5S implementation methodologies: literature review and directions

Jugraj Singh Randhawa*
Department of Mechanical Engineering,
Global Institute of Management and Emerging Technologies,
Amritsar, Punjab, India
Email: jrandhawa304@gmail.com
*Corresponding author

Inderpreet Singh Ahuja
Department of Mechanical Engineering,
Punjabi University,
Patiala 147001, Punjab, India
Email: ahujaips@yahoo.co.in

Abstract: The objective of the paper is to investigate the process of 5S implementation across all the levels of organisations and highlight the significant contributions of 5S to the organisations. The paper is based on a methodical literature review that inspects how the implementation of 5S technique significantly contributed the progress of different organisations in the term of quality, productivity, effective utilisation of space, safety and employees morale values. The manuscript presents the systematic 5S implementation initiatives implementation methodologies suggested by various researchers and practitioners. The success factors that enrich 5S implementation in the organisation are also identified and discussed progressively. The study also highlights the manufacturing achievements through successful 5S initiatives and obstacles that create hindrance in the path of implementing 5S technique. The paper provides comprehensive outlook of 5S approach to the management for implementing it as way of attaining maintainable performance for their organisations.

Keywords: 5S; lean manufacturing; Kaizen; 5S implementation; 5S barriers; 5S success factors.


Biographical notes: Jugraj Singh Randhawa Singh holds a Bachelor’s degree in Mechanical Engineering from Rayat Institute of Engineering and Information Technology, Ropar, Punjab, India. He holds a Master’s degree in Production and Industrial Engineering from Thapar University, Patiala, Punjab, India. Currently, he is working as an Assistant Professor in the Mechanical Engineering Department at Global Institute of Management and Emerging Technologies, Amritsar, Punjab, India. His main research area is process innovation, 5s technique, lean manufacturing.
1 Introduction

The challenges and competitive environment in modern world is characterised by the word ‘Transform’. The pervious methods cannot able to achieve the desirable results in an organisation that are required in the fast growing competition and technologic progress. The manufacturing sector globally has witnessed drastic changes in the later part of 20th century (Ahuja and Khamba, 2008). The achievement of companies and organisation be contingent to respond, manage and accommodate to transform (Kotter, 2007). In this dynamic and technological world, the secret of surviving for any kind of organisation is to be competitive and pioneer in its products or services. Normally, this improvement has been achieved through implementation of best practices, which are chosen to meet a particular objective (Singh and Ahuja, 2012). The ability to achieve higher standards of productivity without sacrificing quality is an important goal of a manufacturing firm (Ahuja, 2012). Some author believes that in order to achieve the competitive benefits, the organisations have capability to adapt the new conditions efficiently and quickly (Spur et al., 1996). The efficacious organising of transformation processes need effective techniques and tools. The different organisation is searching new innovative ideas or techniques for decreasing the manufacturing cost of product, up surging of quality and production within least time in the competitive market (Ahuja and Khamba, 2009). Lean is one of the significant approach for refining the organisational enactment because it is responsible for remarkable position of Japanese manufacturing organisations in the world (Womack et al., 1990; Liker, 1998). The development of lean into management approach efficiently refines all the processes at each level of an organisation. The idea of lean was initiated in Toyota after the World War 2. It has been implemented by distinct organisation for over 15 years.

It is a dynamic learning process which diminishes the wastage and maximising or fully utilises the resources/activities that add value from the customer’s perspectives (Ohno, 1988; Womack et al., 1990). The principle of lean manufacturing is to bring continuous improvement by diminishing the cost which finally means reduction of cost in services and products and hence result of more profits (Ondiek and Kisombe, 2013). Lean thinking approach achieved lot of popularity worldwide in various sector of organisations owing to identification, addressal and elimination of non-value adding activities (Womack and Jones, 1996; Karthi et al., 2011). The manufacturing organisations have envisaged lean principles and tools as potent management philosophies and adopted its techniques in many different forms or names. The lean ‘building blocks’ comprise of critical tools and techniques deployed during lean implementation. Under its umbrella, there are number of tools and techniques which
provide aid to the organisations for implementing lean practices such as: kaizen, 5S, quality circles, Poka-Yoke, visual controls, cellular design, total quality management, total productive maintenance, quick changeover, pull scheduling and value stream mapping (VSM), etc. (Pojasek, 2003; Farooquie and Mohapatra, 2009; Chowdary and George, 2012).

The interconnected ability of lean tools contributed significantly in improving operational performance. In order to build quality of products, the managers of various organisations have to implement lean tools together such as 5S, VSM, CM, etc., for identify or visualise the wastages in the organisations and prevent its occurrence possibility in future (Chowdary and George, 2012). Lista International Corporation (2007) has concluded that 5S is typically the first lean method that facilitates organisations in pursuit of: waste reduction, eliminating unplanned downtime, improving the workplace, eliminate searching time of items at workplace, eliminating difficulties in using and returning of items and exercising enhanced inventory management. 5S is simplest and easiest tool in lean manufacturing for the employee to learn for the improvement and elimination of waste from the workplace. Waste reduction is the primary function of lean concept and can be widely used throughout the whole organisation (Bicheno, 2004; Howell, 2009; Muruganantham et al., 2014).

