

# **Implementation of Shitsuke for Sustaining with 5S Culture in a Mechanical Workshop**

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## **Abstract**

Shitsuke is the last S or rather last phase of the 5S. It is to maintain discipline prior to the previous Ss which are Seiri, Seiton, Seiso and Shitsuke. This paper reconnoiters Shitsuke for sustenance in a mechanical workshop. The purpose of this paper is to report on implementation of Shitsuke for continuous improvement in the mechanical workshop of University of Johannesburg. The proposed strategies will be the root of sustenance so that the other 4Ss are well maintained, are preserved for prolonged time in years, and maintain the culture of the workshop. The aim of this study is to implement and use strategies to maintain Shitsuke, thereafter, maintaining discipline and culture in the workshop. It is through these strategies that the workshop and the 5S culture will have new perspectives. The newly cultured workshop shows more discipline and standardized workplace. Orderliness and suave operations are the greatest results by far. In a developed checklist which is a data collection technique to check and collect effectiveness of 5S and Shitsuke. Efficiency and effectiveness of the workshop through sustenance is the ultimate goal attained.

## **Keywords**

Shitsuke; 5S; Kanban; Quality; Efficiency

## **1. Introduction**

The last S out of the 5S is “Shitsuke” a Japanese term meaning “Sustain”. Shitsuke stresses on making a habit of accurately maintaining the right procedures. Sustaining a workshop involves setting new standards as well. The continuous success of implementing Shitsuke starts with “self-discipline” from an individual so that it escalates to the workplace. Becker (2001) confirms that self-discipline has much to do with forming favorable “habits” or “common behaviors” and maintaining them in the long run. With Shitsuke, the actions and behaviors of employees towards the workshop reveal a lot about “self-discipline” and discipline towards the workshop. To instill organizational culture in a workshop, the employees have to be well trained, equipped and provided with full view training on 5S and on its Shitsuke stage. This paper brings the attention of implementing continuous strategies to firm sustenance. These strategies account both the employee and the workshop. Ramdass (2015) also confirms that commitment from everyone is crucial so that the rewards of program are gained. This paper presents Shitsuke as a tool and technique for quality and productivity improvement, which will also lead to increased employee engagement and participation, improved work environment and enhanced performance.

## **1.1 Problem Statement**

The lack of handling materials, tools and people in a workplace has led to many challenges such as misplaced tools, and materials, decreased employee participation and commitment. Most challenges with regards to workshops and machine shops in dept of mechanical engineering at University of Johannesburg was that, due to conventional working strategies, ignorance and lack of awareness in the workshop staff, there was no proper storage form, organization, safety, and inventory for tools, materials, and other items. There was high usage of tools and materials from different individuals that leads to misplacements and unnecessary movements. The absence of programs which detail the basics of the workshop have caused unending issues because different individuals have access to the workshop and no strict rules are instilled for them to follow. Implementing Shitsuke in the workshop along with the strategies has never been a formalized technique before.

## **1.2 Mandatory Applications on Shitsuke**

- Awareness – Everyone should be aware and understand what 5S is all about
- Time – Enough time should be given to conduct 5S
- Structure – Formulate a structure on how and when activities of 5S will be conducted
- Support – Support from management is required for leadership, acknowledgement and resources
- Rewards and recognition – Any efforts made have to be recognized
- Satisfaction and Excitement – Any achieved goal and vision has to be share amongst everyone in the organization.

## **2. Literature Review**

### **2.1 Review of Past work on 5S Workshop Implementation**

Vaidya et al. (2017) worked on implementing 5S at a workshop, the objective set on the study is to organize the workplace, eliminate duplication of unwanted and unnecessary materials. The outcomes revealed that implementing 5S led to improved identification and minimized waste, free usage of working area, reduced time searching for documents, equipment and stationery. Major changes surfaced after implementation of 5S.

A case study conducted by Ebuete (2018) aimed at standardizing a laboratory by 5S implementation and thereafter evaluating the effectiveness of 5S by investigating some performance indicators such as efficiency, workspace, equipment search time, safety, and improved working conditions. They reported attainment of very satisfactory results.

In another important work, Jimenez et al (2015) used 5S methodology to organize, sort, maintain the perfect working conditions using available resources. In the analysis of outcomes, reduction in faults and accidents and well managed inventory are reported.

