

A STUDY OF IMPLEMENTATION OF 5S IN AN ELECTRONIC MANUFACTURING FIRM IN MYSURU

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Abstract - 5S practices in the organization influence employees thinking, their behaviour, attitude towards their work and motivation to work in their workplace at the organization. A good 5S training program sensitizes employees to all kinds of ways they can become more productive. 5S is a powerful tool and can be implemented in various industries whether it is micro, small, medium or large. This paper reviews an attempt made by VITPL, Mysuru to implement 5S in their organization that would allow great benefits like organizing the workplace, decreasing waste of time by non-value adding activities, optimizing quality and productivity via monitoring an organized working environment. This study seeks to answer the question to what level implementation of 5S have impact on employees and tries to investigate the important factors responsible for 5S practices at the organization. The results show that 5S is an effective tool for improvement of organization's working environment, work culture, etc. This study will inform researchers and practitioners about new management practices for the betterment of working environment.

Key Words: 5S implementation, Total Quality Management, Orderly workplace, Continuous improvement, Variables

1. INTRODUCTION

5S represents 5 disciplines to maintain the workplace. It is a fundamental activity to improve business. 5S represents systematic approach for productivity, quality and safety improvement in all types of business. It is one of the important approaches in journey of continuous improvement is 5S. The 5S program focuses on having visual order, organization, cleanliness and standardization. 5S simplifies and organizes the work environment, reduces waste and non-value activity while improving quality efficiency and safety. And a well organized workplace motivates people. The program is called 5S, since all steps start with an "S". 5S uses five Japanese disciplines

- i. Seiri (Sort)
- ii. Seiton (Set)
- iii. Seiso (Shine)
- iv. Seiketsu (Standardization)
- v. Shitsuke (Sustain)

These five techniques are helpful in organizing workplace day to day. The 5S program focuses on having visual order,

organization, cleanliness and standardization. The results from a 5S program are improved profitability, efficiency, service and safety.

Takashi Osada in 1991 coined the original concept of 5S in the early 1980s. 5S is the acronym for five Japanese words Seiri (organization), Seiton (neatness), Seiso (cleanliness), Seiketsu (standardization) and Shitsuke (discipline) respectively. 5S has been introduced in Japan mainly in the manufacturing and service industries. Japanese believe that 5S Principles are not only valuable at their workplaces but also improve their cognitive sense. Osada refers to the 5S as the five pillars to establish and maintain total quality environment in an organization (Pheng, L.S. and Khoo, S.D.,2001).[1][2][3]

5S Principles focuses on effective workplace organization, simplification of work environment and minimization of waste while improving quality and safety. Success of 5S totally depends upon total employee involvement, its continuous monitoring and everyone should work in a team (Korkut, D.S., Cackicier, N., Erdinler, E.S., Ulay, G. and Dogan, A.M.,2009). [4]

- i. Sort – Remove unnecessary items from the work area and attach red tag to the all unnecessary and infrequently used items.
- ii. Set in order – customize the work area for effective working by keeping important materials, tools nearby workplace.
- iii. Shine – Clean the work area, machines, tools, equipments for finding and eliminating the minor and unwanted constituents.
- iv. Standardize – create a standardized and consistent 5S work flow by maintaining high standards of housekeeping, workplace organization, cleanliness and orderliness, everything in order and in its right place.
- v. Sustain – ensure the 5S as a long term goal and give awareness and training to the workers and employees by explaining its significance. [5]

5S is a system to reduce waste and optimize productivity through maintaining an orderly workplace and using visual cues to achieve more consistent operational results. Implementation of this method "cleans up" and organizes the workplace basically in its existing configuration, and it is typically the first lean method which organizations implement. A 5S program can be applied to

any work environment. It could be a supply/store in a hospital, a repair truck for a telecom company, a CSR desk/work area in a call center, the baggage claim area of an airline or a laptop computer. The 5S begins the laying of the foundation to continuously apply lean concepts and techniques to root out waste and streamline processes.

2. LITERATURE REVIEW

The Japanese developed the quality circle concept during the early 1960 and 20 years later, the concept had expanded to more than a million organizations. At the same time, Dr. Genichi Taguchi, a Japanese quality expert, introduced new statistical concept that was invaluable in improving process and product quality. Due to this improvement, Japanese industry ultimately has developed in various technologies all over the world. Following in their footsteps, U.S made some drastic changes in strengthening their power in the global age.

Besides all kinds of quality improvement techniques developed, one of the most famous is the 5S concept developed by the Japanese. (Osada, 1991 as cited in Gapp, Fisher & Kobayashi, 2008) developed the original concept of 5S in the early 1980s[2] 5S is the acronym for five Japanese words. They are given as followed.