2 5S technique

5S is a management tool or technique developed by Takshi Osada during 1980s in order to constitute and sustain better quality, productivity, safe environment in an organisation. The concept first raised in Japanese manufacturing sector which stand of five Japanese words: Seiri (Organisation), Seiton (Neatness), Seiso (Cleaning), Seiketsu (Standardisation) and Shitsuke (discipline) (Osada, 1991). 5S is program which develops self-pride, regard for others, and team working among the employees by solving the organisation growth problems with collective effort. It also develops a sense of utilisation and systematic organisation for the efficient results from the workplace and act as key for the survival of the company in the competitive world (Mendes-de-Toledo and Andde-Farias-Filho, 2001). A lean material supply chain can be kept in a position with the help of 5S (Bullington, 2003). A systematic methodology and specific lean thinking tools like 5S are suggested to identify value and to eliminate non-value adding processes (Folinas and Ngosa, 2013).

5S not only simplifies the work environment and reduce the wastage but also contributes towards safety enhancement at workplace (Krajewski et al., 2007; Korkut et al., 2009). It helps in providing order and discipline at the organisation with the supervision on even smallest details of company (Erdal, 2007). Ho et al. (1995) have stated that 5S requires total employee involvement (TEI) at each level of the organisation for obtaining significant enhancement in organisational performance. Further, 5S calls upon strong commitment from top to bottom management to bring quality and continuous improvement in an organisation (Liker, 2004).
<table>
<thead>
<tr>
<th>SS pillar</th>
<th>Meaning</th>
<th>Significance</th>
<th>Problems averted</th>
</tr>
</thead>
</table>
| **Sort** | • Take away all items not desired for current production operations  
• Allow only the uncovered essentials: when in doubt, throw it out | • Space, time, money, vigour and other assets can be effectively utilised  
• Decreases difficulties and irritations in the work flow  
• Better communication between workers  
• Uplifts the quality of products and better productivity | • Over crammed of the workplace and difficulties to work in are solved  
• Storage of surplus items obtains in the manner of communication  
• Wastage of time in looking for parts/tools  
• Unnecessary inventory and machinery are expensive to uphold  
• Surplus items and equipment make it difficult to better the process flow  
• Storage of surplus items obtains in the manner of communication  
• Wastage of time in looking for parts/tools  
• Unnecessary inventory and machinery are expensive to uphold  
• Surplus items and equipment make it difficult to better the process flow |
| **Set in order** | • Position desired items so that they are convenient to use and tag the items so that any person can find them according to requirement | • Eradicates numerous kinds of waste, including:  
• Probing waste  
• Waste accumulated while difficulty in utilising the items  
• Waste accumulated while difficulty in returning items | • Wastage of motion  
• Wastage of worker vigour, surplus inventory, imperfect products and in secure circumstances |
| **Shine** | • Everything in the workshop should be kept neat and clean every day | • Workshop changed into a neat and dirt free place where each worker will work with delight  
• The items are in their appropriate places so that it can be used whenever they required | • Uneconomical work and low morale are the results of deficient sunlight  
• Fewer evident of defects  
• Injuries and slipping floor arises due to wet patches of oil and water  
• In adequate upkeep of machines tend to failure and cause defects |
| **Standardise** | • It is condition when we have to support in order to uphold the pervious 3S  
• It enables execution of the first three pillars, by make sure that conditions do not worsen to former state | | • Circumstances go back to their old unwanted levels  
• Areas of work are unclean and messy  
• Storage places of tool become jumbled and wastage of time for looking tools  
• Mess starts to accrue over time and occurrence of reverting |
| **Sustain** | • Making a habit of correctly upholding right procedures  
• In order to evade reverting essential discipline is installed  
• Penalties of not custody to the course of action is superior than penalties of custody to it  
• Unnecessary items begin heaping up  
• Selected places are vacant from their respective tools and jigs  
• No attention is taken toward the unclean equipment  
• Goods are left under the risky location  
• Workplace in the condition of bad light, unclean and disordered environment results in lower morale | | |

*Source:* Adopted from Well (2011)
2.1 5S pillars

Wells (2011) has deliberated upon the meaning, significance and problems averted by the 5S pillars in an organisation as discussed in Table 1.

3 Literature survey

5S is a holistic application used to raise moral, ethical standards and strongly associated with Japanese culture and society. 5S not only improves organisational working environment but also improves the overall industrial management process performance as well (Ho, 1999b). This practice is based on neatness, cleanliness, standardisation and discipline in order to achieve quality standards in goods and services (Ho and Cicmil, 1996; Patten, 2006; Liker and Hoseus, 2008; Samuels, 2009). Most of the organisation workplaces face the problems of disorder, wastage of time and cost due to non-value added activities. These problems affect the work environment adversely, and accumulate to bigger problems such as long lead times, higher defects, low productivity, frequent breakdowns of machines and hidden safety hazards, thereby critically affecting the cost competitiveness of the organisations. These problems can easily control and reduced by holistic 5S implementation at workplace (Chapman, 2005; Chuanjie, 2013). The implementation of 5S methodology not only play significant role in the development of manufacturing sector, but it also make remarkable evolution in defence, banking, mining, agriculture, hospitals and construction sector (Gratiela, 2012; Aziz et al., 2014; Flynn and Vlok, 2015). It is also analysed that the practice of 5S become the supporting activity or in some cases as a base foundation for the implementation of other lean tools such as TPM, TQM, JIT, TPS and ISO standards (Teeravaraprug et al., 2011; Chen and Tan, 2013; Kushwaha, 2015).

Abramovitch (1994) concluded that 5S is driven from the bottom to up level in an organisation, when it is implemented effectively with dedication of sincere efforts by every employee from top management to bottom management of staff.