Sari et.,al (2017), the aim of the study to facilitate work processes and reduce waste, through implementation of 5S in an ergonomic laboratory. They used a radar chart as an audit tool for performance indications. With the results obtained from the radar chart, the laboratory is well standardized as anticipated.

Pentti (2014), 5S method is also used as a lean tool. One of the key objectives of the study from Pentti, is to make a platform for future 5S implementation in laboratories, to begin a process of continuous improvement tool in laboratories. In this study, the implemented 5S showed different results attained such being leaned wastes, wear-off of tools and equipment and stress levels also decreased. Increased knowledge level of continuous improvement among staff and managers, time saved through the sorting event and clearer order of equipment and tools. The evidence proved from this study is the importance of continuous improvement programs in the workplace. As a result, distribution of tools, their visual control and knowledge of staff improved.

## **3. Methodology**

As known, for Shitsuke implementation, various programs and systems are required for continuous improvement and sustenance of Seiri, Seiton, Seiso and Seiketsu. Therefore, certain strategies are introduced in the workshop and implemented on Shitsuke to maintain and sustain the workshop. Shitsuke finds a balance on maintaining all four S equally through those strategies:

### **3.1 Training**

Training is a platform with lessons for everyone to know and understand the basics of 5S. The people that are common and familiar with the workshop and the office laboratory, are given attention as they have to adhere to every detail of 5S. The purpose of training employees is to facilitate, educate and accentuate the importance of 5S and its principles, omitting misconceptions around the workplace and emphasizing on benefits of implementing 5S. Training sessions took place at the workshop to accommodate everyone. Training kits used are posters which clearly demonstrate the 5S map and its meaning from first phase to the last. The pictures showing what the place used to look like and how it was transformed after implementing 5S were used. The pictures give a sense of how the place should be kept and well looked after. The training session also became a turning point for the employees since responsibilities and duties were shared amongst them. Everyone knows what their responsibilities are and have to respect that decision.

### **3.2 Forming Cleaning Schedules**

Cleaning schedules are developed for everyone to know their shifts and routines, responsibilities around the workshop. This cleaning schedule is in a month to month schedule and it is changed at every month end. The activities and responsibilities are rotational so that workers do not get bored with their everyday duties. Rotations and swapping activities among employees gives them a sense that every responsibility is important, no one or no job is harder than any everything and everyone is equally appointed. It is pivotal that each employee pays close attention to the cleaning schedule developed. Each cleaner is allocated an area/zone to clean daily, weekly, or monthly. The cleaners' areas/zones are highlighted with different colours to avoid any confusions and misunderstandings.

### **3.3 Quality Circles**

With quality circles in place, the employees are able to get some motivation from the top managers, and technicians. The involvement of top management actually required so that they know about the workshop and rapidly act to any action required. Quality circles are defined as, group of employees that sits together and provide valuable ideas and feedback to solve problems related to their own jobs.

QCs make it a priority that everything operates smoothly and without unnecessary hiccups. The development of quality circles is designed around three phases which are: planning, implementation and evaluation (Mbovane, 2009).

- a) **Planning a quality circles program** - The technicians and other staff members who have direct contact with the workshop and office are identified suitable candidates in the quality circles programme. After planning the programme, a steering committee has been established. The steering committee of quality circle overlooks the planning and deciding on which venue of the quality circle meetings to accommodate and guarantee attendance at meetings:
  - Planning dates and times of meetings
  - Electing members
  - Dealing with variabilities
- b) **Implementing a quality circles program** - implementing a QC program ensures team work and staff empowerment, and a chairman is selected to oversee the effectiveness of the quality circle program. The chosen chairperson has certified that QC meetings are held weekly, there is an agenda and is communicated to the entire steering committee to confirm productive meetings and complete participation of the steering committee, ensures a monitoring system is in place and reviewed periodically, minutes are generated from each meeting to ensure continuity and progress. They are filed for future referencing.
- c) **Evaluating quality circle program** - evaluating a QC programme aims at generating data based on the progress of the quality circles programme in order to develop and improve the programme. Like when implementing quality circles programme, the chairperson has confirmed that: a policy on the evaluation of the quality circle is formulated, communicated and implemented successfully.

