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5s Implementation in the Paper Bag/Sack Manufacturing Industry and its Impact on Physical Workplace (A Case Study)

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ABSTRACT

This research has been carried out with the objective of identifying the effects of 5s implementation in the paper bag manufacturing industry in Sri Lanka. The research also analyzes how successful the implemented system is in bringing about improvements in the company effectiveness and efficiency in several variables like, production quantities, material usage, wastage, etc. Out of five major companies, one manufacturing plant was chosen for this study. Both primary data collected through observation and secondary data were employed. 5s concept is simple in theory, yet tough in the implementing process designed to organize the work floor, to keep it clean and to maintain worker friendly conditions. Accordingly it can be observed that the stage of the 5s implementation procedure has a significant impact on the total production quantities, the average time for an employee to find a tool/equipment/document and employee complaints. All variables including total production, material usage, wastage, time expenditure and number of complaints by employees show variations according to the status of the 5s system, with the exception of the variable electricity which was used as a proxy in place of human energy consumed. Further feasible and alternative solutions were considered and the best solution was presented with suggestion on sustainability of 5s principles.

KEYWORDS: Paper bag manufacturing industry, Time expenditure, Human energy consumption, Status of 5s system, Sustainability of 5S principles

1 INTRODUCTION

The company selected for this study is involved in production of multi wall paper sacks for the cement and tea/food industry. As per the requirements of several certification bodies and customers it is important for the company to maintain a sound quality management system. And accordingly the management of the company decided to implement a workplace organization methodology, preferably a 5S system, to further strengthen the company operations and ensure maximum quality to its customers.

5S is the stepping stone to achieve lean manufacturing that is essentially a support to such other manufacturing improvements as just-in-time (JIT) production, cellular manufacturing, total quality management (TQM), or six sigma initiatives, and is also a great contributor to making the workplace a better place to work in an efficient manner. Some of the benefits to the company from using the 5S methodology include raising quality, lowering costs, promoting safety, building customer confidence, increasing factory up-time, and lowering repair costs.

This paper presents a case study carried out in a paper sack manufacturing plant where analysis was carried out on several variables before and during implementation of a workplace organization methodology. The aim of the study was to implement 5S and evaluate its effect on productivity, wastage, morale, time and energy expenditure.

2 LITERATURE REVIEW

2.1 Related Literature

Many enterprises, across the world, have practiced the 5S tool and bear evidence to the significant benefits derived. In particular, this tool has been widely practiced in Japan, due to whom it became a widely accepted tool in the manufacturing as

well as service industries. 5S has been a fundamental part of Japanese culture and society for several decades dating back to just after World War II (Osada, 1991). Most Japanese 5S practitioners consider 5S as useful not just for improving their physical environment, but also for improving their thinking processes too (ITC, 2012).

5S lays the basics for significant, achievable improvements in work and the workplace. It provides the groundwork on how people approach their planned future state. Van Patten (2006) and Samuels (2009) concur that 5S is often understood as a simple strategy to clean the shop floor, but it can be a potent application for developing a successful business and deploying a new standard of workplace practices. When everything has a place and there is a position for all things, a 5S program will serve for supporting a clear picture of the workplace (Bullington, 2003). With this program there is less vagueness in the organization creating a more orderly focused direction to travel in. Also it creates unity among the workers in the environment due to the atmosphere of team work and participation.

5S is divided into three core ideas (orderliness, cleanliness, and discipline) upon implementation (Kobayashi, Fisher and Gapp, 2008) Orderliness sorts out all the unnecessary items, simplifies processes, and gives associates their responsibilities. This maximizes efficiency and effectiveness of participants in an organization (Kobayashi, et al., 2008). Cleanliness or visual transparency will help the workplace to be a pleasant and friendly environment. Due to enhanced transparency, anyone in the organization can easily realize current or future errors in an instant (Osada, 1989). Discipline can be gained through culture, training, and education and is implemented within 5S system to standardize the work.

2.2 Related Theories

5s derives from the words Seiri (sort), Seiton (set in order), Seiso (shine), Seiketsu (standardize) and Shitsuke (sustain).