Ho (1997) has reviewed the reasons of having 5S technique in Japanese industries. He concluded that 5S practice was essential because it help to make the life of everyone good in organisation. It was implemented successfully with help of top management commitment, promotional campaign, training of 5S, evaluation of the results and keeping of records.

Ho (1999b) has researched the Japanese philosophy of 5S, and considered it as the base line for industrial management. As the name were new for the western countries. There meanings were translated in their language in order to remove the complexity so that they can successfully implement in the Western firms.

ABK-AOTS Dosokai (2001) has reported that the Indian industries have gained lot of benefits such as reduction of customer complaints and worker absenteeism, improved resources utilisation and worker morale through 5S initiatives at workplace.

Becker (2001) has identified that most significant barriers in the implementation 5S program are lack of improved communication lines and lack of employee involvement. He included that organisation were able to implement 5S successfully with the removal of barriers but the attitudes were gradually changed due to slow progress of 5S in some organisations. He suggested it is important to continuously evaluate the progress of 5S
program by the management to show the demonstration of their commitment towards the program.

Brayer and Walsh (2002) have implemented 5S Technique in the office of the mast international group (Australia) in order to rediscover the value of TQM with the practice of 5S. The results of the study revealed that there were significant improvements realised by the organisation, which helped in development of learning’s for the encouragement of 5S practice in other international groups.

Patra et al. (2005) have discussed the implementation of office TPM initiative in conjunction with 5S methodology in order to achieve performance enhancement benefits in the Indian Institute of Production Management (IIPM) library at Orissa in India. Office TPM is the critical element of TPM implementation program which provides a systematic approach for enhancing administrative and management of an organisation by strengthening basic capabilities. It provides a system capable of responding to any change. Its aim is to reduce losses, provide better work culture and environment with sense of ownership of the jobs which is gained by the implementation of 5S through the awareness of education, training and involvement of top management.

Maddox (2006) has concluded that commitment of management and need of leadership for the program of 5S are the most important requirement for its implementation in an organisation. He demonstrated the importance of management and various initiatives through their actions.

Maggie (2006) has explained that 5S technique has widespread applications in the various sectors of organisations. He shared his experiences of 5S implementation in the library of university, where 5S practice developed a strong relation due to the complete involvement of all staff member with big hearted support. It developed framework and dulcet environment for employees and visitors.

Moreira et al. (2008) have implemented the 5S technique to maintain the complex and dynamic system of digital libraries. The authors developed 5SQual tool which perform automatic evaluation to remove the problems before they occur. It is applicable to various digital libraries and sceneries due to its generic architecture. The evaluation performed with 5SQual guided the design, development and improvement of digital libraries and demonstrated the evaluation of many aspects of the evaluated system.

Khamis et al. (2009) have investigated the 5S implementation process and evolved 5S activity checklist for manufacturing organisations. The authors concluded that 5S can improve whole organisation in an integrated holistic ways. They identified that most significant barriers of 5S implementation are poor communication between top management and shop floor employees and inadequacies of training programs.

Goetsch and Davis (2010) have studied that top management have to play a crucial role in order to realise the significance of 5S technique in the organisation among their subordinates. The dedication and commitment from the employees towards implementation of 5S program only build on the promotion and proactive behaviour of the top management toward 5S technique.

Ho (2010) has investigated an integrated TQM model to overcome the losses caused by oil crises and realising global sustainability. The development of lean 5S checklist by the author is aimed to minimised wastages of all sorts and reduces down the financial problems. From vast experience, he concluded that integrated Lean TQM model helped in global oil energy consumption.
Gnanaguru et al. (2011) have demonstrated the implementation in 6-S process improvement in an aeronautical industry. The authors proclaimed that 6-S (5-S and sixth ‘S’ as Safety) is considered as foundation of all the improvement activities like TQM, TPM, Lean, etc.

Hunglin (2011) has implemented the principles of 5S in Wang Chen manufacturing company in order to organise the tools, improving the work environment and efficient productive process. He introduced 5S methodology at Wang Chen Company for addressing the problems like messy environment, inefficiency, wastage of time and money. The study revealed that 5S implementation led to reduction in time wastage by 49% and provided more productive time to meet the customer demands along with good profits.

Sorooshian et al. (2012) have presented experience of 5S implementation and closely examined the effects of its implementation. The study focused on planning and issues from the manager’s and employee’s perspectives. The authors have discussed the short and long term consequences of implementing the 5S program. They found that 5S concept strengthens and facilitates team work, discipline, productive environment, ongoing commitment and maintain excellent service with involvement from top to bottom level management.

Suárez-Barraza and Ramis-Pujol (2012) have studied that number of multinational companies are utilising 5S technique as a vital step or main driver for the implementation of lean thinking or lean-kaizen approach.

Putro (2013) has reported that with the implementation of 5S in Bengkel ABC, there was about 30,200 cm² more space available for the organising spare and waste in the organisation. The author concluded that 5S technique helped in the effective utilisation of workspace and provides immediate return within 48 days on its investment of implementing 5S program. He added that 5S implementation was helpful in providing better organising environment for spare and tools at Bengkel ABC.

Pasale and Bagi (2013) have stated the practice of 5S technique in small scale manufacturing industries has resulted in enhancement of efficiency of production system from 67% to 88% within a short span of few weeks.