- (a) Seiri (sort)
- (b) Seiton (set in order)
- (c) Seiso (shine)
- (d) Seiketsu (standardize)
- (e) Shitsuke (sustain)

Respectively, Osada refers to the 5S as the five keys to a total quality environment. Osada (1991) refers to 5S as the five keys to a total quality environment. 5S is a system to reduce waste and optimize productivity and quality through maintaining an orderly workplace and using visual cues to achieve more consistent operational results. The practice of 5S aims to embed the values of organization, neatness, cleaning, standardization and discipline into the workplace basically in its existing configuration, and it is typically the first lean method implemented by firms. Kobayashi et al. (2008) make a distinction between 5S as a philosophy or way and 5S as a technique or tool by comparing the frameworks provided by Osada (1991) and Hirano (1995) respectively. From their study, they conclude that 5S tends to be recognized as a philosophy in Japan, but in the other hand it is likely to be considered as a technique or tool in the United Kingdom and United State of America. Osada (1991) views 5S as a strategy for organizational development, learning and change, whereas Hirano (1995) considers 5S to be an industrial formula that differentiates a company from its competitors. [2]

The Japanese have been widely practicing 5S technique and believe it can help in all aspects of life. Khamis et. al (2009)

found that the practice is an effective technique which can improve housekeeping, environmental performance and health and safety standards in an integrated holistic view. [6]

The 5S System, or simply 5S, is a Japanese philosophy that means cleanliness and orderliness to bring maximum productivity and quality. 5S is used by industrial plants and manufacturers, service providers, educational institutions, and government agencies. This structured system is the first step toward implementing all other lean manufacturing techniques. 5S also is an important tool in Total Quality Management (TQM). Over the last century, the Japanese have formalized this technique and named it as 5S Practice (Samuel K.M. Ho, 1993).[5] The 5S practice is a technique used to establish maintain quality environment in an organization effectively and promise the employees to be more self-discipline (Mohd Nizam Ab Rahman et. al, 2010).[7]

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. The Toyota Production System provides a well-known example of 5S principles in practice, the early versions were based on 3-S this, became 4-S (Ohno, 1988).

In recent years, the practice of 5S is commonly used among the Japanese firms in order to enhance human capability and productivity. Since it was introduced by Takashi Osada in the early 1980s, it is believed that applying the 5S techniques could considerably raise the environmental performance in production line including housekeeping, health, safety and more. Result of the study indicates that 5S technique is an effective way to improve health and safety standards, environmental performance and housekeeping (Becker J.E, 2001).[8] 5S is a method for development of companies, change and training. (Hirano, 1995) regards 5S as an industrial practice that distinguishes an organization from the others.

According to the Japanese and organizations 5S have two components, a high level of management organizational system with complexity meaning and it translates to perfect performance and the other one is management provision tools position. Even though the 5S housekeeping program aids production but the 5S technique is one of the most known in industrial and business environment and there are few proofs about its adoption in organizations (Ab Rahman, M.N. et al, 2010). [9]

J. Michalska et al. (2007) In this paper 5S implementation results in increasing of an efficiency, safety and reduction of the industry pollution. The proceedings to research clearly show that training of workers about the 5S rules is very essential. The important task is to divide activities on some main steps and to maintain the continuous improvement. It is also important to understand the need of executing the routine inspections of usage the 5S rule. This inspection is executed by helping of so-called check list and created on its basis the radar graph of the 5S, which serves to estimation of the workplace. [10]

Gupta and Jain, 2014 demonstrated the application of 5s and Kaizen in a small scale manufacturing organization. Implementation of 5s and Kaizen results in increased efficiency and effectiveness in the processes, improved visibility of the process, improved morale and safety of the employees, reduced delays, searching time and dangerous conditions. In order to make successful 5S and kaizen system most important factors are participation, commitment and support from top level management. [11]

Upadhye and Deshmukh, 2010 did their study in Bianor, a polish manufacturing company and found that the application of the 5S method has allowed the creation of a clean and tidy workplace, virtually without large financial input. It contributed to the introduction of the company's new way of thinking and new values. The company has made a significant step towards perfection. Employees cooperated willingly in creating the new rules and standards, and therefore, their awareness of the importance of maintaining order in the workplace has increased considerably. [12]

'5s implementation and its effect on physical workload'- Ayush Khandelwal, Prathik R., Rahul P., Kikani, Vigneshwaran Ramesh (September 2014) in his study indicated that the time consumed and energy expenditure was drastically reduced after the implementation of this methodology, which in turn had a positive effect on productivity. The analysis of the time consumed and energy expenditure for both the subjects after implementing the 5S organizational methodology clearly shows that this tool has potential to deliver a positive impact on productivity. The results of the time study show that proper organisation and efficient material handling saves a considerable amount of time. The results of the energy analysis indicates to us that for a given work 5S methodology plays a vital role in saving energy, that is, after its implementation the energy required to carry out a particular activity would be less than the energy consumed before adopting 5S. The morale of the workers has been bolstered after the changes have been made, which certainly is a major factor for improvement in productivity. [13]

