeeping methods. 5S integrated into 6S with the sixth S being safety. [3].

Lean had gain popularity that spread through manufacturing. Many manufacturing organizations began to jump on the lean bandwagon utilizing tools such as 5S, Poka-Yoke, Kanban systems, just-in-time and Kaizen events as they followed suit of what other organizations were attaining. A case study by The Industry Week/MPI Census if Manufacturers resulted with 70% of plants in the U.S is utilizing a form of lean manufacturing as an improvement method. The study did not focus on if lean was the correct tool for the organizations. A further look at the same IW/MPI survey displays that only 2% of companies who responded to the survey have fully achieved their objectives and less than a quarter of all companies, 24% reported achieving significant

results. That leaves 74% of the responding companies admitting that they are not making good progress with Lean [4]. A successful 5S project is one that is repeatable over time without any diminished effects.

There are numerous motives for implementation of 5S as there are explanations why 5S fails to deliver the results for a manufacturing organization. The main problems associated with sustaining 5S, provides knowledge to quality professionals for understanding 5S. The importance of the investigation is to understand how 5S works so well for one organization and not for another. As a baseline tool in lean concepts, 5S is what many consider the introduction on the start of a lean journey [5].

Barriers causing 5S failure

The results of 5S failures are less likely to be publicized. A case study of collected materials, through qualitative methods within phenomenological research framework, demonstrates that Organization X used to have good level of 5S in the organization. Maintaining this level has how ever been neglected during recent years. Current work in 5S is inadequate and several employees have requested structure and orderliness at the work place. Analyzation of differences between past and present work of 5S as well as analyzing the difference between the employees' expectations and Organization X promises of 5S in the organization and barriers affecting the accomplishment of 5S were identified [6]. This research identified barriers that contributed to a completed 5S effort. Outdated concepts and employee expectations led to the failure of sustaining the 5S.

Suppliers to the U.S automotive industry indicated that key factors influenced all the phases of 5S project. A research study was conducted to develop a better understanding why some organizations fail to implement all phases of 5S. The finding resulted that there is a strong relationship between all factors, elements and phases which created an impact to the success of a 5S project [2].

Toyota might be the leader for lean practices including 5S success but why does 5S perform so well for one organization and not another? Organizations need to interpret their knowledge and use of lean and incorporate it for their strategy. An example from Scania, "which is one of the best examples of lean thinking implementation outside the Toyota Corporation. Study results indicate that success or failure of lean initiatives strongly depends on companies approach to it and on whether the company has created their own philosophy towards lean."[7].

Management

Basics aspects of 5S are to remove waste, organize work areas and maintain repeatability. Effective leadership is required to administer the concepts and expectations. These factors play a role for managers and the cultural involvement of 5S for an organization. The role of

management to support 5S efforts is a crucial factor on the success on proper implementation. Management needs to view the benefits and invest the resources to support a manufacturing environment that adopts 5S [8].

Utilizing 5S as a gesture for the sake of attempting lean techniques which does not endure day to day operations is not a viable conception. Creating a visual board and letting it collect dust does not constitute it as a 5S project. Buy in with employees in a manufacturing setting includes all levels of the organization from assembly personnel, machine operators, supporting engineers, front line supervisors and most importantly upper management. The top down support needs to be existent for 5S to occur and continue. 5S as a trend to clean up work areas only to dirty them in the future or performing an activity for the motion of doing something substantial does not make it a success. Management has to adopt the true 5S model and without appropriate understanding or training, 5S may be destined for failure from the start [7].

Process

The lack of understanding of both manager and employee is a process fail on what 5S is attempting to achieve. Boeing and its Ethiopian Airlines crash led to an FBI investigation into the company. The shortfall of Boeing's action led to continual monitoring from another federal agency. Safety concerns of tankers were grounded due to the fact of foreign debris inside the operational compartments leading to wear and damage over prolonged use and time. Revelations indicated Boeing did not have a standard process of quality control that led to the safety concerns and regulations not being met. A 5S project requires that the process be fully understood for proper implementation. 5S can be masked as a housekeeping tool, or cleanup project, but the continuous upkeep of all the efforts must repeatable. Had Boeing initiated a tool as simple as 5S, would the chances of foreign debris been present inside their tankers? [9]

Not understand the 5S process or any confusion on responsibilities will cause a process to fail. A process can also have multiple variations that led to instability of 5S. Execution of the shine stage before set stage will lead to mismanagement of 5S and could result with confusion. The steps should be implemented in sequence. There are times when 5S is not compatible with the process. This would require further analysis and possibly starting from the beginning or utilizing another tools beyond 5S.