### **3.4 Poka-Yoke**

In the previous step, when implementing quality circles steering committee, a chairperson is responsible for a lot of duties one of them being dealing and solving variabilities. This has been done through the application of Poka-yoke. To sustain the workshop, having a routine, or habitual essence in solving problems promotes sustainability and mistake proofing. Poka-Yoke is commonly used in manufacturing industries since they work with parts and products that may come defected.

Mistakes happen everywhere, whether service or manufacturing sector, and the need to mistake proof is required. The mechanical workshop has been mistaking everything in managing the tools, equipment materials and its own people.

### **3.5 PDCA Cycle Approach**

**a) Plan** - To Plan in 5S is practicing Seiri. P in PDCA is the first step towards continuous improvement. The planning is a process to analyse areas of change and improvement. In 5S implementation planning for improvements is a major goal. Planning around areas of interest for improvement in the mechanical workshop, have been to minimize search time, improved and acceptable working conditions to name a few.

**b) Do** – To “do”, allows the Plan from first phase to be enacted. This phase relates to Seiton and Seiso, where after Seiri – sort, the items are then “set-in-order”, and the place gets refreshed through cleaning. With “do”, data is gathered in testing any changes made. The solutions are more practical actions or rather this “do” phase is of practical actions. Whatever plans made in the first phase, have been preceded to second phase, “do” – to put them into practice. Hence like with 5S, after Seiri is completed, items are then “set-in-order” which is “Seiton” and after Seiton, “Seiso” follows, which means to clean. Both Seiton and Seiso are prepared under “Do”, they both demand practical actions, to proceed with what has been planned.

**c) Check** – check is testing whether the applied “plan” set will work or not in 5S, “Check” related with Seiketsu, that is to standardize the workshop and the office through labelling, colour coding and most importantly setting new standards in place. If in the “Do” phase, data was collected then “check” is whereby that data results are being evaluated. In this evaluation process, any changes made such as changing the setting of the office, are tested whether they are flexible, efficient and fit for the needs of the workers. This is to test the new changes from original settings and plans whether they are functioning properly and worth keeping in the workshop and office. The workshop settings changed from what they were before implementing 5S, therefore with PDCA those changes have been evaluated and the feedback is positive, there is ease in working at the workshop. The same instances apply to the office changes.

**d) Act** – act is the final step in the PDCA. When the previous phase approves the “plan” or “changes” made during the “do” step show improvements, then a new standard about the workshop must proceed with that standard. Therefore, to “Act” in the PDCA strategy involves acting on those standards or whichever plans made. The PDCA Cycle correlates with that of 5S, they are both repeated from step 1 and S1 up until the goal is reached, if not starts from the top to bottom. The last and final step in 5S is “Shitsuke” meaning to “sustain”. As this step is reached, the previous 4S are then sustained for the better and continually finding other ways to improve.

### **3.6 Kanban board and cards**

Implementing Kanban as a strategy for sustaining the 4S and the whole workplace more especially in the workshop because everyone has access to it is the main objective. The Kanban Board serves as a pathway to alert the workers and technicians of what needs to be done, what is in process and procedures as well as completed tasks. The workshop deals with students mostly when they conduct their practical projects for different modules. The Kanban Board has the power to let or notify the users of the workshop on what is currently happening, which students are using the laboratory, it is like the workflow process. The creation of the board takes into consideration the schedules to use the laboratory, the dates with machine names, project names.

## **4. Results and Findings**

Based on the implemented strategies to sustain the workshop, the following findings are made:

- a) Training – from training provided to the workers, they understand all the basics and concepts on 5S and apply them whenever there is a glitch with their work. They are well informed and it keeps the workshop float at all times.
- b) Cleaning schedules – every worker knows their daily, weekly and monthly duties before even consulting the updated schedules. The workshop is dirt-free, well improved working conditions and organized tools and materials in their proper storage stations.