Arash Ghodrati *et al.* (2013) This paper is aimed to determine performance factors and characteristics in industrial organizations and identifying the effectiveness of 5S implementation on organizational performance as well. Surveying method is used and data collection is carried out by distributing questionnaire among five target organizations which have implemented 5S techniques. The target organizations are chosen from different industries and diverse field of work. The results of this research obtained from a comparative measurement of organizational performance before and after 5S implementation. The results show that 5S is an effective tool for improvement of organizational performance, regardless of organization type, size, its production or its service. Consequently, 5S techniques would strongly support the objectives of organization to achieve continuous improvement and higher performance, identifying effectiveness of 5S implementation on the organization performance, has been achieved by using a comparative measurement between performance of organization before and after 5S implementation assisted by

SPSS and Excel software. Finally it is concluded that 5S has positive effect on overall performance and could improve the quality, efficiency and productivity of industrial organizations. [14]

3. RESEARCH METHODOLOGY

3.1 Sample

Sample is a set of respondents selected from a larger population for the purpose of a survey or experiment. In this study a simple random sampling method is adopted. Simple random sampling method is obtained by choosing elementary units in such a way that each unit in the population has an equal chance of being selected. A set of 100 respondents are selected from 500 employees for the purpose of this survey among supervisory staff and shop floor employees.

3.2 Questionnaires

The information obtained from the literature review has been used in designing the questionnaire. The research instrument has 25 statements for 5S trying to measure five dimensions of 5S. Also questionnaires about asking the level of implementation were designed to know the level of implementation. The perception of the employees regarding these dimensions was collected on a five point Likert Scale as "Strongly disagree" to "Strongly agree" on a rating scale of 1 to 5. And the perception of the employees regarding level of implementation was collected as Weak, Moderate, Good, Very Good and Excellent.

3.3 Data collection

In this study, primary data was obtained from supervisors and employees of various departments. This study contains data collection from 100 employees as shown in table

Table -1: Number of respondents to this study

Category of employees	Number of respondents
Shop floor workers	80
Supervisory staffs	20
Total	100

Data was also obtained by direct interview with employees to interpret the results. Every respondent had given full information in the research instrument. For better understanding the statements of this survey, and to obtain correct responses the instrument was also translated to local

Kannada language. The research instrument was validated before administering to employees.

3.3 Statistical Analysis

The data collected from the survey to study the Implementation of 5S at the organization is transferred into SPSS (Statistical Package for Social Sciences) software. Choosing the correct statistical test is the crux of the problem for a specific objective or goal.

The objectives of this study were to determine the factors that promote 5S implementation at the organization and to assess the level of implementation among employees. Thus the data was subjected to **Factor Analysis** to obtain the driving factors for effective implementation in this organization.

4. CONCLUSIONS AND FINDINGS

4.1 Test of reliability for the Instrument

To test the reliability of the data collected, Cronbach's Alpha test was used. From table-2 it is clear that the value of Coefficient Alpha (Cronbach's Alpha) had been obtained and the minimum value of Coefficient alpha obtained was **0.83**. This shows that the data has satisfactory internal consistency reliability. SPSS produces many different tables. The Reliability Statistics table provides the actual value for Cronbach's alpha.

Table-2: Cronbach's Alpha for 5S; Reliability Statistics

Cronbach's Alpha	Number of Items
.83	25

In this study factor analysis was conducted for the first objective to determine the factors that promote 5S implementation at the company. **Kaiser-Meyer-Olkin (KMO)** measures the strength of relationship among the variables. It is used to determine the sufficiency of the sample size and is an index to examine the appropriateness of factor analysis. KMO measure of sampling adequacy index is **0.725** therefore the factor analysis is appropriate for the given data set.

Then, the **exploratory factor analysis** is performed with maximum probability approach to identify the rate of loading of variables recognized in the component, and **Varimax orthogonal approach** is used to interpret the variables. The individual statements of a study on the factors that influence the employee retention is examined using factor analysis based on 25 individual statements and the reliability of the samples collected is tested for internal consistency of the grouping of the items.

The next item from the output is a **table of communalities** which shows how much of the variance (i.e. the communality value which was more than 0.3 were considered for further analysis. Else these variables were removed from further steps factor analysis) in the variables had been accounted for by the extracted factors. It gives information about how much of the variance in each item is explained. Low values less than 0.3 indicates that the item does not fit well with the other items in its components. In this study less than 0.3 communality values are not found, so it is revealed that all items in this analysis fit well with the other items.

