

Literature Review on Evaluation of 5 'S' Conformity in Construction Sites

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Abstract - 5S practice is one of the manufacturing techniques to improve workplace quality, productivity and safety at the workplace. It is found as a basic tool in enabling a worksite for lean transformations. 5S system is a method used for setting up and keeping quality of working environment in an organization. This methodology can manage space, human effort, time, quality and capital to make the end product with less faults and make the site a well ordered, disciplined and clean place to work. 5S application improves personal standards and motivation of workers in their workplace and has a high impact on work area, safety, quality, and efficiency.

Key Words: 5S, Lean Tool, Questionnaire framework, Quality Improvement

1. INTRODUCTION

The global marketplace has become highly competitive in the last few decades, thereby compelling the organizations for imbibing the challenge of continuous improvement for sustained customer satisfaction and organizational competitiveness. The ever increasing competition in the marketplace has been putting enormous pressures on organizations to continuously improve the quality of products and services for sustained organizational growth in order to enhance their position and reputation. This calls for attaining improved organizational performance by focusing on consistent quality improvements, cost optimization, enhancement in productivity, flexibility, safety and ensuring timely deliveries. Thus the organizations must adopt the practices, programs or methods that facilitate continuous improvement in the organization.

Lean initiatives envisage achieving highest quality at lowest cost. Lean focuses on identifying effective and efficient movement of tangible and intangibles operations and acts as yardstick of measuring the progress of an organization. Lean manufacturing environment empowers the employees to suggest and make continuous improvements in work areas, process and services to recognize the problems or wastes associated with the system in order to eliminate them. So it is important to have engagement of all the employees in the lean manufacturing in pursuit of waste elimination.

2. LITERATURE REVIEW

This review paper is concentrated on studies done in the various fields of construction organizations.

2.1 Implementation of 5S Method

Berroir et al. (2015) Studied 5S method implemented in a French construction firm through a Top down approach where top managers decide the performance indicators and bottom up approach where the workers were directly involved and guided were studied. The key actions at the site were defined through thorough inspection by top level managers and 5S ratings of each activity as per a standard reference table were made. When the rates fell below 50%, remedial measures were undertaken and refined 5S strategy was applied immediately. The 5S method implemented at the bottom level was more effective than the top down approach as the workers were motivated to bring changes through continuous improvements rather being pressurized to bring changes as per top level managers' instruction.

Worley et al. (2015) analyzed Lean transformation in a manufacturing unit with high product variability and specific orders were made by implementing lean tools. 5S was introduced as preliminary tool to organize different work areas. The concepts of 5S were studied by each workgroup and necessary changes were made. The unavailability of a lean facilitator for full time in an organization and constraints to apply lean tool at the personal level has reduced the effectiveness of lean implementation. Haitao et al. (2013) suggested that 5S and standardized work were implemented at the initial stage of lean transformation in a US based modular building company. 5S campaign was conducted for middle management and frontline workers to make them visualize the changes when implemented. The changes through cleaning and workplace arrangement showed visible result and enhanced the discipline. Each shop floor were observed and possible changes to be made were deduced after a brainstorming session. Three top areas of wastes were identified and action plan to eliminate these waste were made. Further improvements on action plans were made through biweekly meetings and standardized work procedures were made by eliminating wastes. The workplace arrangement thus helped to spot wastes and carry out more lean operations in the company.

Deshpande et al. (2012) conducted a study on lean practices of Walbridge Inc. a large construction company in US showed optimal worker performance and better workplace arrangement through 5S and lean auditing. A file transfer protocol (FTP) site was structured in an orderly fashion according to discipline to ensure well-organized, easily accessible design documents (Sort). The organization of design information and documents was done by using established, standardized AutoCAD layer guidelines (Set in order). Procedures for updating drawings and showing changes were agreed upon with the owner (Shine). The systems were audited every 3 months by an experienced engineering manager (standardize), and the lessons learned and improvements were implemented through the life cycle of the project (Sustain). The lean audits were performed by independent auditors within the organization. Instead of waiting until the end of the project, areas for improvement in implementation of the lean processes were identified.

Forbes et al. (2011) conducted a study on tools and techniques that have been successfully applied in manufacturing are adapted to the construction environment. But construction processes varies significantly from manufacturing processes. Construction “products” are made in response to particular orders. The same design is rarely used more than once, whereas most manufacturing is repetitious. Construction processes are determined by crews in the field where there is the potential for much variability.

Omogbai (2017) Firm size, product type, employee training and organizational attitude towards quality and continuous improvement affect the implementation of 5S and the system’s performance after implementing it. Establishing 5S strategy successfully involves direct cooperation and harmony of all persons involved in the activities. Although the first three S’s are easy to achieve, maintaining the effort degrades in due course of time.