- c) Quality Circles – the structure of the quality circle for the mechanical workshop had been established. The entire workshop workers own the process of evaluation by active participation during evaluation. The Figure 1, below illustrates the structure of quality circle within the workshop, after the steering committee was chosen:



Figure 1: Quality Circles Structure for Mechanical Workshop

- d) Poka-Yoke - Notably, Poka-yoke has prevented a lot of mistakes from prevailing in the workshop. By carefully examining the implemented 4S so far, it is Poka-Yoke that ensures success of those S.
- e) PDCA – the PDCA cycle was then combined to form a stronger bond for continuous improvement. The combined structure is shown in the Fig. 2 below:

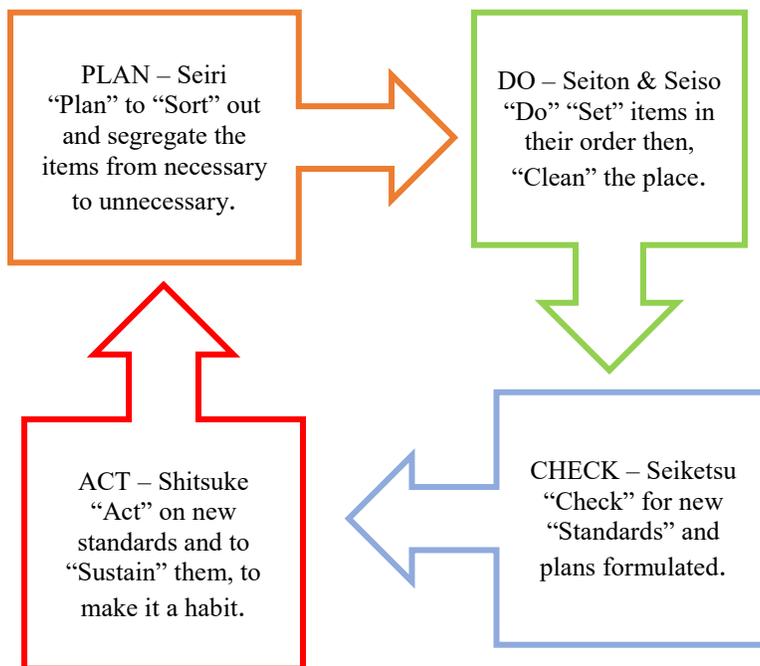


Figure 2: PDCA-5S Combined Cycle

- f) Kanban board and cards – the newly formulated Kanban board with cards for indication of work-flow is illustrated in the Fig. 3 below as:

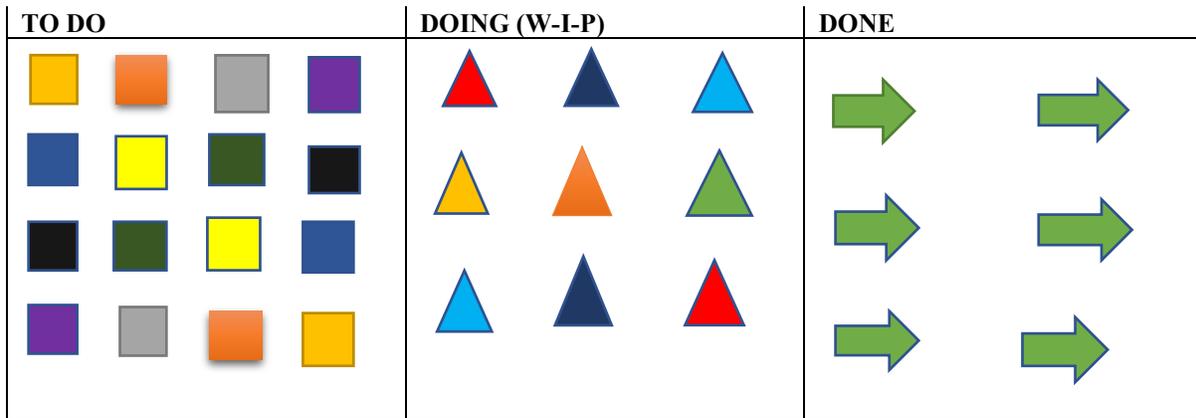


Figure 3: Kanban Board for the present work

#### 4.1 Radar Chart Results

A feedback checklist has also been developed and distributed to the stakeholders who are technicians, lab staff, and other staff members to visit the machine shop. As this checklist is also a strategy to improve continuously (to act on the feedback and take necessary action for improvement), it is also used as a form to analyse how employees really feel about the workshop and its conditions. When employees are happy about their workplace and its conditions, productivity increases, and if not then appropriate steps/actions are required to be taken. A Radar map system is used to plot the results obtained from the checklist as a performance indicator for the workshop. The 5S checklist has a check of mostly 5 questions or statements for each “S” (See Tables 1 and 2).

