

Development of 5S Practice Checklist for Manufacturing Industry

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Abstract—This paper explores the practical use of the 5S Checklist for environment, housekeeping and health, as well as safety improvement purposes at two manufacturing organizations. The main objective of this study is to assess the implementation of 5S and development of the 5S Activity Checklist in manufacturing companies. The scope for this study covers the following areas: identifying problems, looking into critical success factors, their outcomes and recommendations. In addition, factors that may act as constraints to the implementation of the 5S activity and possible solutions for the industries are also identified through observation and evaluation of the improved environmental performance. The study is conducted using a systematic approach with specific software in order to get the most accurate results. In conclusion, effective implementation of the 5S activity depends on the commitment of the top level management, total involvement of the staff at all levels within the company, function and background of the business, publicity given to the 5S activity and finally the training conducted for the organisation in implementing the 5S practices.

Index Terms—5S, Case study, Quality tool

I. INTRODUCTION

This paper concentrates on the results of two case studies carried out as part of a research project in developing and implementing the checklist for the 5S activity in a manufacturing organization. From the case studies conducted, it is possible that an appropriate and simple checklist can be derived and implemented but, it has proved to be rather difficult in getting accurate results, as certain information is considered as confidential and therefore companies are not willing to release their confidential information. Regardless of the difficulties faced in conducting the case studies, they were successfully completed in the early part of 2009 due to the determination and endurance spirit of the team of researchers. This paper is presented as follows: the first part discusses the literature review on the 5S, the second part gives a description of the methodology employed in gaining the relevant information concerning the industries studied and the third part presents the case studies which centre on three main areas which are: the background of the companies; the results of the implementation of the 5S Activity and; the critical success factors of the 5S Activity. Finally, the conclusion and recommendations for future research are given.

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The 5S Practice is a technique used to establish and maintain quality environment in an organization. The original concept was developed by Osada in the early 1980s. The acronym 5S stands for the five Japanese words *seiri* (organization), *seiton* (neatness), *seiso* (cleanliness), *seiketsu* (standardization), and *shitsuke* (discipline).

In a manufacturing environment, the 5S in practice can bring in results that could considerably raise the environmental performance in line with the improved housekeeping and health & safety. The 5S practice in theory involves straightforward steps which lead to continuous improvements. In practice, the implementation of the 5S can be influenced by the human factor and limited resource hence interfering and retarding the effectiveness of the practice.

II. RESEARCH METHOD

An intensive questionnaire survey was conducted based on two companies. The main survey was conducted from September 2007 to May 2008. Generally, a member of the staff at all levels will eventually get involved in the audit process. Several steps have been taken to achieve the target: interviewing and observing the two selected organizations, developing the 5S checklist based on the two case study companies, conducting the audit process by taking into consideration the companies' housekeeping, environmental performance, health & safety, and analyzing the checklist record. In selecting companies for this study, the main criteria are based on the willingness of the company to share and deliver the good information of its company, type of company, and the level of quality system implemented. The auditing process is then followed by the representative of company, together with support from the researchers. Eventually, all staff will be trained to carry out the auditing.

There are two ranking systems for analyzing the condition of the companies in this study, Likert scale and percentage value. The Likert Scale is used in this study for the 5S Checklist to determine the level of implementation of the 5S Practice for each aspect in a developed checklist, for example, with 5 being the highest (indicating greater agreement) and 1 the lowest, indicating lesser agreement. Several parts in the selected organization have been ranked by using this system. The cumulative value is then obtained from the total value of the items in each part. This value obtained is then converted into percentage values. The percentage value is used in order to determine the level of the implementation of 5S Activity in both companies, and to assist these companies in recognizing the areas that need to be improved.

A. Company Background

To maintain confidentiality, the names of the companies have not been disclosed and are therefore referred to as companies A and B. Both the companies are considered basically, as medium scale factories in Malaysia.

i) Company A - Company A is a medium scale Japanese company and has been established in Malaysia since April 1980. Company A is chosen for this study, due to the fact that it is a leading global supplier of advanced automotive technology, systems and components and also because of its eco-friendly characteristic. Company A's fundamental mission is to achieve customer satisfaction through quality products and services maintained by experienced employees. The main customers of this company are local automotive industries which are Proton and Perodua and the other multinational automotive industries like Toyota Motor S/B., Daihatsu Malaysia S/B. and Honda Malaysia S/B. Company A, associates itself with continuously consistent quality and efforts on selecting and implementing improvements that have the greatest impact on its key business plans and goals. It always focuses on achieving high quality and productivity by optimizing product designs and reducing waste, and implementing variation in its manufacturing processes. It has also been awarded certification for the ISO 14001 Environmental Management System, which recognizes its commitment and efforts in maintaining the environment.