The Organization

The culture of an organization to transform into a lean culture is very challenging and involves many individuals from various levels to venture into the journey. The demands are high for both employees and management but rewards lead to the outcome of benefits for the organization. The culture of the organization needs to live and breathe 5S and deem it as a valued tool or it can become a waste itself. The inability to create and maintain 5S as an achievement, a lean tool at the simplest form, will cause barriers to adopt other tools such as Kanban, just-in-time, push/ pull or single piece flow.

Failure rates of Lean implementation including 5S are staggering. A study from I-Six Sigma presented the failure rates of lean implementation around 50 percent and can inflate as high as 90 percent with failure defined as a return to the organization's original way of doing business. Statistically speaking, there's a real chance an organization won't make it through the first year of 5S and lean implementation [10]. While each plant had its own strengths and weaknesses, the one fact that was clear was numerous of the plants which had implemented some form of workplace organization, none were obtaining the results they desired when executing the effort. The practice of 5S when Upper Management was scheduled to visit created an illusion. Casual efforts to implement 5S failed to deliver a lasting impression. The organizational culture of adopting 5S or not adopting 5S can be prioritized as low priority to manufacturing operations.

People

People are a barrier that results in 5S failing. Not engaging employees with participation in project decision making is a main principle affecting innovation, productivity, and work satisfaction. Workers typically have more complete knowledge of their work management; hence, if workers participate in decision making, decisions will be made with better pools of information. Attaining the employee buy in is the initial part of 5S. Lean training is crucial but the content, level, and depth vary by the company and its needs, activity, and function. It goes back to understanding the fundamentals of 5S. The training needs to be appropriate to the functional level of deployment. [11]. When people don't understand 5S, the resistance to change and forced activities will result with lack of motivation to maintain 5S. Expectations of 5S need to be clear and without proper follow up; 5S will end up becoming a waste.

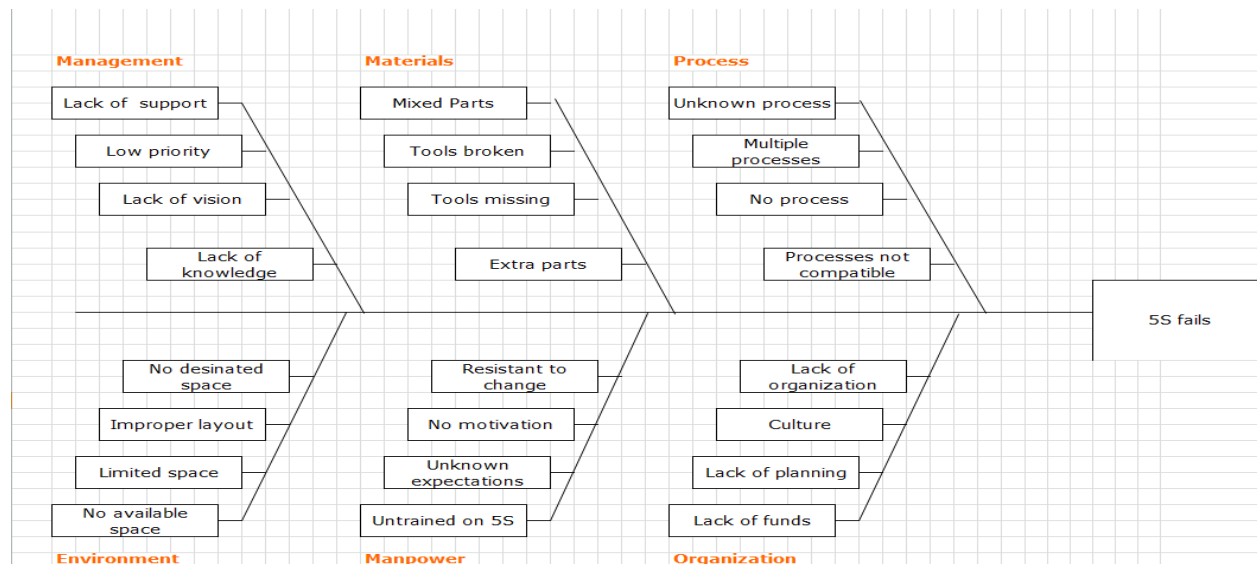Fishbone diagram on causes of 5S failure

Figure 1

Materials and environment also contribute as a barrier to 5S failure. Broken tools or additional parts located at a 5S workstation compromise and oversaturate the work station. That is not to say no additional tools or parts cannot be added, if they are to be added, a proper designation of a location should be provided. Environmental concerns with lack of space, improper layout or unidentified space contribute to failure. Having a 5S station that is not located close to point of use can increase travel time. There are situations such as tool storage or 5S of less frequently used tools into a central location that makes sense. The challenge would be the responsibility of multiple users and their efforts to maintain the 5S would create higher opportunities of failure.

