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A Review on Implementation of 5S for Workplace Management

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Abstract

5S is an important industrial engineering technique which is used worldwide in a wide range of industrial and service type organizations for workplace management. Improvement in efficiency and productivity, and reduction in waste and idle time etc. are some of its benefits. This paper presents a fundamental understanding of 5S technique and review of some important past work on implementation of 5S in various organizational setups. It is worth mentioning that safety has been identified as to be included as the 6thS under this technique. The main aim of this paper is to facilitate scholars, researchers, and engineers of industrial engineering field by providing knowledge and develop understanding of 5S technique so that they may further implement it in various scenarios of the workplace organization.

Keywords: 5S, Efficiency, Industry, Equipment, Productivity, Safety.

1 | Introduction

Utilization of novel industrial engineering tools and techniques for productivity, quality and sustainability has been on trend since last one decade in manufacturing industries worldwide. Total quality management, 5S technique, total productive maintenance, supply chain management, and enterprise resource planning etc. are some of the important concepts being considered these days. Workplace organization, waste reduction, efficiency and productivity improvement, and safety enhancement etc. are some of the essential requirements at basic level that directly contribute to the profit of the organization or industry [1]. 5S, which is a Japanese technique to create and maintain an effective, efficient, organized, and clean workplace is being utilized not only in primary or secondary industries, but also in a wide range of tertiary industries such as banks, educational institutes, and hospitals etc. [2]. This technique was originated by Takashi Osada in 1970. Later Toyota engineers Sakichi Toyoda and Kiichiro started implementing this technique commercially.

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The philosophy of 5S aims to manage a workplace in a sequence of techniques in order as sort-set in order-shine-standardize-sustain, which makes for a clean and ergonomically sound and safe workplace for all stakeholders. Fig. 1 illustrates the philosophy of 5S where all 5 Ss, their English terms, and objectives can be seen. Seiri (sort) implies to remove the unnecessary or unwanted items. In seiton (Set-in-order), items undergo systematic arrangement to promote efficient workflow. Seiso (Shine) is related to workplace cleanliness. Seiketsu (Standardize) tends to set standards for consistency in workplace organization. Shitsuke (Sustain) recommends self-discipline to maintain, and review set standards time to time.

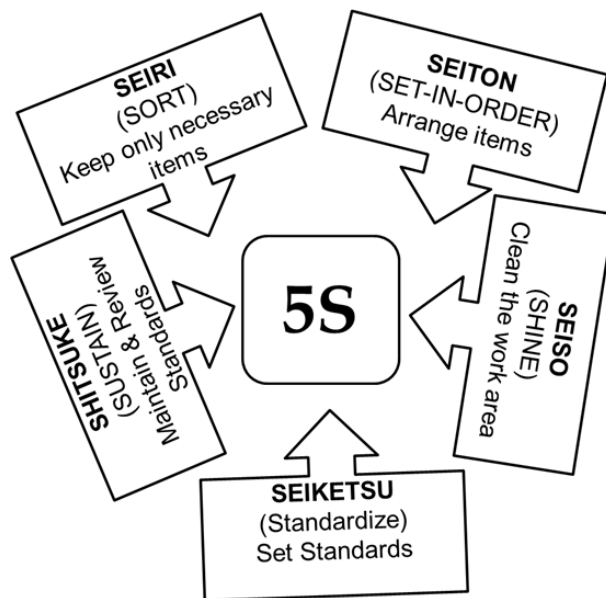


Fig. 1. Illustration of the concept of 5S.

Low idle period and downtime, breakdown reduction, waste elimination or minimization are some of the secondary benefits of 5S implementation. When it comes to the barriers of 5S implementation then along with financial and resource constraints, lack of motivation, communication, training, and participation are the major factors [3]. These factors and interactions among them should never be ignored. Cause and effect or fishbone diagram, plan-do-check-action, kaizen, histograms, pictures, and time and work study etc. are some of the important tools and techniques used for 5S implementation [4]. A basic procedure of 5S implementation can be described as follows:

Seiri implementation

- I. Capture photographs of the current state of the location.
- II. Prepare a layout plan after carefully examining the pictures and the proposed layout after implementation.
- III. Formulate or propose the locations.
- IV. Label the locations for ease of identification.

Seiton implementation

- I. Set like items in order and at the same locations formulated and labelled in Seiri.
- II. Dispose of the unwanted items.

Seiso implementation

- I. Clean the racks, shelves, and items kept in the entire workspace.