4.2 Total Variance

Variance explained indicates that 8 factors nearly explain 63% variance. Eigen value represents the total variance explained by each factor. Percentage of the total variance is attributed to each factor. One of the popular methods used in Exploratory Factor Analysis is **Principal Component Analysis**, where the total variance in the data is considered to determine the minimum number of factors that will account for maximum variance of data.

The components are extracted using **Principal Component Analysis** method and the components are rotated using **Varimax Rotation method**. Interpretation of factors is facilitated by identifying the statements that have large loadings in the same factor.

The factors that promote 5S implementation in the organization were found to have 25 individual statements. Out of 5 dimensions or 25 individual variables, 8 individual variables majorly influence the implementation of 5S. Table-3 gives the factor loadings in an ascending order and these are classified as Excellent, Moderate and Poor.

Table-3: Loading Factor for 5S implementation

Sl. No	Statements	Factor loading
1	I really feel that I learnt a lot about 5S implementation and the training has prepared me completely for it	0.890
2	The training resources identified by the organization are doing a very good job in exposing us to 5S concepts	0.833
3	I have visited a company that daily practices 5S method	0.812
4	The concept of 5S is not at all new to me and I know	0.787

	about its benefits	
5	One important benefit of 5S is that it enhances a better workflow	0.747
6	Set-in-order reduces the time wasted in searching	0.717
7	5S always aims at optimizing the work place	0.716
8	The training imparted for 5S implementation was specially designed to cater to our own training needs	0.683
9	The training duration was quite adequate and we had sufficient time to learn the details of 5S implementation	0.678
10	A strong need was felt to implement 5S to drive its advantages	0.640
11	5S method has a positive impact on maintenance, performance and safety at work	0.610
12	5S aims at eliminating any form of waste (transport, inventory, motion, waiting, overproduction, over processing, defects) thereby improving the production	0.600
13	Effective implementation of 5S results in improved safety and ergonomics	0.594
14	Effective implementation of 5S results in improved safety and ergonomics	0.592
15	The training imparted was adequate enough to give us confidence to implement 5S	0.552
16	My organization is mature enough to implement 5S and I am sure that it would be very beneficial	0.530
17	It has prompted a better environment and improved the work place condition that in turn makes us feel a lot better	0.513
18	5S makes employees responsible for satisfactory maintenance of their workplace	0.509
19	Implementation of 5S makes our work place a lot	0.484

	better and we feel we can do a better job	
20	Goal of 5S principles is to make workplace more productive and efficient, by its own people and with the help of management	0.481
21	Work instructions, procedure, policies, and standards are necessary to sustain 5S movement	0.472
22	The work place is so orderly that it improves the efficiency	0.468
23	Implementation of 5S results in improved morale of the employees	0.458
24	A clean and orderly environment favors a good work atmosphere that brings out the best in us	0.443
25	The workplace is always clean and free from any clutter making it absolutely safe to work	0.400

4.3 CONCLUSIONS

Items which were loaded to 8 emerged components were newly labeled and those could be considered for further analysis. Also from table-3 factor loadings were arranged in an order to group them as Excellent, Moderate and Poor. i.e., they were classified as followed.

- i. From table-3, it was considered that loading factor >0.7 as excellent and 5S implementation variables were good.
- ii. Where loading factors lie between >0.7<0.5, it was considered as moderate and some improvements were needed.
- iii. Loading factor which is <0.5 was considered as poor and a lot of initiatives could be taken to enhance the status.

6 items were loaded onto Component 1, these items relate to improvements and advantages of 5S. This component loads onto various advantages and improvements by 5S practices in the organization. This component was labeled as **"Improvements by 5S"**.

4 items were loaded onto Component 2, these items are related to training for 5S. Therefore it was labeled as **"Training and Development"**.

3 items that were loaded to Component 3 are related to the need of 5S at the organization and responsibilities of employees. It was labeled as **"Need of 5S"**.

5 items were loaded onto Component 4 that were related to safety and benefits of 5S. These were labeled as **"Benefits of 5S"**. 2 items were loaded to Component 5 that

were related to knowledge about 5S and it was labeled as **"Knowledge about 5S"**.

2 items that were related about workflow and improvements by 5S practices at the organization were loaded onto Component 6 and was labeled as **"Advantages of 5S"**.

2 items were loaded onto Component 7. These items were related about awareness and training duration of the 5S program at the organization. It was labeled as **"Ease of 5S implementation"**.

An item alone was loaded onto Component 8 that identifies the value enhancement due to training and it was labeled as **"Value enhancement due to training"**.

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