Barrier ratings were identified with the most common occurrences ranked from low effect to high effect of a 5S project.   5S as a low priority from both management and people perspectives both ranked at a high level of failure. This indicates that there are other activities that are more important than 5S. Low level priorities such as lack of knowledge and being untrained in 5S are barriers that could easily be solved with more training and exposure to 5S.

	Barrier Ratings	
Management	**Lack of support**	Med
	Low Priority	High
	Lack of knowledge	Low
Process	**Process not compatible**	Med
	Unknown Process	Med
People	**No motivation**	High
	Resistant to change	High
	Unknown expectations	Med
	Untrained in 5S	Low
	Low priority	High
Organization	**Culture**	Med
	Lack of resources	Med

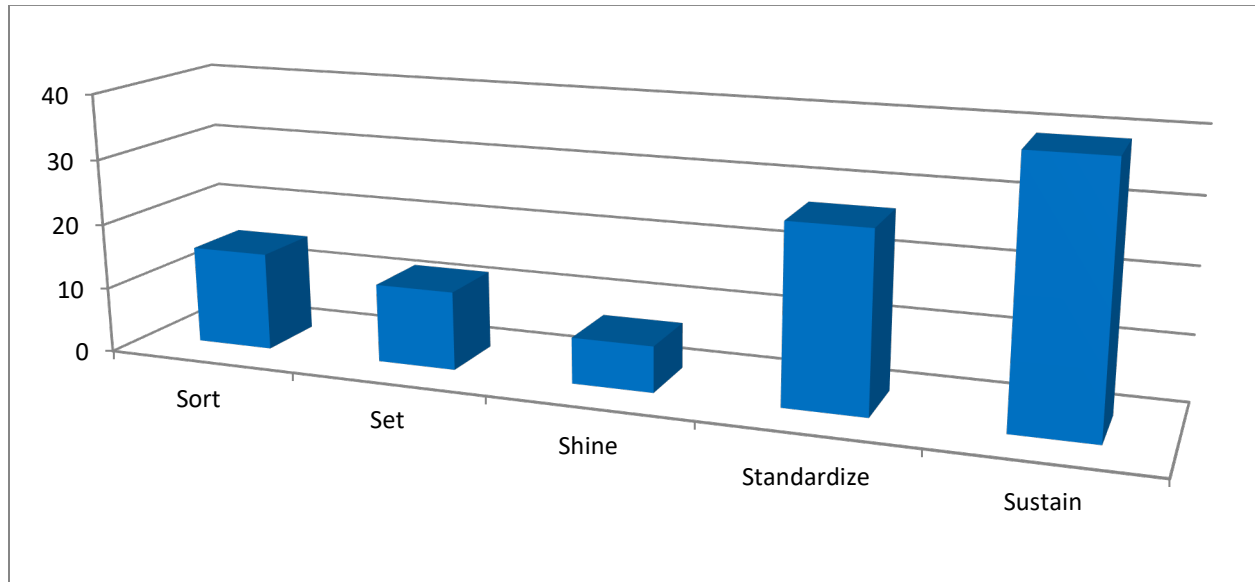Figure 2

Stages of failure

Figure 3

The stage where 5S fails the most is Sustain. Research conducted reveals failure at the Standardize stage reduces the effectiveness of the Sustain stage. Important behaviors and feelings of people including fear and anxiety of being fired, a sense of danger or current position or skills result to overlooking the importance of 5S. The focus on other items in manufacturing such as reaching production goals, reducing scrap and being on time for work have a priority over 5S[12]. Changes usually raise the concerns and introduce uncertainty and ambiguity in place of what is well known. The causes of resistance are also reluctance to additional responsibilities, adherence to tradition and the negative previous experiences. Adding 5S on top of regular duties in manufacturing can feel forced.

