

Evaluating the Effectiveness of 5S Implementation in the Industrial Sector

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Abstract:- The aim of this study was to evaluate the effectiveness of 5S practices implementation in COLDAIR Engineering Company for manufacturing and assembling. The effectiveness of 5S implementation was major concern for organization in industrial sector in the last decade because many 5S project failed to achieve the expected results by optimizing the workplace environments. The researchers used a descriptive methodology. The targeted population of this study was the employees of COLDAIR Company. From The survey population (managers, supervisors, workers), 40 employees were selected to represent the sample using random sampling technique. Finding from this study indicate that 5S implementation increase the efficiency in the workflow, improve working environment in the workplace, reduce human movement, and allows for more orderliness after removal of unwanted items. One more significant findings is that 5S practices Minimize the causes of faults with auditing and continuous cleaning Work environment, preventing accidents and injuries by developing a safe work environment. The findings of this research provide insights for organizations that want to start a journey of continuous improvement for productivity and lean manufacturing, because the first step in that journey is to effectively implement 5S practices. For the practitioners and managers responsible for 5S methodology implementation, this paper shows them how they can effectively implement 5S using a thoroughly tested tools to provide environment necessary for the operation of their processes. Further investigations are needed to examine the mediating role of 5S methodology in the relationship between ISO 45001:2018 and occupational health and safety.

Keywords:- Workplace Environment, Continuous Improvement, Productivity, Lean Manufacturing, Safety.

I. INTRODUCTION

Over the past decades, 5S practice is commonly used among Japanese organizations to improve the workplace environment, enhance human capacity and increase productivity. Since Takashi Osada introduced it in the early 1980s, the application of 5S tool can significantly increase the operational performance of the organization, cleaning practices, occupational health and more. Modern management in companies is not only about implementing quality management system based on the ISO standards series, but also to continuously improve its operational process. In order to implement total quality management in the operating level, 5S is the first methodology that achieved significant results. 5S is the tool help organizations to improve the workplace performance.

➤ *Statement of the Problem*

5S is an integrated way to improve productivity, it is a complete culture that increases production, improves quality, reduces cost, makes on-time delivery, improves safety and improves morale. However, most manufacturing companies in Sudan find it difficult to meet customer demands due to delayed delivery time, and inefficient process flow, tools and components are set without classification. Consequently, poor working environment makes the company's experience less operational efficiency. In some companies, much time was wasted in setting up equipment and equipment handling time. Therefore, to improve operational performance and increase productivity, it is necessary to reduce the wasted time on production line and tool handling time. Therefore, the researchers aim to examine the effect of implementing 5S methodology on manufacturing operations in the industrial sector in Sudan.

➤ *Objectives of the study:*

- The objectives of this study are:
- To evaluate the effectiveness of 5S practices that implemented in COLDAIR Engineering Company for manufacturing and assembling.
 - To identify benefits of implementing 5S approach.

➤ *Hypotheses:*

1. 5S practices are effectively implemented in COLDAIR Engineering Company for manufacturing and assembling.
2. 5S methodology implementation is significantly and positively influence the operational performance of the organization.

II. LITERATURE REVIEW AND PREVIOUS STUDIES

A. Introduction of 5S methodology

[1] Argues that 5S is a Japanese way of organizing the workspace, in a clean, efficient and safe way, in order to achieve a productive work environment. 5S has become a way of doing business, not only to convince customers but also to create effective quality processes as a prerequisite for good products and services. This technique has been practiced in Japan for a long time. Most Japanese 5S practitioners consider 5S useful not only to improve their physical environment but also to improve their thinking processes. Apparently, the 5S can help in all walks of life. Many everyday problems can be solved by adopting this practice. 5S is not only a housekeeping system; it is an integrated approach to improving productivity. 5S is a whole culture that increases production, improves quality, reduces cost, leads on-time delivery, improves safety and improves morale. The primary goal of 5S is to create a clean and orderly environment where there is a place for everything and everything is in place. Moreover, many companies begin to shift lean with the 5S because it reveals some of the most obvious examples of waste. It also helps to establish the framework and discipline required for the successful implementation of other continuous improvement initiatives.