Rojasra and Qureshi (2013) have reported that in Indian economy, small scale industries play a significant role in employment and industrial production with 33.33% of export revenue. It is important to implement the basic lean tool (5S) in small scale industries for their development. He concluded that implementation of 5S in (SMES) bring vital improvement of 88.8% in production system within sequential weeks.

Singh et al. (2013) have experienced the implementation of TPM in a machine shop. The success of TPM implementation was measure by the overall equipment effectiveness. The authors concluded that success of total productive maintenance depend upon various pillar like 5S, quality maintenance, kaizen and office TPM.

Kennedy et al. (2013) have discussed that popularity of lean tools are not up to automotive manufacturing sector, they effectively adopted in the processing industries also. Lean tools such as 5S, single minute exchange dies (SMED), visual management, etc., bring the overall improvement in production and quality.

Jain et al. (2014) have studied that 5S tool has bring significant improvement in the medium size organisation in terms of quality, productivity and work culture. It strongly aided to maintain organised environment with continuous improvement and also contributed TPM implementation.
Khanna and Gupta (2014) have reported that Mayur Uniquoters Pvt. Ltd. Company situated in Jaipur (India) have improved the bad condition of the company with practice of 5S in the plant. The company image was totally changed with huge benefits and thereby helped the company to receive the Forbes Asia top 200 under billion awards in November 2012.

Ikuma and Nahmens (2014) showed that safety is an inbuilt part of 5S in healthcare system. They concluded that 5S can facilitate process improvement, work environment and safety.

Patel and Thakkar (2014) have reported the benefits of 5S in the various organisations. They have observed that 5S technique drastically changes the image of the company. Benefits such as cost reduction, efficiency, effectiveness, quality, safety, security and pollution free environment were obtained on the successfully implementation of 5S. The authors also reported that it is very essential to provide training of 5S technique to the employees.

Gupta and Jain (2015) have examined that implementation of 5S at all the workstations of small scale organisation considerably reduced the tool searching time from 30 minutes to 5 minutes and make workplace efficiently productive. They analysed that 5S is a powerful tool which can be implemented in various industries whether it is micro, small, medium or large.

Sánchez et al. (2015) have studied that implementation of 5S at SMEs in Bogota (Colombia) considerably improved the selected four study factors namely with a rise of productivity (44%), quality (44%), organisational climate (52%) and reduction of risk (90%).

4 Literature review of 5S implementation methodologies

The different authors have suggested various methodologies for the implementation of 5S program. The steps for implementing 5S program have been outlined below:

1. get top management commitment (Ho, 1999a)
2. educate all about 5S (Ho and Cicimil, 1996)
3. draw up a promotional campaign (Ho and Cicimil, 1996; Ho, 1999b)
4. keep records (Ho and Cicimil, 1996; Ho, 1999b)
5. impart 5S training for implementation (Ho and Cicimil, 1996)
6. evaluate the 5S program (Ho and Cicimil, 1996; Ho, 1999a)
7. devise ways for updating the system (Ho and Cicimil, 1996).

The strategy devised by Hirano (1995) depicts that the implementation should be carried in such an order that the simpler and basic methodologies should be installed first (Malik, 2014). Hirano describes the sequence of implementation in Figure 1.
Robertson (2003) has provided a project plan consisting of 16 steps for the implementation of 5S technique in any organisation.

Step 1 Adjudge the need for implement of 5S in an organisation, which is based on certain conditions: If the workspace is droved, excess production of inventory create difficulty in the work, absence of tools and equipment at the right time of its use and reduction of neatness and cleanliness.

Step 2 It is important to build up a positive learning environment for holding 5S methodology. To make it easier visual assist, lectures, presentations, pictures and discussions should be deployed.

Robertson (2003) has provided a project plan consisting of 16 steps for the implementation of 5S technique in any organisation.

Step 1 Adjudge the need for implement of 5S in an organisation, which is based on certain conditions: If the workspace is droved, excess production of inventory create difficulty in the work, absence of tools and equipment at the right time of its use and reduction of neatness and cleanliness.

Step 2 It is important to build up a positive learning environment for holding 5S methodology. To make it easier visual assist, lectures, presentations, pictures and discussions should be deployed.
Step 3 The organisational goals, objective should be clearly identified, which may include the following:
- increase of productivity and establishing good quality
- decrease of wastage in any form in an organisation
- improve the working environment of the organisation
- effective utilisation of the workspace.

Step 4 The commitment of top to bottom management along with support of each employee of an organisation is the most necessary factor for the success of 5S project in organisation.

Step 5 In order to evaluate the results of 5S project, an evaluation method is build up in the form of checklist which should be exercised bi-monthly.

Step 6 Time policy management should be made by the organisation in order to decide the time period for the exercise of 5S practice at the workspace.

Step 7 Problems such as loss of interest or support by the management and other obstacles/resistances in the journey of process may occur in early stage of 5S project. These problems should be identified and tackled appropriately.

Step 8 The benefits derived from 5S project by other companies should be communicated to get full support from the upper management and employees.

Step 9 The pictures/videos of the workplace of an organisation should be taken before the beginning of 5S project in order to evaluate the progress report.

Step 10 Responsibility of the implementation should be given to 5S teams for training, evaluation and enforcement.

Step 11 Start out the first S (SORT): The unwanted materials and items lying on the workplace should be identified in order to provide tagging on it, when the tagging process is completed. It is inquired about the purpose of tagging items on the workplace and further action should be taken for its removal from the workplace.