A rating system used is 1-5 scale of points, with the conditions observed: 1 point = very poor (unfavourable conditions, no standards, and unsupervised, higher dissatisfaction), 2 points = poor (lack of standards, fewer problems), 3 points = good (approximately very few problems, well maintained, improved state), 4 points = very good (impressive, satisfaction, no problems), 5 points = excellent (greater satisfaction, highly motivated, overall improvements).

The results scores obtained before implementing 5S are shown as Seiri = 20. Seiton = 24. Seiso = 17. Seiketsu = 20 and Shitsuke = 17. The conditions showed no favourable results, as the workshop did not satisfy its employees; therefore, the scores are depicting an unfavourable or rather dissatisfying score of 98 points in total.

In the Radar chart (Figure. 4a), the 5S checklist scores (before implementing 5S in the workshop) are mapped and plotted.

**Table 1** Checklist and feedback scores before 5S implementation

<b>5S CHECKLIST: WORKSHOP AREA</b>										
<b>Before 5S Implementation</b>										
I. SEIRI – “Sort” Segregation of items, the important are separated from the unimportant items. Everything belonging to the workshop is sorted and classified accordingly”.										
						<b>Very Poor</b>	<b>Poor</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
1.	The equipment, materials, and tools are well separated.				1	2	3	4	5	
2.	The shelves have clearly segregated the tools and materials.				1	2	3	4	5	
3.	The is visibility of clear storage of tools and materials.				1	2	3	4	5	
4.	Only the necessary items have been kept and marked for visual controls.				1	2	3	4	5	
5.	There are non-marked items in place, or any loose material that is uncontrolled.				1	2	3	4	5	
<b>TOTAL</b>									20	
II. SEITON – “Set-In-Order” Placing the segregated items in good order. There must be a place for everything and everything in its place”										
						<b>Very Poor</b>	<b>Poor</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
1.	The tools, equipment and materials are located in correct appropriate places.				1	2	3	4	5	
2.	All necessary workshop supplies are properly identified and stored correctly.				1	2	3	4	5	
3.	All store-bins have accommodated those small tools, and there is space for more of them.				1	2	3	4	5	
4.	There is a place for everything and everything is in its place and clearly defined.				1	2	3	4	5	
5.	The shelves and lockers have accommodated all necessary tools and materials, and all are labelled and well organized.				1	2	3	4	5	
6.	The tools and equipment are well organized and placed clearly for ease of take and return as well as immediate identification.				1	2	3	4	5	
<b>TOTAL</b>									24	
III. SEISO – “Shine/Clean” Cleaning and keeping the area shiny, free of dirt, dust and grime.										
						<b>Very Poor</b>	<b>Poor</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
1.	The schedules and responsibilities are defined for cleaning and checking the area.				1	2	3	4	5	
2.	The cleaning materials and supplies are well organized and easily accessible.				1	2	3	4	5	
3.	Responsibilities and roles are clearly defined for each person on a daily, weekly, monthly basis and semester.				1	2	3	4	5	
4.	The workshop, equipment, tools and materials are kept clean and free from uncontrolled dust, dirt and waste.				1	2	3	4	5	
5.	The floor area, shelves and lockers are clean, undamaged and without any unnoticed leakages or quality hazards.				1	2	3	4	5	
<b>TOTAL</b>									17	

IV. SEIKETSU – “Standardize” Developing standards to maintain the workplace.					
	Very Poor	Poor	Good	Very Good	Excellent
1. The workshop is standardized (everything coded, labelled and marked for better visualization).	1	2	3	4	5
2. There is a display of 5S information with signs and colours for employees’ attention.	1	2	3	4	5
3. The standardized rules strictly state the dangers of not wearing proper protective equipment.	1	2	3	4	5
4. The first aid kit is easily reachable in case of an emergency.	1	2	3	4	5
5. The shelves and lockers are standardized and demarcated colourfully	1	2	3	4	5
<b>TOTAL</b>					20
V. SHITSUKE – “Sustain” Maintaining discipline in implementing the prior 4Ss.					
	Very Poor	Poor	Good	Very Good	Excellent
1. The stipulated rules and regulations are adhered by the entire team.	1	2	3	4	5
2. The Kanban Board is clearly visible for everyone to take heed of the flow in the workshop.	1	2	3	4	5
3. Standardized cleaning and work procedures are followed.	1	2	3	4	5
4. The developed strategies are mapped and displayed for everyone to understand them.	1	2	3	4	5
5. The 5S checklist is regularly reviewed for further and continuous improvements and it is displayed for everyday motivation.	1	2	3	4	5
<b>TOTAL</b>					17
<b>Overall Total Before Implementation</b>	<b>98</b>				