B. 5S methodology

5S is a management tool from Japan, focusing on creating a good environment in the enterprise, ensuring adherence to standards and in the process, promote the spirit of continuous improvement. The methodology (Figure 1) explained as follows:

➤ *Seiri = Sort out*

This step focuses on getting rid of everything that is not useful in the workplace: residues, spaces, unused tools, equipment, scraps and replaced documents [3].

➤ *Seiton = Set in order*

The main purpose of stability is to find the practical deposit of each necessary tool and these repositories must be properly marked. Each element, which is necessary at work, will be organized in a way that can be easily found when needed. Setting in order ensures that it's easy for everyone to find, use, and place the item away. The aim of all these actions is to eliminate futile research, improve work safety and make the work environment better [3]

➤ *Seiso = Shine/Sweep*

This step can be performed in parallel with the stage of organization and storage. It aims to ensure that workplaces and machines are cleaned regularly and in optimal operating conditions, where anomalies are detected more quickly and easily in cleaner workplaces. Regular cleaning allows the sources of disturbance to be identified and eliminated, and clean workplaces maintained. During cleaning, the cleanliness of the machine, the workplace and the ground, the tightness of the equipment, the cleanliness of the lines, pipes, lighting sources, current data, the clarity and comprehensiveness of the information provided etc. are examined. Care and maintenance of personal hygiene are also indispensable of the Operator [4]

➤ *Seiketsu = Standardize*

It is the integration of the work done in the first three steps. A standard 5S audit calendar was introduced to simplify the entire 5S process. Maintaining this calendar certainly helped to keep records if the scheduled task for all 5S components was completed or not [5].

➤ *Shitsuke = Sustain*

Revolves around the mental and physical disciplines needed to maintain other 4S items [6]. One of the key factors to achieve and maintain the successful implementation of this methodology is the implementation of regular audits to detect the status of each S. Audits should focus on ensuring that specific procedures and timetables are implemented [7].

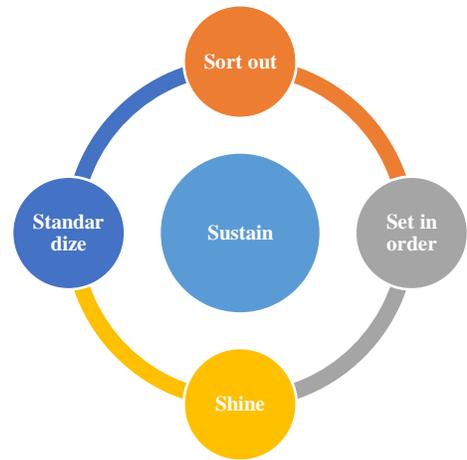


Fig 1:- 5S Methodology

C. Benefits of the 5S

5S is an organized way to clean, organize, standardize and create a workplace instead of wasting and maintaining improvements. Efficiency improved from 67% to 88.8% through successive.

D. 5S implementation approach

The implementation of 5S requires the commitment of senior management and everyone in the organization. [13] Developed a business model to create a 5S structure and to

establish an implementation process at the Technical School of Engineering - ICAI, Comillas University, Madrid, Spain. The 11-step approach consists of: (i) training of the management team; (ii) laboratory testing; (iii) directory naming; (iv) establishment of the implementation team; (v) implementation planning; Board of Directors; (8) implementation development; (9) results; (10) implementation of other laboratories and (11) continuous improvement. In order to start implementing the 5S methodology.

Appropriate training and the right attitude of employees leads to a sense of joint effort and satisfaction of both the company and the workers, bringing them closer to the goals. The implementation process should follow the PDCA cycle as shown in Figure 2.