Step 12 Start out the second S (SET IN ORDER): After the sorting process, the needed and useful items left on the workplace should be set in order at their respective places having easy storage and retrieval with labelled tags. The colour coding should also be done at this stage for more convenient accessibility.

Step 13 Start out the third S (SWEEP): In this step, areas which need frequently cleaning should be identified first and ranked according to the frequency of use. Afterward the clean tools should be assembled to eliminate any source of dirt or dust at each corner and edge of the workplace. The cleaning initiatives should not focus on the floor and walls only, it should be implemented on every smallest crack in the case frame of machinery and equipment.
Step 14 Start out the fourth S (STANDARDISE): It is formal way which ensures that first 3 principles of 5S are carried out in daily routine. The duties of first 3S should be integrated in the daily duties of employee which must become a standardise process in the organisation. The checklists and schedules must be followed for the confinement of 5S methodology.

Step 15 Start out the fifth S (SUSTAIN): It is the most difficult step to implement. It should focus on standard of work place organisation and develop the mindset of continuous improvement and maintaining all previous four S.

Step 16 Evaluation of 5S must be done in order to measure the improvement and achievement in the form progress reports.

McBride (2003) has suggested eight step methodology for successful implementation 5S. These steps include: organising the program committee; envisaging a plan for each S; communicating the start of 5S program to all employees; provide training and education to employees; motivating employees to clean up working area; motivating employees to organise working area; evaluating the results of 5S and performing self-examination and taking corrective actions.

Ho and Cicmil (1996) have envisaged steps for the successful implementation of 5S program, which include:

1. A strong commitment is must for the implementation of 5S. The commitment is not only to start or approval of process but also provide necessary resources for training and improvement.

2. A promotional campaign of 5S program should focus on developing progressive time bound initiatives for six month duration as follows:
   - top management engagement
   - running of 5S elements, each one perform their respective roles
   - everyday routine of 5S practices
   - award/prizes should be given to the 5S winning team in order to increase the morale and interest in the program.

3. Records should be kept for maintaining the progress report before and after the implementation of 5S. The record is to be done by taking pictures or video of the workplace

4. 5S training: As the technique focuses on the elimination of waste, the employees should be trained appropriately to develop new ideas for obtaining solution of the problems faced by the organisation.

5. Evaluation of 5S program should be done with 5S audit worksheet.

Pheng and Khoo (2001) have also suggested some considerable steps for 5S implementation in an organisation.

Step 1 It is important to make a leader for 5S program from the members of the top management instead of getting approval from them.
Step 2  The knowledge about 5S concept is important for its implementation in a company. A proper education course related to 5S should be provided. The top management of company should facilitate 5S steering team in organising the workshops and seminar for 5S education.

Step 3  Training of 5S – in training program it is important to identify persons from the company for executing 5S program in the various departments. The appointed persons should be trained well and become the facilitators for their respective department with a responsibility to train rest of the employees.

Step 4  Promotional campaign should involve new trained trainers with their innovative ideas. The ideas from various department should be collectively taken in which the top most ideas should be further used to make the change for the improvement in the organisation.

Step 5  Exercise of 5S principles – one week program should be launched in which 5S principles should be aggressively promoted. Each principle must be carried out effectively during its particular date.

Step 6  Evaluation of 5S progress: The results of 5S programs in various activity areas must be evaluated and awards should be presented to the winning teams. This will facilitate in improving the motivation and continue practice of 5S among the employees of organisation.

Step 7  Maintenance of 5S system requires recording, inspection, cross evaluation and innovation ideas for the effectiveness of the system.

Lista International Corporation (2007) have suggested that 5S methodology involves three step implementation process, that includes establishment of a cross functional teams covering entire organisation, critical analysis and coverage of entire workplace, and envisaging methods and ideas for improving workplace in pursuit of elimination of waste. Further, VSM should be deployed in 5S process for evaluation and analyse of material, process, and information flow. The current state map should be developed and analysed for evaluating the present work procedures and methods. 5S teams should then identify opportunities for workplace organisation and housekeeping improvements by considering wide range of ideas, for envisaging an environment to promote value added work through waste elimination (Da Silveira, 2006). This should be followed by developing and implementing future state map. The process should be iterative with future state becoming current state, and a continuous improvement process should follow to identify new ways to reduce waste.

Ministry of Health and Social Welfare, Tanzania (2009) has proclaimed that 5S is usually implemented gradually – often over a one or two year period of time. They have recommended four phase implementation plan for effective and efficient implementation of 5S-kaizen activities as depicted in Table 2.

### Table 2 Implementation plan for effective and efficient 5S-Kaizen implementation

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Phases</th>
<th>Approximate time period</th>
<th>Steps involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preparatory phase</td>
<td>Three months</td>
<td>Step 1: Dissemination/sensitisation of staff of 5S-kaizen-TQM concepts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Step 2: Training for Management level staff</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Step 3: Formulation of quality improvement team (QIT)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Step 4: Execution of situation analysis before 5S activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Step 5: Selection of target area(s)</td>
</tr>
<tr>
<td>2</td>
<td>Introductory phase</td>
<td>Six months</td>
<td>Step 6: Training all staff</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Step 7: Work improvement team establishment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Step 8: Practice of sort, set and shine</td>
</tr>
<tr>
<td>3</td>
<td>Implementation phase</td>
<td>Two years</td>
<td>Step 9: Proper practice of S1 to S3 (sort, set, and shine) to generate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>maintenance system, develop standards and regulations</td>
</tr>
<tr>
<td>4</td>
<td>Maintenance phase</td>
<td>Ongoing</td>
<td>Step 10: Making 5S activities a culture of your facility</td>
</tr>
</tbody>
</table>
5 Obstacles in 5S implementation