Seiketsu implementation

- I. Standardize the workspace and keep all necessary items to their allocated workspace.
- II. Use colorful tapes and tags etc. for a clear representation of the item levels.
- III. Prepare display boards showing the rules, roles, and responsibilities.

Shitsuke implementation

- I. Train stakeholders and employees who directly use the workspace and contribute to its management.
- II. Formulate follow-up plan, feedback, and review of previous 5s implementation.
- III. Pay rewards to efficiently contributing employees.

2 | Review of Past Work on 5S

This section presents the reviews of the past work conducted on implementation of 5S and productivity and efficiency improvement, reduction of wastes, improvement of space utilization, and other factors. 5S implementation studies for different work scenarios have been conducted in past. The review methodology adopted to prepare this article is based on the content analysis of the published literature on 5S implementation. The qualitative and quantitative contexts of 5S implementation are considered in content analysis of the relevant past work. To develop this review paper, four different resources have been explored, i.e. books, magazines, journals, and conference proceedings. Fig. 2 shows the categories of important articles referred from different resources.

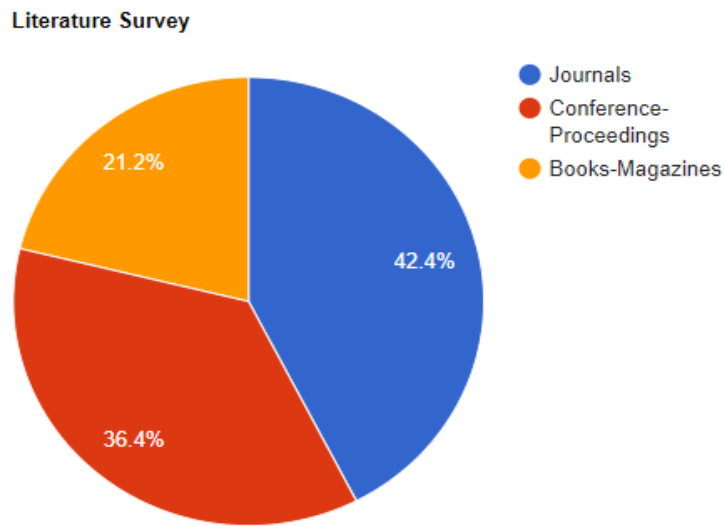


Fig. 2. Categories of resources referred for 5S literature review.

Some of the important work is discussed below.

2.1 | 5S in Manufacturing Industries

A study on implementation of 5S in a product manufacturing company drastically reduced the inspection time of components and number of accidents [5]. An important study where 5S was implemented in a small-scale manufacturing industry, part production rate was increased up to 15% because of the search time reduction [6]. Enhancement in part quality was also reported. A better workplace arrangement with minimum cost was attained by some researchers while employing 5S in a manufacturing company in Poland where 5S was used as one of the tools of lean manufacturing system [7]. In a metal working company, the 5S technique effectively found useful for both production as well as quality. Workers' efficiency was improved, and the occurrence of mistakes were reduced with improved ergonomics and workplace safety [8]. In an interesting study, Mane and Jayadeva [9] utilized 5S as a tool to facilitate lean manufacturing and

TQM in a small-scale tooling manufacturer. Drastic improvement in space availability up to 70% was achieved after implementing 5S. High performance rating was also observed after comparing pre- and post-implementation audits. Gupta and Chandna [10] conducted a case study on 5S in a scientific instrument manufacturing company. The objective was to optimize the workplace condition in the shop floor. They followed systematic strategies from sorting of items to control in the sustain phase of the implementation cycle. A significant reduction in tool searching time was achieved. Prolific workplace practices were developed and standardized, which further planned to be extended to the whole organization. Patel and Thakkar [11] attempted to implement 5S in a storage and insulator department of a ceramic manufacturing company and reported 12 % of space saving after implementation. With a better working environment, the morale of the employee was also found to be high which directly contributed to their efficiency. In an automotive manufacturing company, productivity of a cable production plant was enhanced after 5S implementation that directly influenced the overall performance of the company [12]. In yet another study, the packaging section of a tea and coffee company was indulged with 5S practices, where it improved safety and quality, which further reduced the product development time [13]. Islam et al. [14] used 5S in an apparel industry where they found it effective indeed and achieved 82% saving in the searching time for files and 27% space saving. An interesting case of 5S implementation was conducted at the container terminal where sorting of containers was found to play an important role in improving competitiveness and 62% reduction in turnaround time was achieved [15]. The utilization of 5S is not only limited to manufacturing and automotive industries; rather it is recognized as a major lean engineering tool for aviation industry as well. [16]. A group of researchers reported an important work where 5S was implemented in the forming department of a manufacturing industry with an objective to reduce change-over time [17]. The post-implementation observations led to eliminating or reducing non-value-added activity and improved the changeover time, which was helpful to meet production targets of the company. As an important tool of lean manufacturing, 5S was used for capacity enhancement in occupational safety in an automotive industrial unit [18]. A twenty-five day long implementation procedure made use of comparison of features and conditions pre- and post-5S using photographs and risk assessments. A risk assessment tool was used in addition to 5S and a 64% reduction in risks was achieved. As a lean tool for waste minimization, the technique of 5S was found effective in a welding workshop in terms of minimizing the search activity by 18.75% and space occupancy by 11.2% [19]. A pine gum processing industry benefited from 5S technique where pre- and post-implementation audits found significantly different scores and in favor of cleanliness, neatness, and orderliness of the work area [20]. *Table 1* provides a summary of some important past work on implementation of 5S in various types of industrial, manufacturing, and service type organizations. *Fig. 3* illustrates the benefits of 5S obtained by a wide range of manufacturing industries and service sectors, as discussed in this paper.