**Table 2** Checklist and feedback scores after 5S implementation

<b>5S CHECKLIST: WORKSHOP AREA</b>										
<b>After 5S Implementation</b>										
I. SEIRI – “Sort” Segregation of items, the important are separated from the unimportant items. Everything belonging to the workshop is sorted and classified accordingly”.										
						<b>Very Poor</b>	<b>Poor</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
1. The equipment, materials, and tools are well separated.						1	2	3	4	5
2. The shelves have clearly segregated the tools and materials.						1	2	3	4	5
3. The is visibility of clear storage of tools and materials.						1	2	3	4	5
4. Only the necessary items have been kept and marked for visual controls.						1	2	3	4	5
5. There are non-marked items in place, or any loose material that is uncontrolled.						1	2	3	4	5
<b>TOTAL</b>										25
II. SEITON – “Set-In-Order” Placing the segregated items in good order. There must be a place for everything and everything in its place”										
						<b>Very Poor</b>	<b>Poor</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
1. The tools, equipment and materials are located in correct appropriate places.						1	2	3	4	5
2. All necessary workshop supplies are properly identified and stored correctly.						1	2	3	4	5
3. All store-bins have accommodated those small tools, and there is space for more of them.						1	2	3	4	5
4. There is a place for everything and everything is in its place and clearly defined.						1	2	3	4	5
5. The shelves and lockers have accommodated all necessary tools and materials, and all are labelled and well organized.						1	2	3	4	5
6. The tools and equipment are well organized and placed clearly for ease of take and return as well as immediate identification.						1	2	3	4	5
<b>TOTAL</b>										25
III. SEISO – “Shine/Clean” Cleaning and keeping the area shiny, free of dirt, dust and grime.										
						<b>Very Poor</b>	<b>Poor</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
1. The schedules and responsibilities are defined for cleaning and checking the area.						1	2	3	4	5
2. The cleaning materials and supplies are well organized and easily accessible.						1	2	3	4	5
3. Responsibilities and roles are clearly defined for each person on a daily, weekly, monthly basis and semester.						1	2	3	4	5
4. The workshop, equipment, tools and materials are kept clean and free from uncontrolled dust, dirt and waste.						1	2	3	4	5
5. The floor area, shelves and lockers are clean, undamaged and without any unnoticed leakages or quality hazards.						1	2	3	4	5
<b>TOTAL</b>										25