Priorities in Manufacturing

Through a conducted study, 5S rates as one of the lowest priorities in a manufacturing setting. The highest priority is reaching production goals. Productivity priorities such as performing quality work and being on time for work rank much higher than 5S. This data represents the people and management barriers contribute to failure of 5S projects. 5S is not a measurement of productivity, such as a sustained 5S work area does not relay to performance excellence in productivity. Just as the case that the most productive worker might have the worst 5S station on the manufacturing floor. Though the relationship of a successful 5S might not always transfer to performance excellence, 5S as a practice must be integrated as a process to be meaningful.
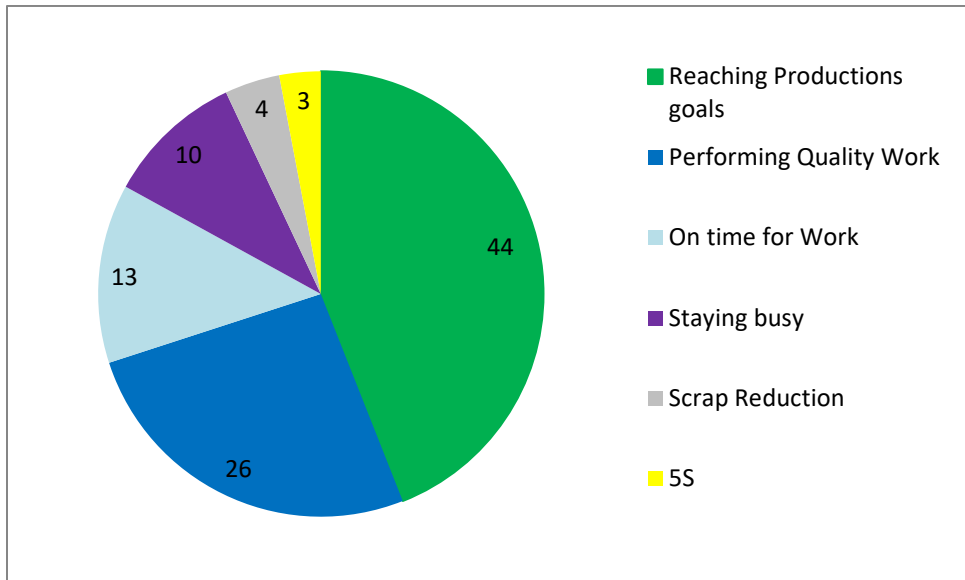
Top priority in Manufacturing

Figure 4

Case Study of 4 lines in a manufacturing organization

A study, at my place of employment, of 4 manufacturing assembly lines from an organization in the consumer goods industry was conducted. The history review of a 5 year span of 5S projects that were implemented or updated was reviewed. 2016 is the year where 5S was formally introduced to the company. In 2017 Supervisors of the lines were assigned a goal to complete 1 5S project per month for the calendar year as part of their annual review. The goal was not renewed for 2018, 5S projects were encouraged to be initiated or upgraded according to line needs. All completed 5S projects were documented through a power point presentation that highlighted before and after pictures of 5S projects at the specified work stations.

Number of 5S projects implemented				
	Line 1	Line 2	Line 3	Line 4
2016	5	3	0	12
2017	12	13	17	11
2018	2	6	7	8
2019	5	11	12	10
2020	1	0	3	2
Total	25	33	39	43

Figure 5

Number of 5S projects sustained				
	Line 1	Line 2	Line 3	Line 4
2020	1	0	2	2

Figure 6

In 2020, a walkthrough was conducted for all the projects and the results of sustained projects were announced. Only 5 of 140 projects were sustained to the original power point document. That concludes that 3.5 percent of 5S projects that were implemented proved to endure day to day manufacturing operations. The 1 sustained project from Line 1 was implemented in 2016. Both projects from line 3 were implemented in 2019. Line 4 had 1 sustained project from 2016 and one from 2018. The ability to decode if the current personnel were in position from the date of project implementation is difficult to attain.
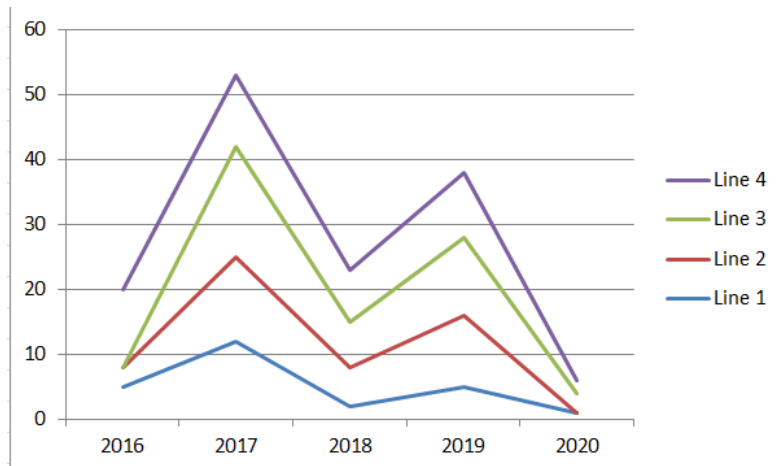