ii) Company B - Company B was established on 17 March 1975 as a joint venture project between Malaysian and Japanese partnership and granted pioneer status for the manufacture of flexible light packaging materials. Several years ago, the ownership of this company has been changed due to the business culture. Since its inception, this company has led the local converting industry by being listed on Kuala Lumpur Stock Exchange in 1990 and obtained SIRIM's certification of its ISO 9001 Quality Management System in 1996 and ISO 140001 Environmental Management System in 2000. Its vision is to become a No. 1 ASEAN Company for Quality, Cost and Delivery in parallel with its mission which is to be a total package solution provider. Besides manufacturing conventional packaging products, Company B produces special application packaging for medical, pharmaceutical, seasonings and electronic industries. As part of the company's commitment to environmental protection and corporate social responsibility, it changed its waste water treatment system in 2002 to one using "Cleaner technology".

Fig. 1: Checklist for general requirement



Fig. 2: Front page

C. Development of a Practical System through Visual Basic Software

Developing a software purposely for a 5S's Activity is one of the objective of this study. In this study, the researchers came up with one package using Visual Basic in order to assist the corresponding company's implement of the 5S's Activity successfully. It only shows the scoring mark for each division. Fig. 1 and 2 shows several pages in this package. Generally, this package covers all aspects that are observed in the audit manual. All the pages are connected via some command that has its own programming code.

III. RESULTS AND ANALYSIS

A. Company A - From auditing process, it shows that the implementation of the 5S Activity at Company A is in excellent condition. From the six areas inspected, only two areas were found to be out of the excellent condition, and they are inventory and production areas.

Inventory division - This area has twenty-one aspects with two main categories which are raw materials in process and finished products. Company A is a company that practices Just in Time (JIT) and Supplier Kanban which have become the catalyst for excellence in delivery and receiving of goods. Furthermore, this company, always wins the Award of Excellent Supplier for its customers which are Proton Holdings, Toyota Motor Corporation and several other companies.

Production Line - Out of the forty-five aspects that have been observed, labeling the machines at the production line is one of the factors that contribute to the lowest score of this area. For each type of production, there are four lines that are covered in this observation and these are Radiator Line, Piping Line, MF Condenser Line and the Evaporator Line.

General requirement - In this study, there are twenty-five aspects concerning education and training, patrol system, current information, reward system and awareness activity, 5S record, discipline of the employees, sound and vibration system, lightning, and ventilation and piping system. The Quality Control Circle Community (QCC) has become one of their approaches to continue improvement in this company. The structure for conducting continuous improvement is by way of having an improvement facilitator who reviews quality problems together with related teams to find

improvement opportunities. To make sure that meetings among the members are held regularly and without any hitches, a space in the production line is provided with complete facilities like a meeting table, chairs and a white board. Company A has also introduced a reward system in the form of allowances and incentives for each superb idea in developing the company to an excellent level. Even though the method appears to be simple and obvious, the involvement of employees and management in contributing their ideas and skills for better job execution lead to higher employee satisfaction. The 5S module is provided by the company to all its employees in order to show the importance of this activity to the company.

B. Company B - From this research, it indicates that all seven areas that have been inspected in Company B are in good condition. This is established by the analysis that we have carried during auditing. However, as comparison with Company A, some of the areas are explained below and followed by some suggestion for improvement.

Inventory division - Considering the eighteen aspects of inspection for packaging and printing items, the inventory area percentage is 74.44%. Most of the assessment in this inventory division considers the ergonomic factors in handling the items. It is due to inadequate and ineffective tools and equipment in material handling.

Production line - For the production line, thirty-three aspects are considered, and these are involving the condition of the floor, warning signs, transportation, chemical substances used, machines, workbenches, raw materials and finished product storage, material handling and equipment, and also emergency plans. Generally, there are three types of production areas in this company and these are printing and extrusion, dry lamination and the bag making section. From the material handling and equipment aspects, the study found that the weaknesses lie in labeling and storage of product.

General requirement - Further, general requirement with the percentage of 75.8% is the second-highest score with stresses on thirty-three important aspects which comprises the fire system, electrical system, lightning, pathways, stairs, emergency aid, activity record 5S member, discipline and awareness of the employees and also the ventilation and piping systems. A change of ownership in company B influenced the implementation of the 5S Activity. With a new ownership, 5S activity was implemented by structuring and establishing a committee known as 5S Sub-committee organization. Each 5S activity will be recorded in a special column at the production line. Daily, a 5S meeting is held at 7.00 o'clock in the morning involving a representative from each department and a few of employees (particularly the foreign employees). Checking the level of cleanliness is also monitored once one month by using a particular check form. As part of the company's commitment to environmental protection and corporate social responsibility, it changed its waste water treatment system in 2002 to one using a "Cleaner Technology".

