

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The 5-S practice developed by Takasi Osada during the 1980s (Warwood and Knowles 2004; Sui-Pheng and Khoo 2001; Ho et al 1995) have been popular among TQM experts for several years (Ho and Fung 1994; Krueger 2001). 5-S stands for the Japanese words Seiri, Seiton, Seisu, Seiketsu and Shitsuki (O'hEocha 2000; Kojyo 1985). Authors like O'hEocha (2000) and Warwood et al (2004) cite the English equivalent of 5-S as follows:

Seiri (Sorting): Check all the items in the workplace and keep only the essential ones.

Seiton (Simplify): Organize the items in a manner that promotes work flow. For example, items should be kept where they will be used, and the process should be set in an order that maximizes efficiency.

Seiso (Shine): Keep the workplace clean as well as neat. The key point is that maintaining cleanliness should be part of the daily work - not an occasional activity initiated when things get too messy.

Seiketsu (Standardization): Standardization of work practices or operating in a consistent and standardized fashion.

Shitsuke (Sustain): Refers to maintaining and reviewing standards. Once the above mentioned 4S's have been established, a new

way of working, a new tool or a new output requirement, then a review of the first 4S's is appropriate.

Over the last three decades, Japanese have been practicing 5-S techniques in their organizations for improving physical environment (Kobayashi 2005; Schonberger 1982). Ho (1999 a, b) and Osada (1991) state that 5-S is the foundation for implementing Total Quality Management (TQM). Even though 5-S has been viewed as a TQM tool (Ho and Fung 1995; Besterfield et al 1999), today it finds its adoption in other techniques like Lean, Total Productive Maintenance (TPM) and Kaizen (Ricky et al 2004; Dennis 2004; Suzuki 1992). 5-S principles help in maintaining high levels of productivity with Safety. 5-S is considered as a first step of all quality improvement activities, but less than fifty percent of Indian organizations are implementing 5-S due to poor understanding and communication (Vinod 2009).

The Japanese follow this technique for improving involvement of employees in 5-S activities by proper communication across the organization with the help of effective auditing methodologies (Ho 1997 a b; Sun et al 2000). A noteworthy cause for the slow uptake of 5-S may be the absence of a proper evaluation technique (Suresh et al 2007). In general, after the 5-S consultants had left, the established 5-S zones looked the same as it had before implementation of 5-S principles, even after six months. Most of the shadow boards were empty and items were scattered everywhere without identification. Housekeeping had returned to its previous condition because of poor 'standardization' and 'sustain' activities (Ron Moore 2007; Hubbard 1999).

Although Ho (1998) had developed an auditing system to indicate the performance of 5-S, its outputs were not clear (Lashley 1999;

Bryar 2002). Though safety is an integral part of house keeping (Ho 1995), no separate checkpoints were included for safety in 5-S auditing. The sustenance of ISO 9001 and 14001 depends on the auditing system (David Hoyle 2005; Tice et al 2005; Zeng et al 2007). Similarly, 6-S (5-S+Safety) may be sustained only if an audit system is incorporated with it. Most of the recent push towards improved safety has been motivated by cost reduction goals and regulatory pressure (Karen 1996). Hence, there is a possibility of 6-S fading away from the organizations and research institutions.

In order to fulfill the above needs, a 6-S audit work sheet was developed for Shop floor, Stores and Office. It includes sixty potential areas for improvement, and can be applied to various work places. A limitation of this 6-S checklist was the extensive manual calculations to obtain the final 6-S score. As a solution, a software based on 6-S auditing methodology was developed that would help in computing the 6-S audit score effectively without ambiguity.

The success of 6-S implementation depends on two aspects: the assessment criteria which have to be done at regular intervals, and communication within the organization to highlight its performance. Poor communication methods result in low performance because of unmotivated state of employees (O'hEocha 2000; Ho and Cicimil 1996; Ho 1999c; Sui-Pheng and Khoo 2001; Shih and Gurnani 1997). The roadblocks to 6-S practice are poor planning, lack of feedback, poor communication and absence of recognition (O'hEocha 2000; Warwood and Knowles 2004; Suresh et al 2007; Timothy and Bruce 2006).