Figure 7

Barrier failure by stage

This organization utilized 5S as a tool to clean up and declutter work areas. As time progressed the importance of 5S began to slip away. Once 5S was no longer used as a management goal, the effectiveness began to decrease. In year 2019, supervisors were reassigned to different lines as a means of cross training. This provided an increase of 5S projects throughout the lines. Data from 2020 is limited due to the shorter period of up to date information.

A survey conducted at the organization shows the failure of 5S projects at each stage with all root cause barriers. All barriers are close to equivalent at the start. Process barriers become more disruptive, as employees learn to understand the intended use and level off towards 5S

completion. Organization barriers trend downwards as the project matures. Management barriers become the top barrier as 5S projects near completion. The lack of follow up or support from management begins to take its toll on projects. People barriers remain consistent with all stages, with regards to 5S projects not attaining initial buy in or the priority of 5S compared to other operational activities.
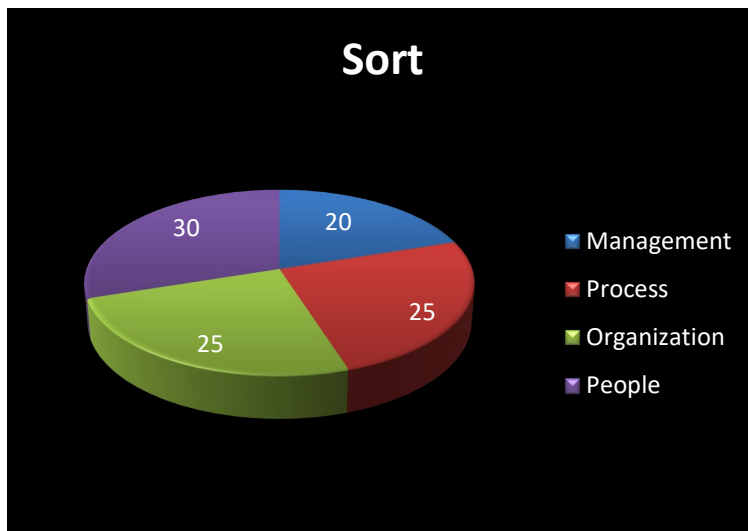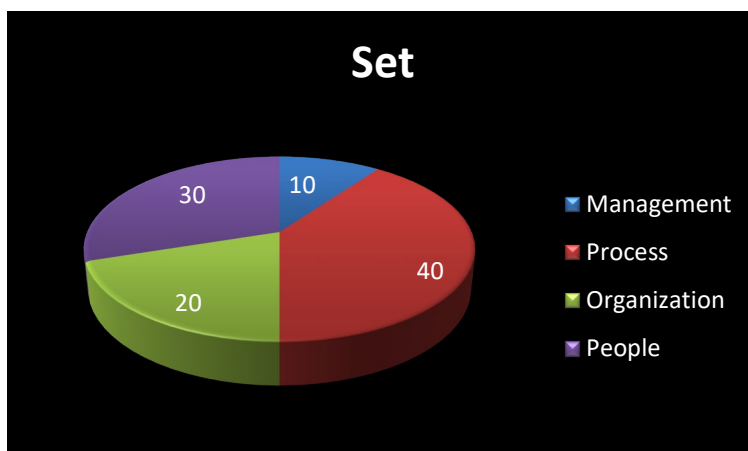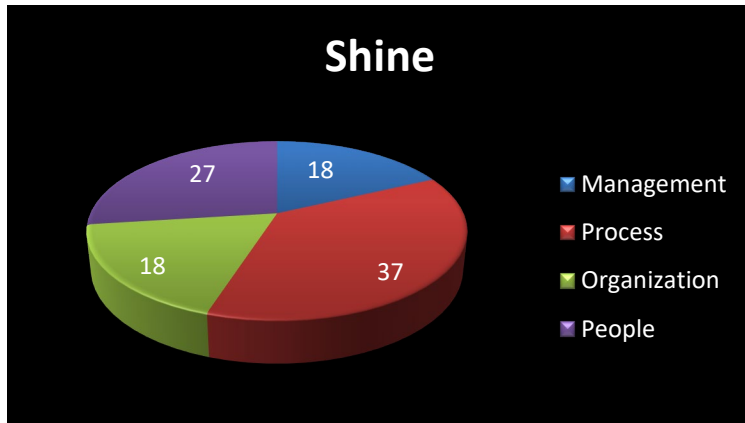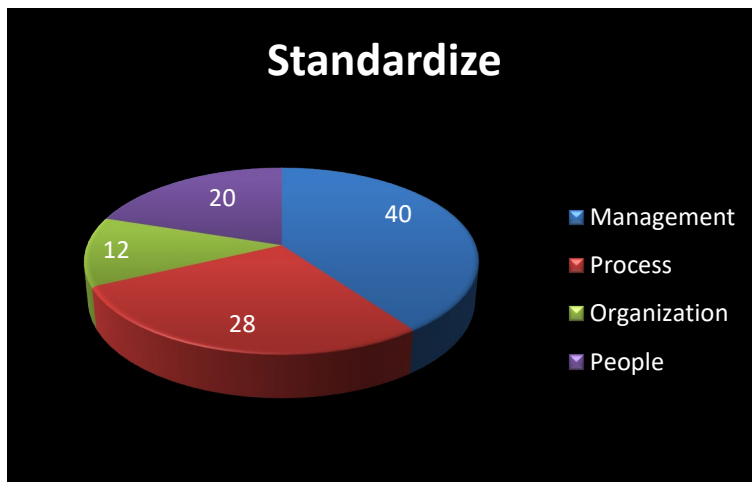