Seiri or Sort is the first step in 5S, and it refers to the sorting of the clutter from the other items within the work area that are actually needed. Sorting is the first step-removing all surplus items from the work center which are not needed for the immediate continual operations (Hough, 2008).

Seiton or Straighten is the process of taking the required items that are remaining after the removal of clutter and arranging them in an efficient manner through the use of ergonomic principles and ensuring that every item "has a place and that everything is in its place."

Once the unneeded is thrown away and sorting and set in order has taken place, it is now time for the sanitize phase (Howell, 2009). This is sometimes referred to as shine or sweep stage where teams thoroughly remove clutter and fix equipment or building components (Hough, 2008).

After the organizing and cleaning of a production area, it is essential that the area is maintained (Cooper, Keif & Macro, 2007). Seiketsu or standardize is the process of ensuring that what we have done within the first three stages of 5S become standardized.

The final stage is Shitsuke or sustain, ensuring that the company continue to continually improve using the previous stages of 5S, maintain housekeeping, and conduct audits and so forth. Several Studies have identified fifth phase as the most difficult phase to perform of this program (Bullington, 2003; Cooper et. al, 2007; Womack & Jones 1991).

3 METHODOLOGY

Several variables were considered to measure the improvements in productivity and other factors, listed in Table 1. Observation of the factory floor and its workers was carried out during the complete research period to monitor the change process. To monitor the changes in the workplace statistically, secondary data on energy expenditure, direct production output, wastage, complaints by workers, and

material usage from the company archives were used.

Table 1: Operationalization of variables

Variable	Data collection method
Direct Production output	Company archives (Batch reports)
Material usage	Company archives (Batch reports)
Wastage/ Defects	Company archives (Batch reports)
Energy expenditure in locating items	Cannot be measured directly. So a proxy for energy in the form of electricity consumed was measured.
Time expenditure in locating items	Through observation/ personal recording sheets of the selected workers for the study.
No. of complaints by workers	Complaints registry at the factory

4 DATA COLLECTION AND ANALYSIS

Microsoft Excel and SPSS analytical tool were used to analyze collected data and to test hypothesis built. More weightage was given to descriptive statistics since as per the nature of study it was required to get a comparative idea of before and after implementation of the system.

5 OBSERVATION AND DISCSSION

During the first two weeks of the campaign ground work for the 5S system was decided upon and an initial clean up, by the cleaning crew, of the factory was conducted in order to understand the situation of the work floor better.

From third to sixth week the first step of the 5S concept was initiated on the floor, 'Sort'. Due to the initial clean up there were many areas of clutter identified and also many tools/equipment dug up from forgotten corners. These were set aside, in a holding area, by the cleaners.

Then the operators were instructed to "red tag" the identified clutter and to move them to an area allocated within the premises dubbed the "red point". These articles were then traced back to the reason of purchase through old records to determine if a particular item had any significance on the factory work, and according to the verdict an action was taken on the article/tool with the factory manager's consent. And the items which were considered not to be clutter were moved to places where they would best support their function.

Training programs and briefings related to cleanliness were also conducted for the workers. Briefing on cleanliness and work floor maintenance will be included in future induction programs for factory floor workers. Operating standards which were in place for the tuber and bottomer machine were reviewed and changes were made where necessary. Also changes were made in the workers' job description to standardize their work methods.

The best way to measure the sustainability of the concept introduced was decided through an internal audit. It was decided to include audit elements on 5S system sustainability into the audit procedures.

The tuber machine originally had a tray which was too deep to contain the gum in the machine and was feeding only the top layer leaving the bottom layer to be scraped off at the end of the day. This meant that the process kept using up more glue than it was required. As part of the standardized step this tray was replaced with a more practical one which had exactly the depth for a proper glue flow.

Also posters were put up near the glue mixing machine and the worker on the task

were taught on the exact ratio of mixing and composition, which had led to the desired viscosity of glue being achieved every time.

A rack was installed next to the tuber for the sole purpose of temporarily storing the ink cans necessary for the batch being run, as part of standardization.