To overcome the above limitations, a model based on Toyota management communication tool known as "A3 Report" was introduced in

6-S activity. A3 report is an integral part of the problem solving technique and decision making process, which allows sharing important information with others for perfect assessment of the thought process (Shingo 1982; Liker 2005; Monden 1983). The current research work was carried out with the primary objective of investigating into 6-S auditing methodologies and introduction of Toyota's A3 reports in 6-S activities for improvement in performance.

1.2 PROBLEM DEFINITION

The audit score would vary greatly depending on the auditor's expectation and experience, and could create much confusion when several people opine on modes of improvement. Sui-Pheng and Khoo (2001) suggest that comprehensive evaluation criteria should be set up in the form of an easy-to-use checklist. The audit work sheet should be customized and adopted depending upon suitability of use in each department. It also suggested a revision in audit sheet with introduction of new ideas and statistical analysis of audit scores in order to study 6-S performance. Most of the organizations that were studied were adopting the Japanese 5-S, however, customization was seen as a necessary part of organizational change (McDonald 1998).

Workplace safety is being considered as a 6th 'S' to be added to the 5-S principles, but no research has been carried out to identify auditing methodologies for 6-S practice (Suresh et al 2007). Most of the service organizations failed to implement and sustain the 6-S principles owing to non-availability of effective evaluation mechanisms to improve proper communication.

In this research work the following four questions were taken up to fill the gap in the research on the progression of 5-S.

Research Question-1: What are the check points to be introduced in the 5-S audit work sheet to improve the industrial safety along with house keeping?

Research Question -2: Why are standard deviations of audit scores high when auditing is carried out in same areas by different auditors?

Research Question -3: Why are most of the service sectors not implementing 6-S even though the implementation is easier than in manufacturing sectors?

Research Question -4: What are the methods to be followed for improving the performance of 6-S activities through proper communication?

In pursuit of deriving solutions against the above research questions the following four research problems were formulated.

Research Problem-1: Check points are not incorporated in the 5-S audit worksheet to improve the industrial safety along with house keeping.

Research Problem- 2: Check list type of audit sheet not available for 6-S auditing.

Research Problem- 3: Absence of effective implementation of 6-S in service sectors.

Research Problem- 4: The performance of 6-S activities and its communication is poor.

1.3 OBJECTIVES

After defining the problem for the research work, following were the objectives for which solutions were sought:

1. To study the theoretical and practical aspects of 5-S.
2. To study the need for Safety along with 5-S as 6th 'S'.
3. To develop 6-S audit sheets for Shop floor, Stores and Office.
4. To conduct implementation study and evaluate its performance.
5. To develop a software for 6-S auditing.
6. To conduct implementation study at shop floors.
7. To develop a software based 6-S audit system for a Library.
8. To conduct implementation study at libraries.
9. To develop Toyota's A3 reports for 6-S activities.
10. To conduct implementation study on Toyota's A3 reports.

1.4 METHODOLOGY

The objectives of this research work were achieved by adopting the methodology as depicted in Figure 1.1 using 'Action Research'. Findings of the literature survey have suggested that 6-S is underutilized due to non availability of proper auditing system. The performance of 6-S activities can be improved through proper communication (Suresh et al 2007). This research work consists of five phases to solve the above mentioned problems.