Figure 8

Figure 9
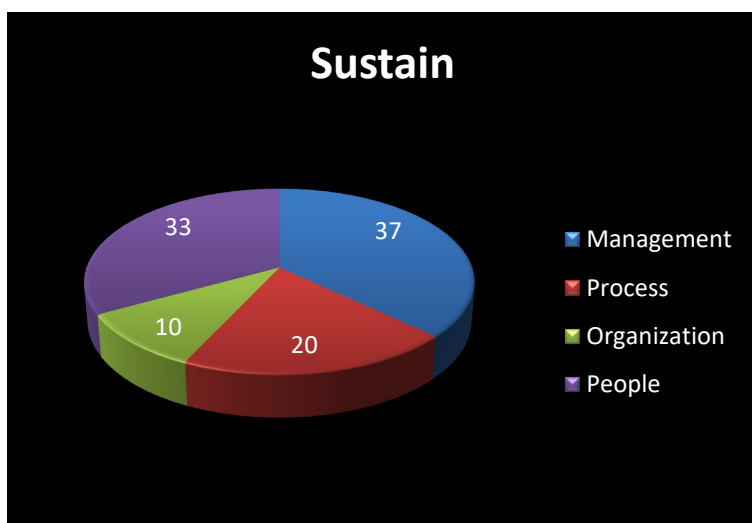
Figure 10

Figure 11

Figure 12

Options for a failed 5S project

There are options when 5S fails at a stage. The decision will lead to one of the four conclusions.

1. Start at the beginning with a new 5S project
2. Return to the preceding stage before failure
3. Eliminate 5S entirely
4. Continue with the 5S and update accordingly

Starting at the beginning with a new 5S is favorable early in the project. If the project fails at the sort or set stage, it is still early in project where there is no critical decisions yet made. The project can be restarted at any failed phase but as the project nears completion it leads to loss on the efforts contributed at each stage.

Returning to the preceding stage before failure is an option to preserve the work of the completed stages before failure. This is a good option to improve on work that has been completed without sacrificing the efforts that have been completed.

Eliminating 5S entirely is an option that could be beneficial if 5S is not the desired tool. The further the stages of implementation have been completed creates the more efforts that have been wasted. The decision to eliminate 5S should not be made by just one individual but should be confirmed by the strategic direction of the organization.

