A study of 6S workplace improvement in Ergonomic Laboratory

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Abstract. This article discusses 6S implementation in Ergonomic Laboratory, Department of Industrial Engineering, Islamic University of Indonesia. This research is improvement project of 5S implementation in Ergonomic laboratory. Referring to the 5S implementation of the previous year, there have been improvements from environmental conditions or a more organized workplace however there is still a lack of safety aspects. There are several safety problems such as equipment arrangement, potential hazards of room dividers that cause injury several times, placement of fire extinguisher, no evacuation path and assembly point in case of fire, as well as expired hydrant condition and lack of awareness of stakeholders related to safety. Therefore, this study aims to apply the 6S kaizen method to the Ergonomic laboratory to facilitate the work process, reduce waste, improve work safety and improve staff performance. Based on the score 6S assessment increased audit results by 32 points, before implementation is 75 point while after implementation is 107 point. This has implications for better use for mitigate people in laboratory area, save time when looking for tools and materials, safe workplace, as well as improving the culture and spirit of ‘6S’ on staff due to better and safer working environment.

Keywords: 6S, laboratory, management, safety

1. Introduction

The concept of 6S is the development of the 5S introduced by Hiroyuki Hirano as a control and work environment control method designed to reduce time wastage, improve safety and optimize productivity, is an acronym of 5S + 1 (seiton, seiton, seiso, seiketsu, shitsuke and safety) [1] [2] [3] [4]. The 5S method (seiri/sort, seiton/set in order, seiso/shine, seitsuke/standardize, shitsuke/sustain) was originally developed in Japan as the basis for the creation of the principle of continuous improvement, also known as kaizen. From 5S is to create a more organized and consistent work environment with high quality, in addition 5S is also useful to reduce the ineffective time due to waste [5]. In principle, implementation of 5S concept without safety aspect is useless / waste, because safety is the main priority in work [6]. The safety concept of 6S is the implementation of safety in the work area including hazard identification, ensuring the absence of potential fire spark cable, safe working equipment free from injury, the existence of fire extinguishers that work properly, and the evacuation path is clear information in case of fire [2]. It aims to work efficiency, work quality, work safety, and improve work discipline [2] [3].

Some research related to 6S application in laboratory among others is done for laboratory management in College Laboratories [7], laboratory center in China [8], Clothing Technology Laboratory in University [9]. Similar research is the Application of 6S Management in Parker manufacturing plant Houston, Texas [2], Industry on India [3], as well as 6S practices in the silk multi-end reeling industries in Andhra Pradesh [4].
Objects in this study were developed within the University, to respond to the continuous improvement process implementation and the need to optimize existing resources. This research is a continuation of 5S implementation in Ergonomic laboratory [10]. Ergonomics Laboratory is a laboratory majoring in Industrial Engineering, with activities in it include teaching, tutorial, research and administrative activities. Tutorial activities are done more using tutorial tools such as anthropometer, lux meter, stopwatch, sound level meter and other practical fittings such as toy cars, plugs, resistors. Besides tutorial activities, business processes in the laboratory include administrative activities such as tool lending, attendance and research activities [10].

Referring to the 5S implementation of the previous year, there have been improvements from environmental conditions or a more organized workplace however there is still a lack of safety aspects. There are several safety problems such as equipment arrangement, potential hazards of room dividers that cause injury several times, placement of fire extinguisher, no evacuation path and assembly point in case of fire, as well as expired hydrant condition and lack of awareness of stakeholders related to safety. Therefore, this study aims to apply the 6S kaizen method to the Ergonomic laboratory to facilitate the work process, reduce waste, improve work safety and improve staff performance.

2. Methods

The focus of this study is to analyse the working area of Ergonomic laboratory, Industrial Engineering Department. The first step is to identify problems by using the method of observation and checklist on the condition of every area / room available in ergonomic laboratory. Assessment 6S is applied to laboratory headroom, assistant room, lobby, classroom, equipment room, climate room and training room. The work processes that exist in the ergonomics laboratory include teaching and learning activities by lecturers, tutorial activities by assistants, research activities and laboratory equipment borrowing. The next step is to apply the 6S concept. Then in the value analysis of the assessment results 3S, 5S, and 6S so that can be given recommendations for continuous improvement (continuous improvement).

Basically, 6S method consists of 5 stages representing the meaning of five Japanese words [1] and 1 S for Safety [2]:

1. **Seiri equals to sort**, it means removing the waste and unused items from the working area. By sorting the unnecessary tools employee will be able to prioritize the equipment whether it is needed or not to be placed in their workplace.
2. **Seiton equals to set in order**, it means arranging tools in specific place and keeping it into the right position. Therefore, the items can be found easily by the workers when it is needed.
3. **Seiso equals to shine**, it means cleaning all working space and necessary tools. Therefore, the workers will have convenient place to work, and the equipment will always be ready to be used for other employee.
4. **Seiketsu equals to standardize**, it means ensuring all setup and equipment which has been arranged and cleaned in the right condition by promoting visible and modest rules.
5. **Shitsuke equals to sustain**, it means obeying the rules and procedures which has been issued as a respond of the first four phases.
6. **Safety**, It means make the workplace safe and free of recognizable hazards.