The lack of leadership and TEI are only the common misunderstandings or errors carried out in the 5S management (Lixia and Bo, 2008). Grier (2008) argues that resistance to change is a significant challenge in implementing and sustaining a 5S system. Becker (2001) has identified that most significant barriers in the implementation 5S program are lack of improved communication lines and lack of employee involvement. Eocha (2000), Warwood and Knowles (2004), and Ablanedo-Rosas et al. (2010) have identified the following obstacles in the path of successful running of 5S technique in the organisation.

- lack of top management commitment
- low interest of top management in 5S program
- lack of clarity of the purpose of 5S implementation (Suárez-Barraza and Ramis-Pujol, 2012)
- lack of enthusiastic and motivation of workers towards 5S
- lack of impetus, vision and guiding principles of 5S
- firm culture is also responsible for the failure of 5S program
- lack of integration of 5S initiatives with other quality improvement drives and organisational goals and policies.
- hapless communications among employee in the organisation.
- lack of application of plan, do, check, act (PDCA) in the implementation of 5S (Suárez-Barraza and Ramis-Pujol, 2012)
- inability of management to convince employees that improvements from 5S initiatives are true or will be sustained (Radnor, 2010)
- strained industrial relations with trade unions and employees severely affecting buy in of management to pursue improvement initiatives
- lack of empowerment at workplace
- inability of the management to convince all employees that 5S is there to stay and is not slogan of the week or month
- low team spirit among the employees of organisation
- low availability of resources or restricted resources
- poor cooperation amongst departments (Ikuma and Nahmens, 2014)
- demand of high financial investment is a reluctance to adopt 5S
- poor employee attitudes
- collision of position level of employee in the organisation
- inadequate training for employees at all levels in the organisation
- appropriate employee training updation and evaluation
lack of kaizen implementation at the workplace
lack of acknowledgement and planning
lack of response to an inquiry
absence of appropriate record keeping mechanisms, and auditing mechanisms for evaluating and sustaining the progress 5S program in the organisation
lack of incentives and rewards for work and process improvement
inappropriate evaluation and standardisation of 5S initiatives
intent of employees to do tasks with minimum of effort, even though it may cause damage to machinery or the product (Malik, 2014)
inability of the medium level management to oversee the laid out procedures are being strictly adhered at workplace by the employees
some of workers think that workplace become dirty again then why should it clean
some of workers think that their duties are to make the jobs not to clean and organise the workplace
some of workers think that they are already too busy in their work, they have no time to clean and organise the workplace (Titu et al., 2010).
some of employees have wrong perception that it is a tired process and failed several years ago
adoption of multiple implementation projects simultaneously by the organisations and lack of time for employees to the successful implementation of any one initiative.

6 Success factors in 5S implementation

Ikuma and Nahmens (2014) have observed that 5S initiatives should be integrated with organisational objectives and top management across the entire organisation for becoming a successful initiative. The other success factors for fruitful deployment of 5S initiatives in organisations include the following:

1 The strong support and commitment from the top management is the most essential success factor for the implementation of 5S in any organisation. The commitment is not as a lip service or giving the approval to start the process. There should also be commitment of providing resources for intense training and improvement by the top management.

2 It is also important to build a positive learning environment of 5S methodology in order to realise the importance of the 5S technique in an organisation with the help of promotional campaign, lectures, presentation and discussion for the improvement and development.
The need of leadership in the 5S program is also an important success factor for its implementation. It is important to select the leader of the program from the members of the top management instead of getting approval from them.

The organisations should develop strategic link of 5S initiatives with other problem solving and quality improvement drives and consider 5S as part of an organisational policy and strategic plan (Suárez-Barraza and Ramis-Pujol, 2012).

There is a need for top management of organisations to create an environment of trust and open communication with trade unions for improving industrial relations.

The top management need to obtain buy in of all employees that 5S is a virtuous cycle for the organisation, and must follow the PDCA cycle consistently.

5S program should involve Kaizen approach of small incremental changes to better adapt the employees to the changes with little disruption. By imbibing incremental changes at workplace, 5S system will be better received and be more sustainable (Grier, 2008).

Team formation, improved communication among various departments, involvement of all employees from top to shop floor, autonomous culture and kaizen activities are critical factors for successful implementation of 5S program in an organisation.

The organisation should develop and demonstrate detailed 5S guide or implementation program indicating the way 5S will be implemented, evaluated and institutionalised.

The 5S teams should be trained and motivated to work like self-directed work teams adept in problem solving in addition to their regular work (Gnanaguru et al., 2011).

The success of 5S implementation program is dependent upon establishment of quality improvement team, development of roles and responsibilities for each team members, training of staff, regular communication, establishment of effective feedback function and development of effective time bound action plan within the organisations (Ishijima et al., 2014).

Since 5S is a team oriented program, the organisations should encourage all employees to offer suggestions on improvements.

To continue the gains from implementing the 5S system, efforts should be taken to instil the importance of maintaining employee dedication for a neat, orderly and safe workplace, and reinforcing good work habits (Maggie, 2006).

The successful implementation of 5S can be attributed to the devotion and adherence of the employees to the rules and standards (Malik, 2014).