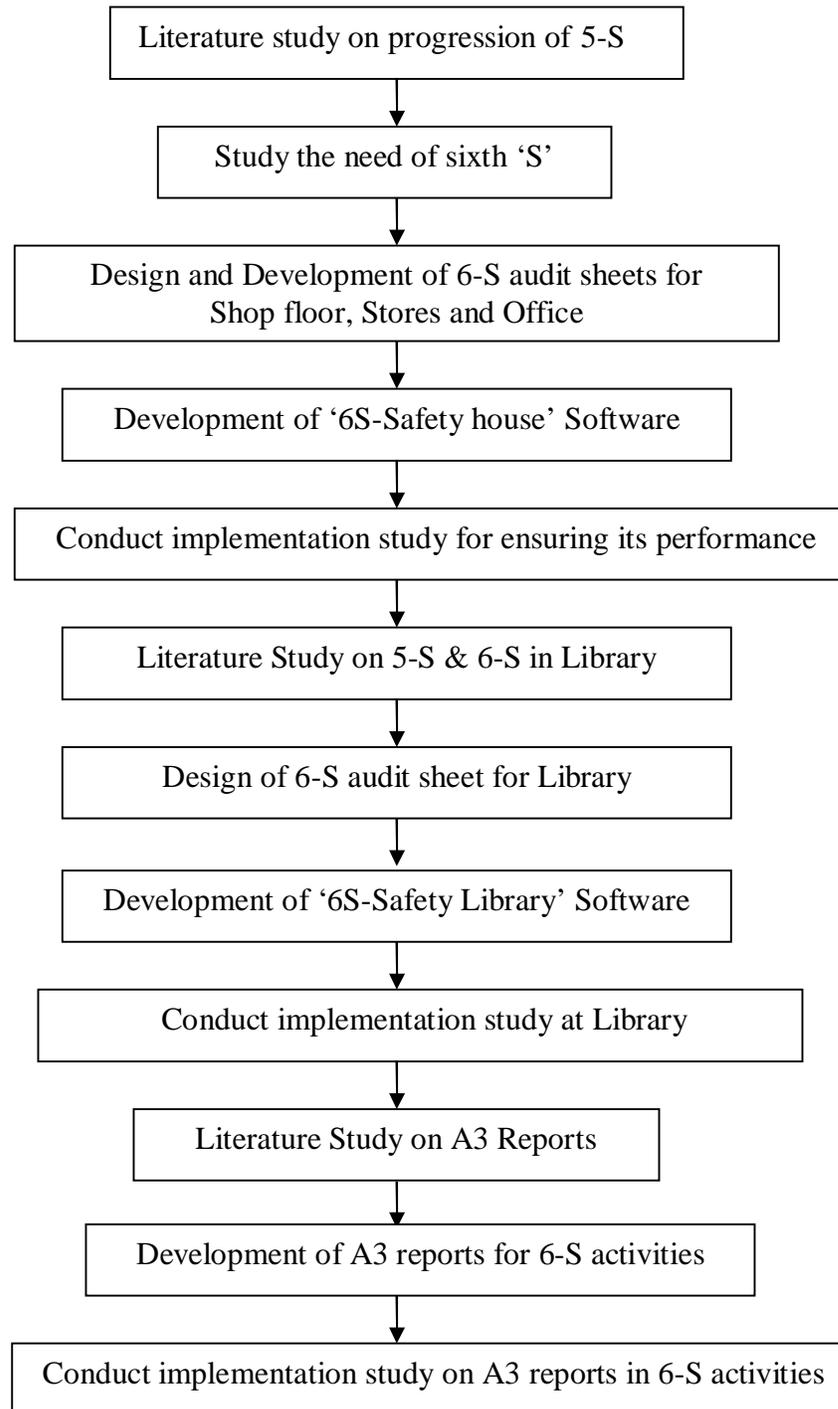


Figure 1.1 Research Methodology

Action research can include many research methodologies, which pursue action and research outcomes at the same time. It therefore has some components, which resemble consultancy or organizational change management, and some that resemble field research. Conventional scientific research has developed certain principles to guide its conduct. These principles are appropriate for certain types of research; but they can actually inhibit effective participation and organizational change (Whyte 1991; Greenwood and Levin 1998).

“There is no learning without action and no action without learning” (Revars 1983); using this quote as a base, the Action Research is used to design and develop the 6-S auditing methodology and implementation of A3 reports in 6-S activities. Action research may be defined as an activity that involves all members of an organization as an integral part of the research process. The members are used for fact finding, conceptualization, planning, execution and evaluation of implementation. Action Research uses results of the initial study to begin a new cycle of activities. Which emphasis on research that leads to action (Revans 1983; Shock 2008; Stringer 1996; Cunningham 1976).

Action research is an inquiry or research in the context of focused efforts for improving the quality of an organization and its performance. It is typically designed and conducted by practitioners who cooperatively plan and analyze data to refine their own practice. Action research can be done by individuals or by teams of colleagues. Action research focuses on sustainable improvements. It provides opportunities to reflect on and assess their work; to explore and test new ideas, methods, and materials; to assess the effectiveness of new approaches based on planned action; to share

feedback and make decisions about new approaches (Davidson et al 2004; Argyris 1985; Dick 1992; Heller 1993; Greenwood 1998).