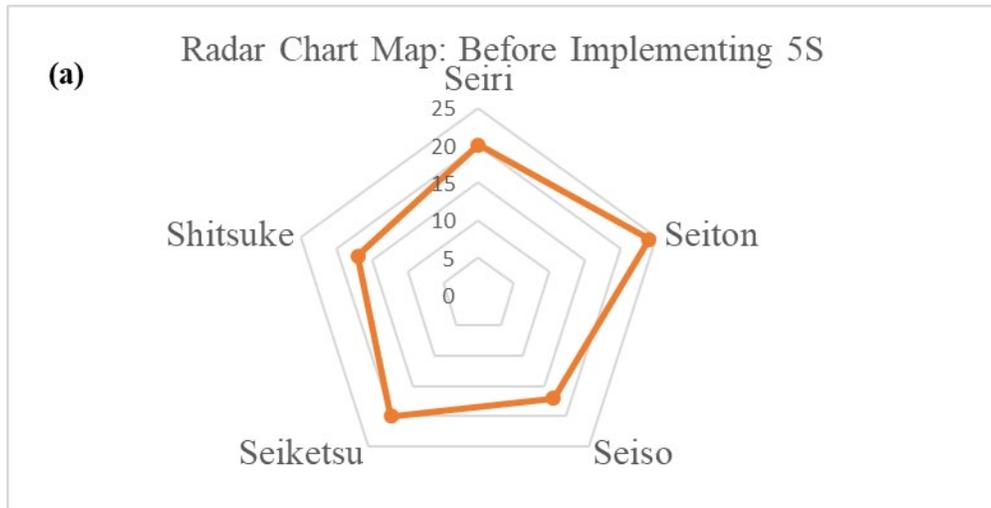


Figure 4a: Radar Chart Map Before 5S Implementation

The results scores obtained after implementing 5S are as follows: Seiri = 25, Seiton = 30, Seiso = 25, Seiketsu = 25, and Shitsuke = 24. Although, looking at Shitsuke, it has not obtained the anticipated score due to the fact that employees are new to the newly developed strategy which means the new system is not yet fully understood, but with time the score will highly escalate. The Radar chart mapped and plotted after 5S implementation is shown in Fig. 4b. On the Radar chart, it shows a much different shape from the “before implementation” chart. After everything has improved, the results showed a higher score of 129 points in total.

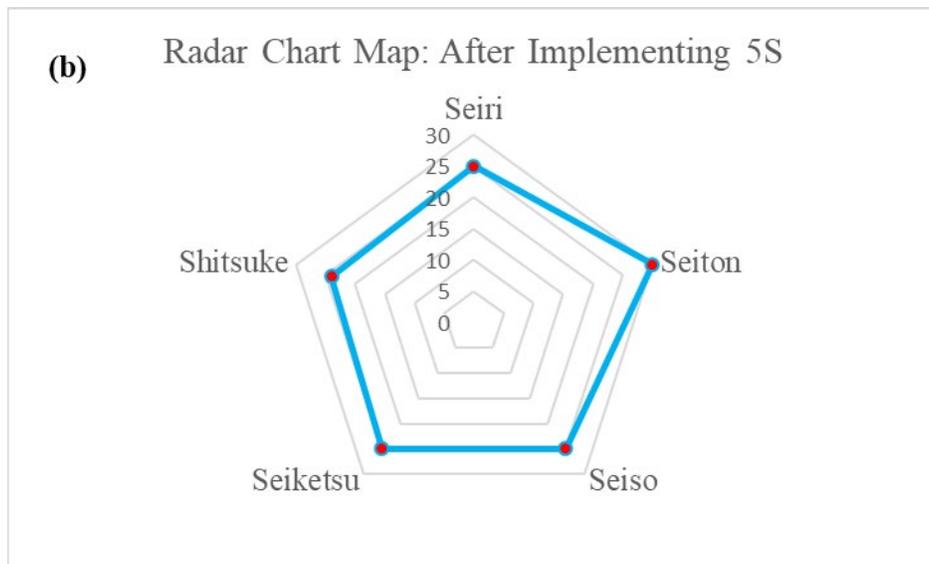


Figure 4b: Radar Chart Map After 5S Implementation

The two charts have a different shape now, whereby in the before implementation, it is much skewed towards right hand side i.e. towards Seiton, where the highest mark 24 is achieved. Whereas, the chart after 5S implementation is much balanced, because of the better scoring in the 5Ss. Hence, it shows the effectiveness of 5S implementation in terms of greater satisfaction, favourable conditions and well organized workplace.

## 5. Conclusion

Implementing 5S at the workshop has proved to be manageable and easy, with the help from employee participation. The 5S as tool is implemented for the first time at the mechanical workshop. A lot is achieved other than set objectives. Firstly, the workshop area is clean, free from any hazards, improved working environment and conditions, well organized workshop, and well secured locations for tools, materials and equipment. Moreover, space utilization has been achieved through proper placements. Implementing Quality Circles has shown greater improvements because everyone who uses the workshop is able to voice out, suggest and co-operate with fellow employees. The essence of implementing Quality Circles in the workplace has shown greater results in a sense that everyone is involved and participated. Implementation of Shitsuke for continuous improvement and to sustain with 5S implementation has been successfully done with proper training, making cleaning schedules, effectively utilising tools such as Poke-Yoke, Kanban, and Quality Circles. Positive feedback from the stakeholders via checklist and in the form of radar chart proved the success and effectiveness of 5S implemented in mechanical workshop of University of Johannesburg.

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## Biographies

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