2.2 | 5S in Service Sectors

Utilization of 5S is also done in the service sectors such as hospitals, banks, and universities. Remarkable benefits have been gained after employing 5S in service sectors. Some of the important cases are discussed below.

A recent study highlights the effectiveness of 5S implementation in the laboratories of a mechanical department at an international university [21]. Photographs representing the pre- and post-implementation conditions of the laboratories reveal enabling easy equipment identification, improved safety, and better space utilization of the laboratories. Khumalo and Gupta [22] and [23] reported a comprehensive study on implementation and effectiveness of 5S in a university workplace. Many tools have been used, such as time and work study, photographs, cause and effect diagram, plan-do-check-action, bar charts, and audits. A significant reduction in item searching time in the workshop was achieved. They reported success in overcoming workshop and office abnormalities.

Table 1. Literature review on implementation effects of 5S in various organization type.

S/N	Type of Organization	Results	Reference
1	Small scale manufacturing industry	15% improvement in part production rate	[6]
2	Polish manufacturing company	Better workplace management, cost reduction	[7]
3	Metal working company	Improved efficiency	[8]
4	Small scale tooling manufacturer	70% space availability resulted	[9]
5	Scientific instrument manufacturer	Tool searching time reduction	[10]
6	Ceramic manufacturing company	12% space saving	[11]
7	Automotive manufacturing company	Productivity enhancement	[12]
8	Packaging section of Tea & Coffee company	Reduction in product development time	[13]
9	Apparel industry	27% space saving	[14]
10	Container terminal	62% reduction in turnaround time	[15]
11	Forming department of manufacturing industry	Reduction in non-value-added activities	[17]
12	Automotive industry	64% reduction in risk, better occupational safety	[18]
13	Welding workshop	11.2% reduction in space occupancy	[19]
14	Pine gum processing industry	Improvement in work area cleanliness	[20]
15	Mechanical laboratory of university	Better equipment identification, improved safety	[21]
16	Workshop of university	Significant reduction in item searching time	[22]
17	Industrial laboratory of university	30% reduction in practice preparation time	[24]
18	Hospital	Reduction of patient's waiting time	[25]
19	Vocational high school	Improvement in efficiency of teachers	[27]
20	Hospitality sector	Better utilization of space and increased profit	[31]
21	Ink manufacturing company	Reduction in waste and workplace safety	[32]
22	Bucket manufacturing company	Performance improvement of various shops	[33]