Action research, as defined by Kemmis and McTaggart (1988), is systematic and reflective. In their model, action research consists of four phases that take place in a cycle planning, acting, observing and reflecting.

- Planning - All members of the research team question 'what are' the realities of their particular practices and begin to search for "what ought to be?"
- Acting - Researchers implement the plan they have collaboratively developed, addressing all or a particular set of problems or issues.
- Observing - Collection of data simultaneously with action. Observation is important for subsequent reflection and action. Various observation methods can be used.
- Reflecting - Researchers reflect upon the progress of their project, developing revised action plans based upon new questions that may arise and the knowledge gained from the process of planning, acting, and observing.

In planning phase, initially the problem statement is defined focused on 6-S auditing methodology. Then, the literature study on 5-S and 6-S is completed. Under the acting phase, the 6-S audit work sheet is designed for Shop floor, Stores, Office and implemented at Tejas aircraft assembly shop in Hindustan Aeronautics Limited (HAL), Bangalore, India. During the observation phase, it was clear that the current 6-S audit work sheet consumed more time to complete the audit owing to a huge amount of manual calculations. Under the reflection phase (revised action plan), this limitation was overcome by developing a software named as

‘6S-Safety house’. This software was further developed for libraries and named ‘6-S-Safety Library’.

During the Phase-I, literature survey was conducted on progression of 5-S. Subsequently, the need to include ‘Safety’ in 5-S was examined by referring to the previous researchers’ literature reported in this direction. In phase-II, the conceptual features of 6-S were designed. 6-S audit sheets were developed for three categories namely Shop floor, Stores and Office as trial basis. The 6-S audit methodology was then implemented at LCA Production Group in HAL, Bangalore. The Standard deviation of audited scores was compared with the previous auditing system.

During Phase-III, the software based 6-S auditing system was developed and named as ‘6S-Safety house’ to reduce the cycle time of auditing. Implementation study was conducted at shop floor of various divisions under HAL, Bangalore to ensure its operational performance. During Phase- IV, another software ‘6S-Safety Library’ was developed for Library to ensure its customization and flexibility. Following this, implementation study was conducted at five libraries in various divisions of HAL, Bangalore and to determine its performance, Time Study was performed to prove the advantages of Software based auditing methodology.

Phase-V involved introduction of Toyota’s A3 Report in 6-S activities for improving communication and performance of 6-S activities. During this phase, the A3 report was developed for 6-S activities and case studies were conducted at Tool Crib in LCA Production Group of HAL, Bangalore.

In order to examine the acceptability of this research work among the scholarly community, all the modules of this research work were submitted to the Editors of UK based International Journals in the form of five papers. After review, two papers have been accepted and others are under review.

1.5 FEATURES AND BENEFITS OF 6th S

According to the information available in www.jicosh.gr.jp/english/osh/jisha-nsc/chusaibo.html, work injuries were reduced to 1.75% in the year 1998 and productivity increased 1.5 times up from the previous period due the activity of 6-S during the year 1981 to 1998. These data lead to the influence that the activities of 6-S must be playing a role in helping to reduce work-related injuries and improving the productivity significantly (Table 1.1).

Table 1.1 Development of 6-S

Period	Activity	Work injuries	Productivity
1950 - 1955	2S	44.08 (1950) 24.49 (1955)	1
1956 - 1972	4S	22.29 (1956) 7.25 (1972)	3.6 times up from the previous period
1973 - 1980	5S	7.25 (1972) 3.59 (1980)	1.4 times up from the previous period
1981 - 1998	6-S	3.23 (1981) 1.75 (1998)	1.5 times up from the previous period
(Source: Japan Industrial Safety and Health Association, 1999)			

6-S is a method used to create and maintain a clean, orderly and safe work environment. The day-to-day benefits of 6-S include less searching, decreased man and part movement, reduced down time, fewer safety hazards, improved flow, fewer mistakes and better utilization of space. These daily benefits add up to immense annual improvements in productivity, quality, cost, delivery, safety and morale (Ho 1997 a; Yamashina 2000; Engelman 1993).

Conceptual model of 6-S is shown in Figure 1.2. Safety is considered a shield of 6-S, which creates a safety place to work and sustenance as the core. Furthermore, time for equipment setup can be drastically reduced by implementation of 6-S. Valuable time is lost searching and gathering the tools and supplies needed to perform setups.