C. Comparison

From the observation carried out, it can be concluded that Company A is sitting more so towards the excellence level as compared to Company B. Company B's organization shows weaknesses in several aspects. It is due to the overall percentage of Company B where it only acquires 72.35%

(good) as compared to Company A's organization that obtained an excellent level of 90.48%. The difference in both the percentage happens possibly due to the size, background and the position held in the market by both companies in Malaysia. Although Company B started its operation in Malaysia in 1975, it does not seem to have an established background in the management of an industry and still have not be able to strengthen its position in the local market and competing in the global market would be farfetched at this point of time. In comparison Company A, which was launched five years later in 1980 in Malaysia has already become a strong competitor in the global market. This is probably due to the fact that the mother company had been already solidly established in Japan since the year 1949. Company A is also probably set up as a partner of the renowned Toyota Motor Corporation with being a very distinguished upholder in the area of quality. Obviously, a strategic partner with a strong position also assists a company to stabilize itself in the industry.

Apart from that, the type of production also plays an important role to determine the level of the industry involved. For example, with the moderate size of Company B that only manufacture products based upon packaging, it has lacked in addressing issues related to environmental awareness due to being a factory with less complicated processing amenities. On the other hand, Company A manufactures electronic and mechanical based products which obviously require the most profound scrutiny in their production process due to sensitivity of the nature of the product on external factors like the temperature, pressure and emission of gases, it would therefore be compulsory for this company to have installations to prevent environmental degradation.

D. Recommended Improvement

Company A - This organization did not have any objections or raised any issues on the practice of the 5S Activity and have used it consistently. On the implementation of the 5S Activity, the company's overall score is 91 percent, which is an excellent level. However, several critical problems have been observed in this study by the researchers and therefore suggest an improvement proposal as summarized below.

- i) Taking action on reducing the sound and vibration levels of the decibel to an appropriate level in order to decrease the noise as generally required by regulations.
- ii) Maintenance of the piping system should be carried out frequently.
- iii) The arrangement of the equipment is seen to be in an unsatisfactory condition. Fixing the right sized work benches and more drawers will help to reduce the clutter as well as improve the ergonomics of the workplace.
- iv) All machines need to be labeled and work pathways should be marked correctly and clearly in colours.
- v) Machines need to be thoroughly cleaned periodically otherwise problems concerning the cleanliness of the machines would arise due to oil and chemicals settling via the installation inhale fluid system of the machine which is the support mechanism in the machine itself to suck up the oil that spills during processing.
- vi) The distance marker element and a warning system sound should be installed in helping to improve the capacity of the material handling and the transportation system in the workplace. Besides that, fire drills need to be carried

out at least three times per year and the latest and most effective emergency plan should be displayed at each exit.

Company B - Although this company has been established for the last three decades, it has only been practicing the 5S Activity at its workplace for the five years consistently but however it has been observed that the 5S Practice is not conducted formally. The practice of the 5S Activity needs to be improved due to the fact the overall percentage is only 72.35% which ranks it as only good. Several critical problems have been observed during this study and therefore an improvement proposal is summarised by the researchers as follows.

- i) The company should establish a benchmarking system with other successful organizations and make references from time to time with any member of Quality Control Bodies which will provide aid to this organization in realizing its mission and vision.
- ii) In order to make the 5S work the top management has to give its full support to practice this activity in their company. But it is observed that the top management of this company is not supporting the 5S Practice and the reason given by them is the amount of the time and money that would be required to implement the proposed activities in the 5S. In order to make the top management aware of the effectiveness of the 5S they have to be shown the performance indicators relating to the costs involved, sales, profits and product quality of this approach. For example, by comparing the quality of production by a machine before and after the implementation of 5S Activity
- iii) This company has limited space and is a closed building. Therefore the ventilation system in this company is in a critical condition. The odour of the printing materials is of course hazardous to the health of the employees especially those in the production line. Therefore Company B should take into account this problem by installing or mounting vacuum suction equipment. Besides that, the management should fix proper air conditioners or efficient fans in the production line area.
- iv) The labeling system is found to be unsatisfactory especially in the store. The labeling of goods should also be monitored as it is incomplete and not enough. This matter needs to be seriously looked into to avoid confusion and technical problems that could happen in future. There should also be a coding system to label documents and files. A flow chart of the storage for both raw and finished materials needs to be presented and updated, so the employees will place the items at the right place.

E. Critical Success Factors

From this study, we can note that there are several factors that influence the implementation of 5S Activity. Several approaches to stabilize the 5S Practice at workplace can be initiated and implemented in accordance by stages that involve:

Top management participation - Improved communication and a greater shop floor involvement in the implementation of 5S is the most important means of removing barriers between the top management and the employees. Besides that, it is felt that the management structure should be flattened and empowerment given to the

employees in order to make decisions quickly for certain cases. For both companies, there is a gap in the relationship between the top management and the employees and this is difficult to fill. Both companies have their own respective reasons. For Company B, lack of time and being busy individuals and with a limited number of workers, creates a gap between managers and employees. While for Company A, it is due to large number of employees who work in shift and so do not have same working hours among them.