3. Results and Discussion

The 6S program is conducted from March to August 2017. This program is a continuation of the 5S program in the laboratory [10]. Stages of implementation of 6S in this study are as follows:

3.1. **Sort**

Sort is the initial stage of the 6S activity, in Japanese called **Seiri** [1]. Sort activity is identifying equipment / materials between required and unnecessary. Red tags / red labels are used to help identify the sorting, as well as given the time required for the storage of temporary goods [2] [11].(6S farm). The sort stages performed in this study include:
a. Identification of required/unneeded tools/materials is required [3]
b. The broken tool is separated
c. Sorting hard and soft documents of unused and expired files

Some concise tools or materials include tutorial files for the period September-February 2016, unused posters, drugs expired on first aid boxes, replacing dangerous room divider rollers. The red tagging is done on items whose status is still temporarily removed. All non-essential items located inside the laboratory are given red tags (Figure 1).

![Figure 1. Sorting item and reg tagging](image1)

3.2. Set in Order
Set in order or seiton is the second stage in 6S, the set in order activity is physically organize the work area. Tidying these areas makes it easier for workers to find needed items [3]. Stages in seiton/set in order include:

a. All shelves and stored items are clearly identified
b. Good storage is organized thus it's easy to see, retrieve and restore
c. There is a clear indication of the maximum or minimum inventory amount.
d. All areas are equipped with a dividing line & all the items inside the line.
e. Document storage should be well-documented and easy to quickly find

Detailed activity on the laboratory is to color-label the tutorial class area, assistant room, exit door with yellow dotted line marks, labels for light extinguishers, and label carefully with red. Can be seen in the following picture:

![Figure 2. Sticked colored tape and labelled](image2)

3.3. Shine
Shine step includes activities like cleaning workplace, maintaining its appearance and using preventive steps to keep workplace clean [1] [3] [12]. Stages in shine activity based on 6S checklist:

a. No dust, dirt, stains, insect house / cobwebs and regularly cleaned
b. There are bins, identifiable and in accordance with its use
c. Hygiene tools enough, placement neat, protected from dirt
d. There are mechanisms for responsible hygiene

Detail Shine activity on laboratory ergonomics include, before leaving the laboratory, the staff is required to clean first in the area especially in the assistant room such as washing utensils and beverages that have been used, positioned the seat back to the place, tidied goods on the table, and throw garbage if there is garbage in the room area assistant. Meanwhile, for cleanliness coordinate with cleaning service to assist in cleaning every room in the laboratory ergonomics such as sweeping, mopping and so forth. Includes check marks on the board of janitorial activities that have been done.

3.4. Safety

The objective of this phase is to ensure that workers are constantly aware of the value of safety and health in the workplace and therefore adopt preventive measures against recognizable hazards. Figure 3 shows the evacuation route in ergonomic laboratory based on the location of exit door and the evacuation sign. While stages of safety activity based on 6S checklist are listed as follows:

a. Carried out hazard identification and risk assessment
b. There is a suitable fire extinguisher
c. There is a fire extinguisher sign, easily accessible (125 cm) and there is a usage way according to Minister Regulation 04 / Men / 1980
d. Checking fire extinguishers periodically
e. There is a safety sign / poster
f. There is a sign of an evacuation path
g. There is an evacuation route map
h. Available personal protective equipment that is suitable and appropriate to the standards
i. Connection cables neatly arranged, the socket is closed
j. The panel is closed
k. There is a well-functioning indicator panel
l. Available Emergency lights / Genset
m. Available first aid kit and medicines

3.5. Standardize

Standardize the ways of maintaining tidiness, orderliness, and cleanliness [1] [2]. Stages in standardize activity based on 6S checklist: The standardization of the room by making the picture on the conditions that have applied 6S as well as their poster invitation to do 6S (Figure 4). Moreover, the team make slogan /poster solicitation to always implement 6S in the laboratory.
3.6. Sustain
Sustain means commit to 6S and practice it daily or make it a way of life [2]. The stages involve efforts for 6S learning and the involvement of every assistant, employee, and lecturer as well as make a 6S internal audit periodically, every 6 months. The 6S checklist was assessed by auditor through direct observation, interview to laboratory assistant and head of laboratory, as well as check several items such as identification sheet, checklist activity, standard sheet, audit report form, and evaluation report.
Figure 5 shows a 6S checklist before and after the implementation of 6S. As a result, there is an improvement 32 points from 75 became 107. This has implications for better use for mitigate people in laboratory area, save time when looking for tools and materials, safe workplace, as well as improving the culture and spirit of '6S' on staff due to better and safer working environment.

4. Conclusion
Based on the score 6S assessment increased audit results by 32 points, before implementation is 75 point while after implementation is 107 point. This has implications for better use for mitigate people in laboratory area, save time when looking for tools and materials, safe workplace, as well as improving the culture and spirit of '6S' on staff due to better and safer working environment.

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