6-S is also a crucial aspect in TPM. While operators carry out cleaning they must inspect the equipment – listen and lookout for anomalies, and take action before a breakdown occurs (Anthony 2006; Rod Gapp et al 2008; McKone et al 2001). While implementing visual inventory replenishment systems such as Kanban, pull systems, etc. 6-S aids in organizing and simplifying the management of the physical inventory. Proper organization ensures minimal material handling by using ‘Point of use’ storage with applicable and visual replenishment signals. For these reasons, a 6-S system needs to be an integral part of all improvement tools and act as the foundation for Lean (Joel 2008; John 2000; Condel et al 2004; Bicheno 2004).

Workplace injuries are one of the major issues in the Operations Management. The operations manager should take the responsibility of providing safe work environment. It is of utmost importance in the

manufacturing sector where injury rates are increasing day by day due to new technologies and insufficient awareness. Unsafe work environment is one of the reasons for poor quality, low productivity and employee dissatisfaction. Hence, awareness on safety is essential along with housekeeping or 5-S (Karen 1996; Melton 2005; Greg 2007; Melanie 1996; Hayes and Pisano 1994; DeJoy 1994).

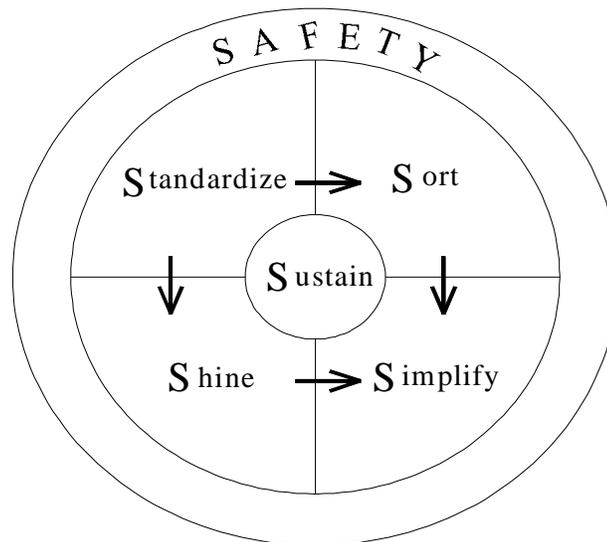


Figure 1.2 Conceptual model of 6-S

Ho (1997 b) introduced a check point for workplace safety in the audit sheet worksheet. Ho recommends a check on the personnel protective equipments (safety helmets/gloves/shoes etc.). Osada (1989) believed that workplace safety can be improved by Sort and Simplify activities. As per a survey by the Japan Industrial Safety and Health Association (JISHA), work injuries reduce by introducing the sixth 'S' (Rod Gapp et al 2008). 6-S helps in improving the work place health and safety along with enhanced quality and productivity. Hence, 6-S is the need of the hour. Even though 6-S is an essential part of workplace organization, no literature discusses the 6-S auditing methodologies.

1.6 CHAPTER ORGANISATION

The organization of this research thesis report is pictorially depicted in Figure 1.3.