Continuing with 5S and updating accordingly is considered a 5S work in progress. 5S should never be left incomplete but there are barriers that have been discussed or yet to be discovered that can influence the project to continue until a concrete solution can be implemented. Sort, set, shine might be the only stages that the organization requires at the moment.
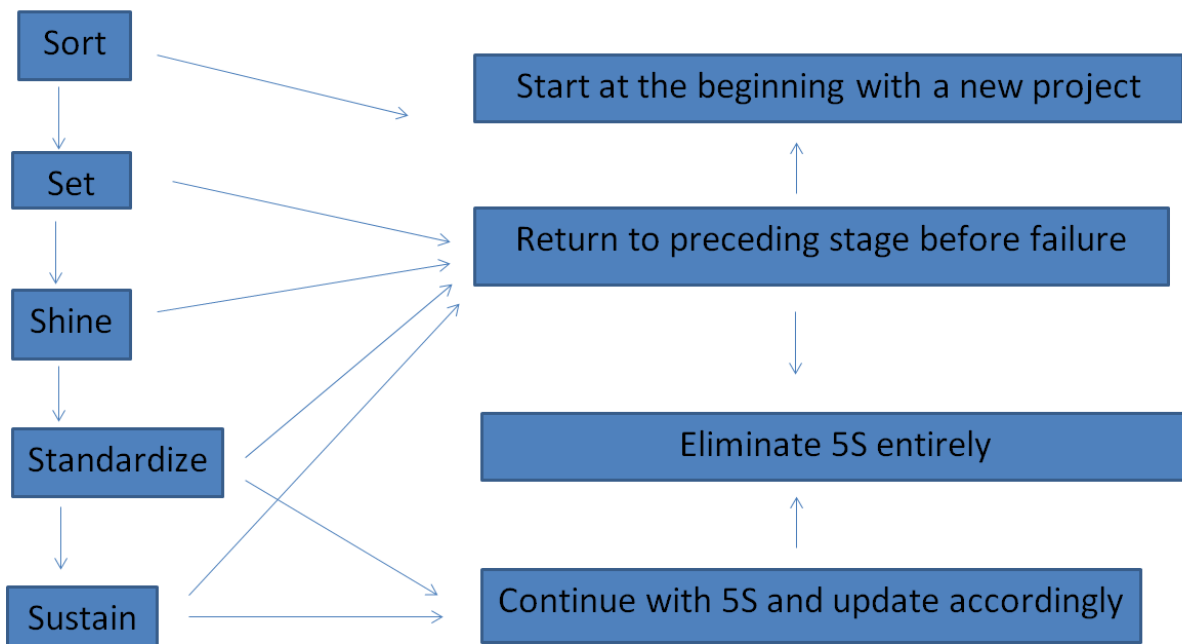
Flowchart of 5S failing at a stage

Figure 13

Summary

The benefits of 5S implementation consists of a simple tool that can be implemented at a low cost to improve manufacturing operations where the workplace becomes cleaner and better organized, shop floor and office operation becomes safer, visible results enhance the generation improved ideas. The most important factor for 5s to be successful is a full commitment and participation and involvement of everyone from production operators to front line supervisors to upper management.

5S failures have been identified into 4 categories of barriers that lead to its ineffectiveness consisting of management, process, organization and people. These categories further indicate the 4th and 5th stages of standardize and sustain are where 5S has the highest opportunity for failure. Misconceptions of 5S and the intentions of what an organization is attempting to achieve must be clearly defined.   Measurability must be created in a form that an organization can view the results of what 5S implementation has created. Examples include 5S improving the product quality, reduction of scrap and defects, improved changeover times or organized tooling for streamlined access.

Lean manufacturing focus on waste elimination. However current 5S failure rates are well over 50 percent, according to many advocates and professionals, are much too high for this to happen. The 5S definition can be lacking and not concrete enough. Failures at the management levels and training levels can lead to failure before the start of the project.

Conclusion

Before 5S is considered, an organization should decide what role 5S plays in the organization. The 5S priority should be measured against other organizational goals including financial gain, profitability, safety concerns and strategic direction. Successful projects can deliver what an organization might be looking for but when there is a failed 5S project, invested time is lost, and resources for resolutions could face availability concerns in time and financial allocations. Manufacturing has been a key industry where 5S projects turn dirty factories into organized work areas. Data indicates the failure stages but the success or failure of 5S depends in the manufacturing organization intent on the role of 5S and what the organization is trying to achieve. The barriers of 5S achievements are created by failures within the stages of 5S.

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