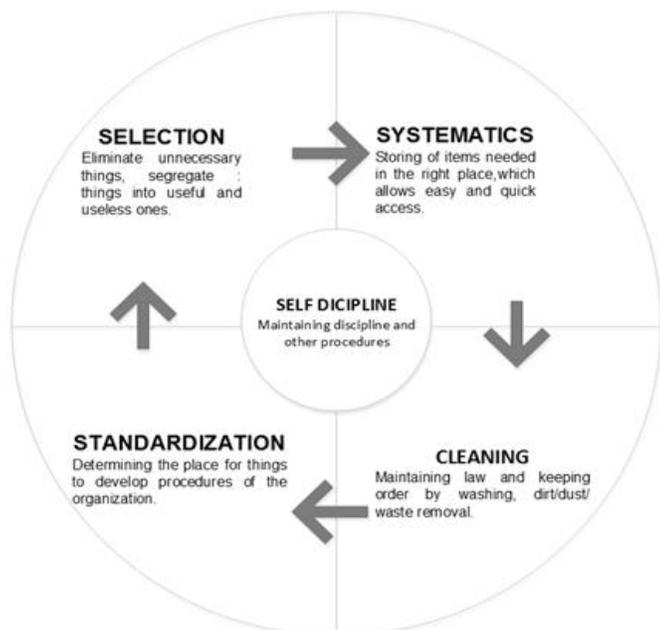


Fig 2:- Falkowski & Kitowski method for 5S implementation

Most Previous 5S implementations approaches evolved from Hirano’s six-step strategy. However most recent studies [9] [10] [11] indicated that 5S method has been implemented using the PDCA cycle methodology based on the process approach.

III. METHODOLOGY AND COLLECTION OF DATA

A. The Methodology

The researchers used a descriptive methodology. The study employed survey methodology to assess the effectiveness of 5S practices that implemented in COLDAIR Engineering Company for manufacturing and assembling.

B. Population and the study Sample

The population of the study is a set of units in which the survey will be conducted. [12] He argued that there are two different types of population: the target population (consisting

of a set of units for which you would ideally want information) and the survey community (the units we can survey). An important consideration in sample design is the choice of sample size, since a larger sample provides greater accuracy but is more expensive. The common way to choose a sample size is to select the desired resolution and then determine the optimal sample size that provides the resolution. [13] It was suggested that sample sizes suitable for most research should be greater than 30 and less than 500. Subject to these guidelines, the target population in this study is COLDAIR employees. From the survey community (managers, supervisors and workers), 40 employees were selected to represent the sample using a random sampling technique.

C. Instrument of the Study

The study questionnaire consists of two parts; Part 1 is about the demographic information about the participants while Part 2 is about the study variables. The study used 5 points Likert Scale measurement that ranging between five=Strongly Agree, four = Agree, 3=neither, two= Disagree and one=strongly Disagree as shown in table 1.

No	Value	reliability	Validity
1	Sort	0.85	0.92
2	Set in Order	0.83	0.91
3	Shine	0.71	0.84
4	Standardize	0.75	0.87
5	Sustain	0.84	0.92
Total		0.79	0.89

Table 1:- Response Degrees on Five Point Likert Scale

D. Reliability and validity of the study instrument

Reliability is the consistency of the measurement, which means the questionnaire gives a similar result or the same results each time it is used under the same condition with the same subjects or issue that is studied. A reliability alpha coefficient of 0.70 or higher is considered acceptable in most social science research situations [14]. To verify the study instrument Reliability and validity, 15 samples were distributed and analyzed using the internal consistency measure. As shown in table 2, the coefficient of Alpha Cronbach = (0.79) indicating the stability of the scale and reliability of the study. The coefficient of validity is (0.89) this indicates that there is a high validity of the scale in favor of the study, which confirms the accuracy of the questionnaire and acceptance of the results of this study results.