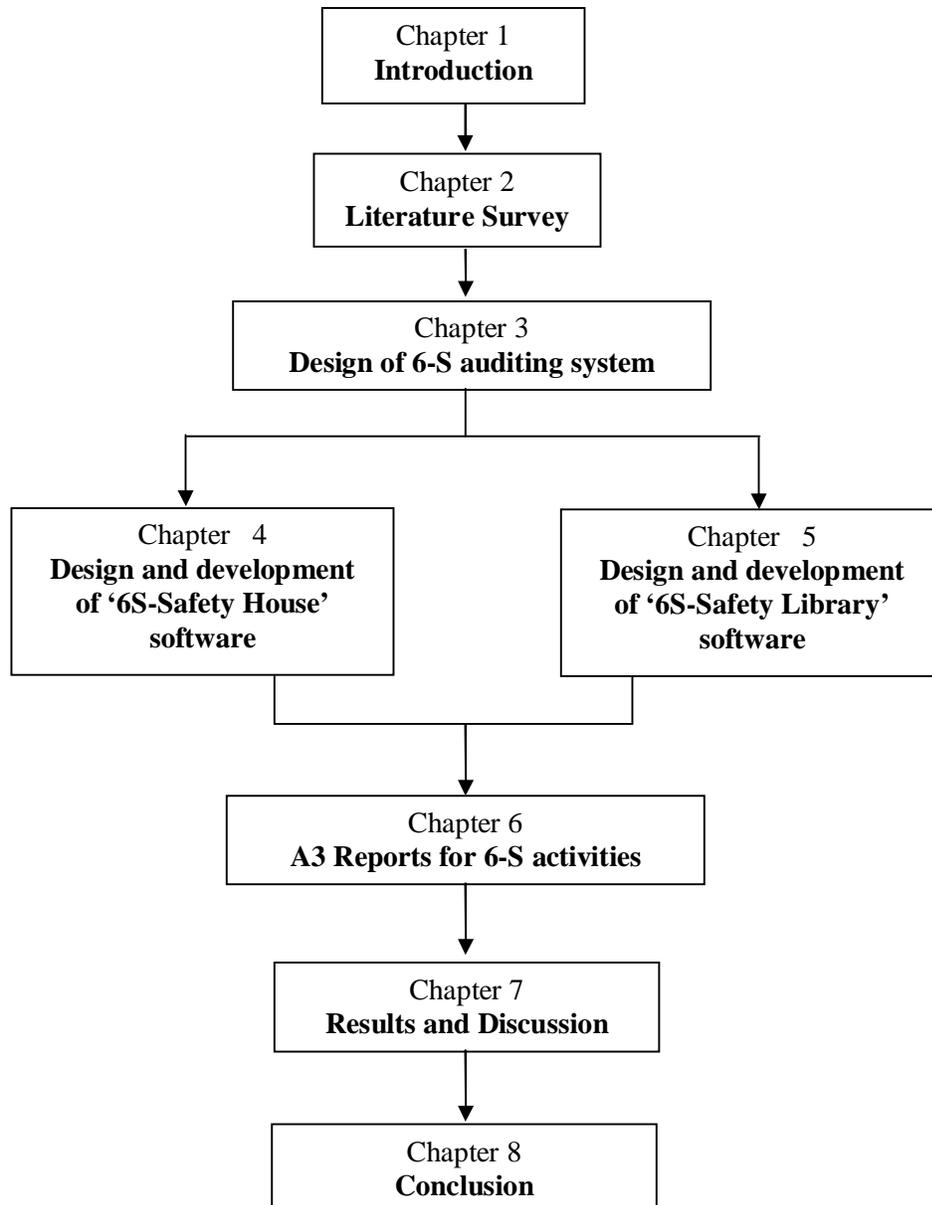


Figure 1.3 Chapter organization

This thesis has been organized in to eight chapters, starting with Introduction and followed by Literature survey on Progression of 5-S. Third chapter deals with the design of 6-S auditing sheets for Shop floor, Stores and Office and includes the implementation study of the 6-S auditing system at LCA Production Group in HAL, Bangalore. Chapter four describes the design and development of the software for 6-S auditing named '6S-Safety house' and its implementation study at HAL, Bangalore.

The development of the software named '6S-Safety Library' for Library 6-S auditing and a case study at Libraries of HAL are described in chapter five. Chapter six discusses the implementation of A3 reports for 6-S activities with an implementation study at LCA Production Group in HAL. Chapter seven presents Results and Discussion and major conclusions are summarized in chapter eight.

1.7 CONCLUSION

Currently, the world is witnessing the progression to 6-S from 5-S for ensuring housekeeping of organizational facilities. Success of applying 6-S to organizations and institutions would depend upon auditing the facilities. Auditing score is often a subjective and the score varies depending on the auditor and expectations of auditor. This can create much confusion when several people express their opinion on methods of maintaining 6-S. Even after the implementation of 6-S, sustenance and performance improvement remains a big question.

This thesis aims to help find solution for the above problems and investigate 6-S auditing methodologies, implementation and progression in both manufacturing and service sectors. It also studies the feasibility of introducing A3 reports in 6-S activities for effective communication and

performance improvement. The rudimentary features of this research and the presentation aspects of this thesis have been described in this chapter. The subsequent chapters elaborately present the research work.