Background Information on Company Business - There are four areas to look into when discussing the company and these are: the type of business conducted the size and condition of the company, the strategic partners and background of the staff. Company A creates great partnership with well-known and well-built automobile companies like Proton and Toyota. Besides that, they practice good customer relationship in order to ensure their place in the market.

Company B on the other hand carries out business based on plastic packaging with its establishment being the result of an agreement between Malaysia and Japan. Nevertheless from the aspect of the 5S Activity, this company still needs improvement in certain areas due to the business volume as well as the fact that it is running at a location and building with limited space and is still at a tenancy process. Therefore, modification of the space is limited.

Apart from that, from the level of education and background aspect of the employees, it shows that most of the support staff of Company B are not Malaysians but foreigners and have formal education till form five and below. While, Company A employs Malaysians as its support staff because it is easier to with them although they do not have high level educational qualifications.

Raising Awareness - Both companies have been found to practice all these methods to deliver this activity:

- *Seminar, workshop and talk:* Inviting experts, academicians, members from DOSH and other manufacturing industries is one of the approaches towards the optimum practice of the 5S.
- *Promotions:* Presenting this activity in form of banners and posters, brochures and organizing competitions among the different sectors in the industry each month is one of the best way to promote this activity.
- *Educational Visits and Benchmarking:* Useful information from successful organizations is a useful method to get effective results. It is good if the industry visited has a similar type of business. From the benchmarking aspect, Company A can refer to Toyota Motor Corporation as a best source of reference in maintaining the 5S Activity.
- *Competitions, Conventions and Dialogue:* The 5S group that has conducted the 5S Activity is sent to participate in competitions, conventions and 5S dialogues. The objective is to raise interest and awareness amongst the staff.
- *Auditing:* Each department will be assessed on the level of the implementation of the 5S. For now, Company B focuses this assessment only at the production line while Company A assesses the overall department at their workplace. Both the companies, use auditing as a way to recognize and improve weakness in this activity.

Training - There are two ways in providing the training and these are internal and external training. From representatives we found out that at both companies, they

agreed with providing the training internally through four methods; from other experienced individuals; having commitment in the project; job sharing & task rotation and; guidance individually in the programme. While, for the external training it can be done through sending the employees to 5S Activity seminars or workshops conducted by recognized bodies. Through this method, the staff involved will become the resource person in the manufacturing industry. Therefore, it can be advantageous to the organization for this activity. 5S Transformation Process can be interpreted through the model, as shown in Fig. 3.

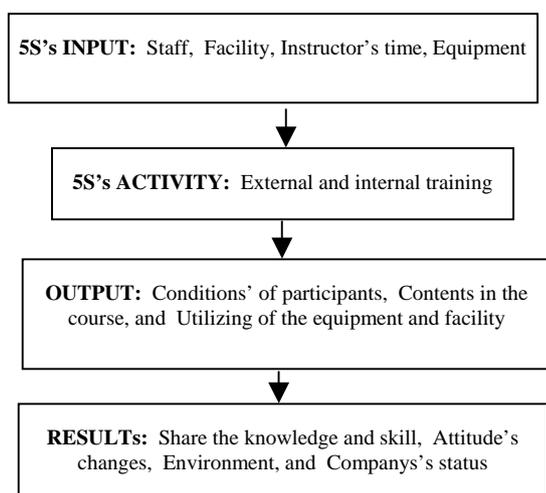


Fig 3: Transformation Process

IV. CONCLUSION

The outcome of the surveys at both companies demonstrates clearly that the 5S practice is seen as an effective technique that can improve housekeeping, environmental performance and health & safety standards in an integrated holistic way. It can be observed that there are some similarities in the approaches adopted by the companies. It can be regarded as the promotion of the 5S Activity amongst the staff and as a training method for the staff. The survey demonstrates, however, that there are obstacles in the effective implementation of the 5S for any improvement purpose. The most significant barriers identified are related to lack of communication, gap between the top management and shop floor employees and also the lack of training and consciousness of this activity amongst the staff. Thus, the full benefits of the 5S cannot be experienced in the business sector until all the obstacles associated with implementation of the technique are recognized, fully understood and addressed. Continuous assessment in both companies is one key driver to changing the culture of the organization. This assessment should be focused on the progress and improvement based on all input from this study. Having a differentiation will be beneficial when attempting to finalize an implementation of the 5S Activity suitable for a medium scale company. In terms of developing the package using the software, having the details of the assessors, a comment page, and analysis of the data are good applications for the next research.

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