Response	Weight	Median
Strongly Agree	5	4.20- 5.00
Agree	4	3.40 – 4.19
Neither	3	2.60 – 3.39
Disagree	2	1.80 – 2.59
Strongly Disagree	1	1.00 – 1.79

Table 2:- Cronbach’s Alpha Results

E. The statistical methods used in the study:

The research used a number of statistical methods (Frequency tables, Percentages, Graphs, Median, Chi square. and Alpha Cronbach coefficient)

IV. RESULTS AND ANALYSIS

A. Descriptive statistics of study variables and hypotheses testing

The research aim assess the effectiveness of 5S practices that implemented in COLDAIR Engineering Company for manufacturing and assembling. Descriptive data were generated for all variables as indicated in the following table. The items were scaled on five points Likert scale. The responses was analyzed using Medians and Pearson Chi-Square as summarized in Table: 3 below.

No	Variable	Chi-square value	df	Sig.	Median	Scale
	Sort out	15.95	4	0.000	3.80	agree
1	Set in order	9.62	4	0.000	4.00	agree
2	Shine	14.71	4	0.000	4.00	agree
3	Standardize	23.38	4	0.000	4.00	agree
4	Sustain	12.75	4	0.000	3.50	agree

Table 3:- Chi-Square Results For The Study Variables (5s Practices)

H1 5S practices are effectively implemented in COLDAIR

B. Engineering Company for manufacturing and assembling.

The data in Table 3 indicate that the value of chi-square is (15.95, 9.62, 14.71, 23.38 and 12.75) and that the median was (3.80, 4.00, 4.00, 4.00 and 350), respectively, for all 5s practices (ranking, ranking in order, brilliance, Consolidate and maintain). With the Sage of (.000), which is less than the probability value (0.05) this means that the 5S practices are effectively implemented in COLDAIR Engineering for Manufacturing and Assembly.

H2 5S methodology implementation is significantly and positively influence the operational performance of the organization.

No	Chi-square	Df	Sig.	Median	Scale	Statistical significance
40	25.26	3	0.00	4.0	Agree	Significant

Table 4: Hypothesis (2) Result.

As can be seen from the table (above), the Chi-square test value (25.26) has a significant value of 0.00 which is less than the probability value (0.05), meaning that there is a statistically significant relationship between the implementation of the 5S methodology and the operational

performance of the organization. In summary, these results show that equipment is distributed in the workplace (effectively) and free of randomly scattered objects, Things are sorted by priority for a certain period (using a red color card) and tools and equipment (many use) are placed in clear and close places for users. This finding is consistent with that of [16] who found that organizations who implement 5S activities, has a clean and efficient work environment and experienced improved work efficiency in the organization. This study supports evidence from previous studies [4] [15] that 5S implementation organize the workplace so that the tools and files are obtained quickly and in a short time , Files and tools are returned to their specified location immediately after use and the level of safety in the work environment has increased. One more significant findings is that 5S practices Minimize the causes of faults with auditing and continuous cleaning Work environment, preventing accidents and injuries by developing a safe work environment.

V. CONCLUSION AND RECOMMENDATIONS

A. Conclusion and Practical Implications

This study developed to examine the effectiveness of 5S implementation in the industrial sector. The results of this investigation show that 5S implementation help organizations to distinguish and sort out the unneeded objects, tools and materials and eliminating redundant things. 5S implementation increased the efficiency in the workflow, improved working environment in the workplace, reduced human movement, and allows for more orderliness after removal of unwanted items. The findings of this research provide insights for organizations that want to start a journey of continuous improvement for productivity and lean manufacturing, because the first step in that journey is to effectively implement 5S practices. These findings contribute in several ways to our understanding of 5S methodology and provide a basis for further research.

For the practitioners and managers responsible for 5S methodology implementation, this paper gives a relevant contribution because it shows how they can effectively implement improvement activates using a thoroughly tested tools and techniques to determine, provide and maintain the environment necessary for the operation of their processes and to achieve conformity of products and services in their respective firms.