The organisations should demonstrate their ability to imbibe a culture of discipline spirit for ensuring success with 5S initiatives (Aoki, 2008).

The documentation of work procedures and adoption of visual workplace management tools assist in successful deployment of 5S initiatives in the organisations.
17 The organisations should ensure the deployment of various tools for facilitating the 5S programs. These tools include: bulletin board dedicated to 5S program; educational material for employees; posters at the workplace to consistently impress upon employees to holistically follow 5S system; posting educational material, event notices and location charts at designated areas; before and after pictures reflecting improvements realised through 5S programs (Grier, 2008).

18 It is necessary to make schedule or time table for exercising the 5S principles at the workplace weekly or monthly so that it do not interrupt the production period of the company.

19 The primary condition for 5S quality efforts to become successful is that those efforts are continuous and that they are implemented throughout the entire organisation rather than certain parts of the firm and under the leadership of the senior management (Hyland et al., 2002).

20 The new concept of benchmarking also may be adopted by the employees to highlight best strategies of 5S implementation from other successful organisations (Puttapalli, 2014).

21 Awards and prizes distribution should be given to the employees for the successful practice of 5S technique at their workplace area. It should build interest, motivation, morale and dedication towards the implementation of 5S among the employees of the organisation.

7 Manufacturing performance achievements through 5S implementation

5S technique is precious for every organisation since it facilitates realisation of motivating and safe working environment for all employees in the organisation. It requires top management commitment, promotional campaign, employee training, team working environment, evaluation of the results and maintaining the 5S records (Ho, 1997). Skaggs (2010) has stated that 5S program starts with employee training at all levels and with appropriate training, the employees in the organisation can practice the 5S easily. 5S helps in facilitating the smooth running of operations and encourages employees to align with organisational goals (Olofsson, 2010). 5S practice can bring significant improvement in environmental performance leading to improved housekeeping, health and safety. It is a set of straightforward steps for realising continuous improvement (Eocha, 2000). 5S can be effectively deployed in any size or kind of organisation, offices and other places (Taubitz, 2010).

Ho (1999c) has studied the number of achievements gained by 5S in various sectors of organisations in Hong Kong. At C&K Systems Ltd. (security systems manufacturer), 5S has facilitated realisation of the best quality of product with cheerful environment and reduce the staff turnover rate in the plant. At central textile limited, it yielded tremendous results in cleaning and tiding with continuous improvement in quality. At CKFC construction Ltd., 5S settled down the problems of quality and delivery requirements to the clients. At Computer Products Asia Ltd. (manufacturer of computer power supplies) 5S built the base foundation for JIT and TQM in the company. It contributed to productivity improvement including quality, cost, delivery, safety and morale. At Communication Services Ltd. (subsidiary of the Hong Kong Telecom Ltd), 5S helped in
providing best services facility to their customers. At Elec & Eltek Ltd. (printed circuit board manufacturer) 5S resulted in development of improved communication and team spirit among the employees.

Ho et al. (1995) have investigated the implementation of 5S principles in 3000 companies in UK and 200 companies in Japan. The results were good with response rate of 12%. They studied whether the 5S principles have significant contributions towards total quality management or not. The finding revealed that 5S practices facilitate realisation of total quality environment in the organisations which is important base of TQM in companies.

Ho and Cicmil (1996) have reported that Wellex Corporation, USA has witnessed productivity improvement exceeding 26%, with turnover exceeding from US$13.5 million to US$23 million within two years of holistic 5S implementation.

Bamber et al. (2000) have combined the quality (ISO9000), maintenance (TPM and 5S), environment (ISO14001), operational (JIT, Kaizen) and occupational health (BS8800) management system in order to develop an effective integrated manufacturing system, traditionally which was run separately by other departments. They concluded that TPM and 5S were the crucial elements for development of an integrated manufacturing system and can support the operational elements of these certification systems.

Eocha (2000) has researched that 5S can bring considerable improvements in housekeeping, health, safety and environment. But the implementation of 5S can only be successful if the organisations are able to harness total involvement of all the staff from top to bottom within the firms. ISO9001:2000 certification is essential for every industry. The author also concluded that 5S technique plays important role to fulfil the requirements of ISO certification.

Pheng (2001) has integrated the 5S principles with ISO9001:2000 in order to bring the movement toward total quality management. He observed that practice of 5S principles fulfil the most of ISO requirements and help in achieve the ISO9001:2000 standards more readily. He concluded that 5S principles directly contribute towards ISO requirements and in long run the integration of ISO 9001:2000 with 5S principle leads towards TQM.

Pheng and Khoo (2001) have observed that adoption of 5S initiatives in the organisations has helped in the enhancement of team performance by providing facilities of employee participation for the generation of ideas to build quality production and services. They concluded that for effective deployment of 5S principles in the organisations, there is a need of full involvement from top to bottom management and cooperation from every department of organisation in the form of teams.

Skinner (2001) has stated that 5S initiatives have resulted in 93% reduction in transportation distance travelled by the work in manufacturing operations and improvement in overall space utilisation by 42%.

Albert (2003) discussed the study conducted on the implementation of 5S program at Merritt Tool Company in Kilgore, Texas. The study highlighted the methodology of 5S program whereby workshops were organised, training was imparted, teams formation were taken up to identify the waste, workplace management initiative undertaken and the recommendations made for improvements in every sector of the company. The 5S program significantly facilitated the changes in the growth of the company. The efforts of workforce and management reduced the setup time, eliminate the waste, and improve
profits in the company. The researcher also added that sustainability of 5S program in the company must need a strong support from the workers and top management.