2.2 5S in Waste Reduction

Construction produces a large range of waste at all the stages right from site preparation, demolition to final product. Minimizing the waste and optimizing the profitability is possible by reducing cost of material with proper planning, scheduling, purchasing, procurement, receiving, inspecting, handling, storing and warehousing. Waste is anything, not needed. However, if somebody else can use it, rather as it is (called reuse), or by processing it (called recycling), then the waste created on site can turn out to be beneficial Koskela (1994). The adoption and adaptation of lean production concepts in the construction industry has been an on-going process, better value to owners and at the same time making greater profits. Though lean production theory was developed for manufacturing, the similarities between craft manufacturing and the construction process makes the lean production theory ideal for application in the construction sector also. A primary goal of lean production theory is to reduce or eliminate the share of flow activities in a project

while increasing the efficiency of conversion activities. But 5S caused a raise in budget when implemented for the first time. Salem et al. (2005)

Construction industry represents a relatively large percentage of production cost. The existences of significant number of wastes in the construction have depleted overall performance and productivity of the industry and certain serious measures have to be taken to rectify the current situation. Waste measures are more effective to support process management, since they enable some operational costs to be properly modeled and generate information that is usually meaningful for the employees, creating conditions to implement 7 decentralized control. 5S management techniques have contributed significantly to improve internal efficiencies by finding out value adding activities and non-value adding activities and its elimination to enhance operational effectiveness and on time delivery system to customers, Nahmens et al. (2011)

In general, a very high level of wastes non-value added activities is assumed to exist in construction, and it is difficult to measure all waste in construction. The existences of significant number of wastes in the construction have depleted overall performance and productivity of the industry Aziz et al. (2013), and certain serious measures have to be taken to rectify the current situation.

2.3 Productivity and Performance Improvement

5S as a site management technique enhanced productivity through a continuous and systematic process by eliminating waste enhancing teamwork and operation effectiveness. These qualities directly improve the performance of workers thereby the productivity Huang et al. (2012). Transformation of a batch flow processes to line flow through worker participation in a precast concrete production unit were studied to evaluate the productivity gains. After the implementation of 5S, preventive equipment maintenance and a pull system for steel and concrete productivity was risen by 25%, but not stable. So as to stabilize the productivity gains, audits were performed and changes were made to the action plan. Thus by making the processes more standardized through continuous improvement, stability on productivity was achieved Carlos et al. (2014).

Application of 5S in large Chinese construction firm suggests that the first 3S’s brings fast changes to workplace by exposing abnormalities and defects. This does not enhance the productivity but by standardizing the processes and sustaining the performance productivity is increased Shang et al. (2013), Nahmens et al. (2011).

2.4 5S in Safety performance

Safety is one of the important aspects of construction often underestimated and cause productivity decline. The decreasing level of priority and effectiveness of the controls

makes it difficult to implement methods that effectively control the safety hazards. Even accidents are wastes that cause delay and rework. Companies that implemented lean tools like 5S made jobsites safer through good housekeeping Catarina et al. (2016). Lean implementation in the construction industry show addition of a sixth S, to the lean tool 5S, for safety by conducting a process improvement event in the continuous improvement process dedicated to safety. To enhance safety in a construction project where traditional methods are followed, 5S was easy to set up and make improvements Adnan et al. (2014).

The root causes of accidents, whether associated with worker behavior or not, also provide a strong foundation from which to base judgment on situational awareness and impacts to safety performance. Reducing the work flow variability makes the workplace safe. 5S lean practice has a positive impact on this issue because the nature of the five practices within 5 S's promotes cleanliness, order, consistency, and other qualities that contribute to making fewer errors John et al (2016).

3. CONCLUSIONS

The studies reveal that 5S implementation leads to realization of remarkable results for the organizations. 5S approach can easily be applied in various organizations due to its simplicity and easy recognition. 5S a universal tool which provides huge benefits with no losses by holding improvement initiatives. This practice can be implemented mostly in every sector or organization like banking, industries, construction, mining and Defense. It is an essential tool to compete the organization at global level. The successful implementation of 5S technique in any organization needs participation of top to bottom management and training. It is important to have participation of every employee of the organization for its successful implementation.

5S has proven to be a tool contributing to the sustained growth of organizations and maintain its development in the long term. It is evident that it is not just a pure cleanup or housekeeping process. It brings overall improvements in employee involvement, organizational communication, team work, production, quality, work flow, safety, maintenance, customer complaints, in-process rejections, delivery compliance, absenteeism, inventory management and work environment thereby enhancing the competitiveness of the organization. 5S technique is an essential technique and act as back bone of any organization trying to achieve the certification of ISO standards.

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