B. Recommendations for further research work:

It is recommended that further research be undertaken in the following areas:

- 1- Investigating the application and benefits of implementing 5S concept in all sectors in Sudan whether it is industrial, medical or service sector.
- 2- Exploring the difference between 5S methodology, lean manufacturing and six sigma.
- 3- Examining the mediating role of 5S methodology in the relationship between ISO 45001:2018 and occupational health and work place safety.

REFERENCES:

- [1]. Veres, C., Marian, L., Moica, S., & Al-Akel, K. (2018). Case study concerning 5S method impact in an automotive company. *Procedia Manufacturing*, 22, 900-905.
- [2]. Pirttijoki, V.-P. (2013). Introduction and implementation of the 5S-operation model for ST-Koneistus Ltd.
- [3]. Dulhai, G. (2008). The 5S strategy for continuous improvement of the manufacturing processes in autocar exhaust. *Management and marketing*, 3(4), 115-120.
- [4]. Sharma, R., & Singh, J. (2015). Impact of implementing Japanese 5S practices on total productive maintenance. *International Journal of Current Engineering and Technology*, 5(2), 818-825.
- [5]. Ashraf, S. R. B., Rashid, M. M., & Rashid, A. (2017). Implementation of 5S methodology in a food & beverage industry: A case study. *International Research Journal of Engineering and Technology (IRJET) Volume*, 4.
- [6]. Pasale, R., & Bagi, J. (2013). 5S strategy for productivity improvement: a case study. *Indian Journal of Research*, 2(3), 151-153.
- [7]. Hernández Lamprea, E. J., Camargo Carreño, Z. M., & Martínez Sánchez, P. M. T. (2015). Impact of 5S on productivity, quality, organizational climate and industrial safety in Caucho Metal Ltda. *Ingeniare. Revista chilena de ingeniería*, 23(1).
- [8]. Jiménez, M., Romero, L., Domínguez, M., & del Mar Espinosa, M. (2015). 5S methodology implementation in the laboratories of an industrial engineering university school. *Safety science*, 78, 163-172.
- [9]. Sidhu, B. S., Kumar, V., & Bajaj, A. (2013). The "5S" Strategy by Using PDCA Cycle for Continuous Improvement of the Manufacturing Processes in Agriculture Industry. *International Journal of Research in Industrial Engineering*, 2(3), 10-23.
- [10]. Jamian, R., Rahman, M., Deros, B. M., & Ismail, N. Z. N. (2012). A conceptual model towards sustainable management system based upon 5S practice for manufacturing SMES. *Asia pacific journal of operations management*, 1(1), 19-31.
- [11]. Kumar, K., & Kumar, S. (2012). Steps for implementation of 5S. *International Journal of Management, IT and Engineering*, 2(6), 402-416.
- [12]. Samade, R., & Kogan, B. (2007). Calcium Alternans in Cardiac Cell Mathematical Models. Paper presented at the BIOCAMP.
- [13]. Roscoe, A. M., Lang, D., & Sheth, J. N. (1975). Follow-up Methods, Questionnaire Length, and Market Differences in Mail Surveys: In this experimental test, a telephone reminder produced the best response rate and questionnaire length had no effect on rate of return. *Journal of Marketing*, 39(2), 20-27.
- [14]. Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach*: John Wiley & Sons.
- [15]. Fernandes, J. P., Godina, R., & Matias, J. C. (2018). Evaluating the impact of 5S implementation on occupational safety in an automotive industrial unit. Paper presented at the International Joint conference on Industrial Engineering and Operations Management.
- [16]. Singh, A., & Ahuja, I. S. (2014). Evaluating the impact of 5S methodology on manufacturing performance. *International Journal of Business Continuity and Risk Management*, 5(4), 272-305.