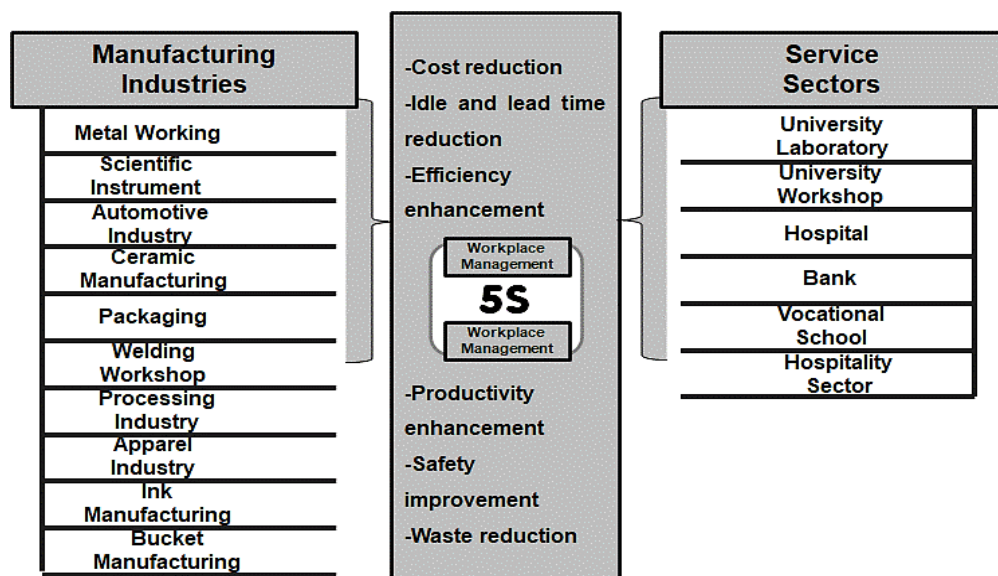


Fig. 3. Types of manufacturing industries and service sectors where 5S is implemented.

A successful staff training was conducted. Further, a significant difference in scores of pre- and post-implementation audits was achieved. Jiménez et al. [24] used 5S for laboratories of industrial engineering. They realized that after implementation the laboratory became spacious, well organized, clean and neat. They found significant reduction in faults and accidents, 30 % reduction in practice preparation time, and 100 hrs/year saving in practices. It was emphasized to consider 5S as a continuous activity instead of a time being project. In hospitals in Tanzania, to reduce the patient's waiting time, the 5S technique was used [25]. Sixteen district-level hospitals were chosen, and implementation started from a basic survey and trainings, which further extended to a core implementation and statistical analysis. A positive influence of 5S was found on reduction of patient's waiting time. Sari et al. [26] attempted to improvise an ergonomics laboratory area with 5S technique. They successfully achieved a reduction in idle time and improvement in workspace management. Pre-implementation and post-implementation audits revealed the effectiveness of 5S implementation. In an interesting study, a significant improvement in the efficiency of teachers was obtained after implementing 5S in the vocational high schools of Jakarta [27]. There is also a lack of work conducted on implementation of 5S in banking sector. Al-Doori [28] recently investigated the combined influence of TQM, 5S, and Kaizen in enhancement of the operational performance of banking sector in Jordan. In fact, 5S has also been recognized as a tool to achieve sustainable institutes and universities [22], [23], [29], [30]. 5S implementation has also been considered to fulfill the requirements of ISO 9001 in higher education institutes [29]. To achieve a green campus of the institute/university, all 5Ss have been recognized as very useful to achieve sustainability in operations [30]. In other words, it is possible to make a university sustainable using 5S technique. A case study on the hospitality sector identified the effectiveness of 5S in optimizing the workspace and better utilization of their kitchen, which consequently increased the profits [31]. The outcomes of this study are useful, indeed, for possible extension of 5S to restaurants and hospitality sector.

With a recommendation of the 6th S, that is, 'Safety', Sukdeo [32] conducted a study on 6S in an ink manufacturing company. Pre- and post-implementation studies by photographic analysis and audits were conducted. For a significant reduction in waste, non-value-adding activities, and cleaner and safer working environment, a 6S-based strategy was recommended. Safety at the fifth position before Sustain was recommended for possible prevention of occupational hazards, injuries and deaths. A recent article reports an evolution from 5S to 7S where safety and spirit of employees have been added as two extra Ss [33]. With a case study on performance improvement of various shops of a bucket manufacturing company, 7S effectiveness was proven by the authors.

3 | Conclusion

The paper reported basic information about the 5S technique and review of past work on its utilization in different workplace scenarios. The following conclusions can be drawn:

- *5S has been found to be an effective technique for workplace organization or management. 5S implementation can bring significant improvement in productivity and efficiency.*
- *Implementation of the 5th S, i.e. Shitsuke is quite challenging and very important, as it is responsible to maintain the previous Ss.*
- *Lack of motivation and participation is a big challenge, which may hinder the success of 5S implementation.*
- *Regular assessments, training, and review are very essential for the sustenance of 5S.*
- *It was also recommended to extend 5S to 6S with the inclusion of Safety as the 6th S.*
- *5S implementation to the educational institutes and other tertiary industries has not been explored much and needs significant future attempts.*
- *Sustainability interventions are required to be explored in 5S implementation.*

Conflicts of Interest

No conflict of interest.

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