Continuous training, changing the mindset of the employees, better preventive maintenance, faster corrective maintenance, use of tool boards (peg boards/ shadow boards) need to be given more importance in order to sustain the system in place.

Throughout the campaign the following results were seen in the first three variables discussed under Table 1.

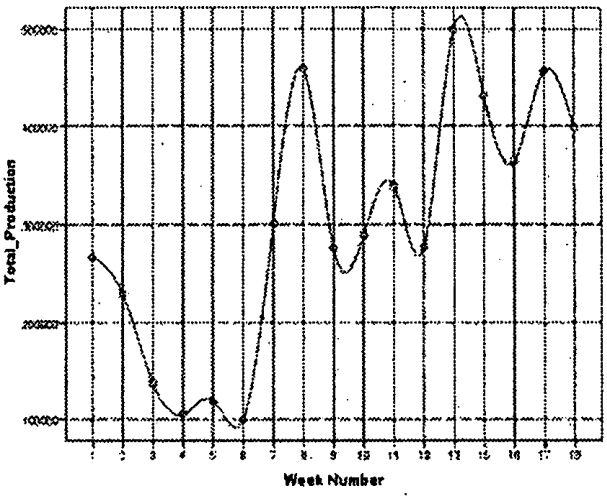

Figure 1: Week Number vs. Production

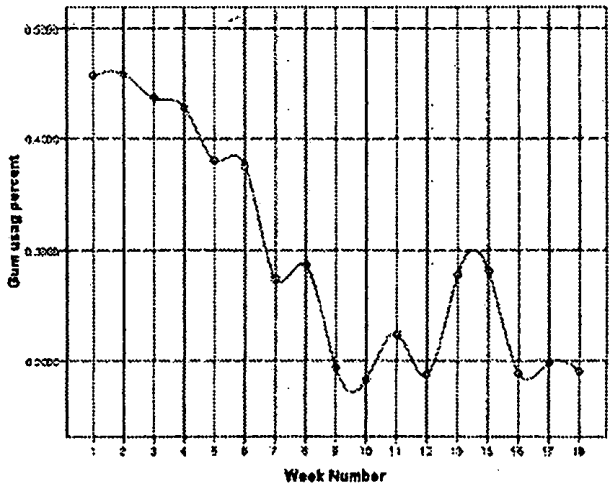

Figure 2: Week Number vs. Percent of Raw Material Usage

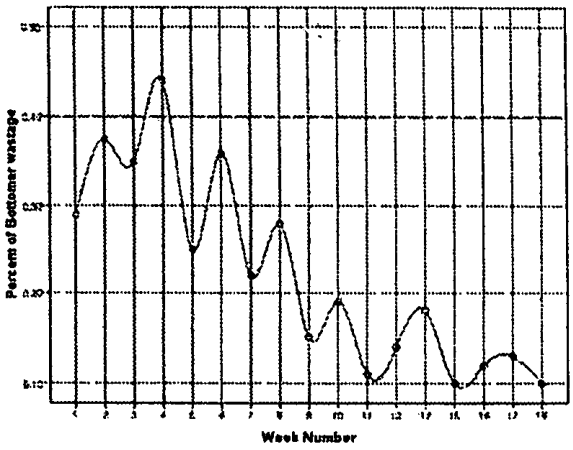

Figure 3: Week Number vs. Wastage

6 CONCLUSION

There was a change in pattern of production quantities, percent of raw material usage quantities (ink and glue) and percent of wastage generated from bottomer and tuber, when comparing the research findings before and directly after implementation. But is not clear whether this is a one-time improvement due to the new systems (so that the results would revert back to the original after some time) or a permanent change in the above mentioned variables. This could be confirmed by analyzing data for a considerably longer time period.

It can be concluded from the research findings that there is a considerable reduction in the time taken to locate an item and number of worker complaints, when a 5S system is implemented at a workplace.

Electricity consumed shows that the unit consumptions of electricity for the span of four months considered was almost equal. This would mean that the energy consumption do not change regardless of 5S implementation. However it was also observed that there was a considerable reduction in time taken to locate a tool which would lead to the employee spending less energy on the task.

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