Dossenbach (2003) has revealed that 5S practice is the most inexpensive system which brings continuous improvement in quality and productivity of the companies. He concluded that it is uncomplicated, effective and powerful tool which manage the floor shop. At last the author guaranteed that implementation of 5S in the company or in a department will bring greater change and development.

Takhar (2004) has admitted that 5S technique provided number of benefits to the organisations such as good working environment, discipline or motivation among the employees, safety and better inventory control. He also warned strongly that if it is not successfully implemented by the top management then image of 5S technique could be seen as wastage of time and act as weekly or monthly clean up.

Ahmed et al. (2005) have suggested a generic model by integration of TPM concept with ecology oriented manufacturing (EOM) and 5S in order to achieve the organisation goals. The study was undertaken at semi-conductor manufacturing company for meeting both internal and external pressures like meeting customer needs, reduction of manufacturing lead times, attaining zero wastages and defects, adoption of new technology along with strict government rules of health and safety. The study reveals that TPM conjunction with 5S play significant role in maintaining the environment friendly eco-efficient manufacturing system.

Kumar et al. (2007) have analysed the financial performance of integrated system of 5S with quality circle financial accounting system (QCFAS). They explained that 5S technique could be used to make fusion between TQM and Quality circle. The authors concluded that 5S concept can be used to maximise the advantages for many world class paradigms including quality circles.

Michalska and Szewieczek (2007) have introduced the way of implementing the 5S methodology in the company. The implementation of 5S rule began with a proper training to productive workers in which control questions have been asked for each rule of 5S. The study revealed that implementation of 5S brings a greater change in the cost reduction, process improvement, maintenance, improvement of work environment, increase of awareness and morale value.

Gapp et al. (2008) have aimed to identify and present 5S concept from the Japanese management perspective. The study revealed that 5S principles translate to overall organisational performance through participation. 5S can be used as a problem-solving intervention at the system or process level; a necessary initiating point within lean management philosophies. 5S within the context identified is the strategic platform for the managerial decisions required for the development of an integrated management system. The authors concluded that holistic 5S interventions significantly contribute towards workplace performance improvement.

Suarez-Barraza et al. (2009) have applied lean-kaizen concept in the public sector by local councils to improve the services. It has been shown by the results that 5S, Gemba Kaizen workshop and process mapping had a great impact on the management system in local bodies. These techniques helped the local government to provide good quality and improved processes to the public.

Bayo-Moriones et al. (2009) have investigated that there exists a positive relation between the 5S deployment and organisational contextual factors like human resources, quality management, products technology and environment. It can also help in measure the operational performance with reference to quality and productivity. The authors
concluded that 5S is essential requirement for the effective quality programs like ISO or European Foundation for Quality Management (EFQM).

Gajdzik (2009) has reported that 5S implementation by Arcelor Mittal, the biggest steel company in Poland, as a basis of TPM initiative, has resulted in increased work efficiency up to 150%, reduced breakdown by 90%, dropped down the number of accidents at work and reduced the production cost by 30%.

Khanna (2009) has studied the status of TQM, quality tools and 5S in the Indian organisation and their relationship among large, medium and small size of organisation. The author emphasised that there is positive correlation of 5S with TQM index and other quality improvement tools.

Salaheldin (2009) has depicted that implementation of 5S program significantly contributed in financial and operational performance of the organisation through empirical analysis. He also added that 5S is the key to develop effectiveness and efficiency of the organisation.

Hunglin (2011) has investigated implementation of 5S in Wan Cheng Industry in Taiwan, and observed that 5S attributes resulted in 38% reduction in average time consumed in looking for and retrieving of drills and also reduced 49% of time for mills. The benefits of time saving helped the employees for productions of goods and meeting of customer’s demands.

Moradi et al. (2011) have studied in detail about the relation between 5S and TPM and evaluated the performance and effectiveness of 5S. He concluded that six big losses regarding time, waste, failure and rework are reduced significantly with 5S principle and found that 5S affects the TPM pillars directly and indirectly.

Ghodrati and Zulkifli (2013) have studied the advantages of 5S technique when implemented in the organisation. The study was aimed at identifying the performance factors and evaluating the effectiveness of 5S implementation. A questionnaire was designed to collect the data from different industries of diverse fields using 5S technique. 5S initiatives helped the organisation in achieving the efficiency from the workplace, decrease the wastage and bring improvement in quality through monitoring practice on the organisation environment. The study revealed that 5S initiatives bring the improvement in the organisation without any matter of size, type and its production. It strongly supports the improvement objectives of organisation.

Pirttijoki (2013) implemented 5S at ST-Koneistus Ltd., a metal industry which manufactured hydraulic blocks. The results showed that company achieved significant improvement in production, reduction in non-value adding operations and lead times, decreased absenteeism and improved quality of products. The practice of 5S helped the company to achieve the ISO 9001 and ISO 14001 in 2011.

Sidhu et al. (2013) have outlined the step by step 5S implementation process in a small scale agriculture industry with the help of PDCA Cycle. The study reveals that 5S initiatives have helped the organisation in addressing high talk time issues in the organisation. The cycle time of assembly line has been reduced significantly from 50 minutes to 41.50 minutes. Thus, 5S initiatives have contributed successfully towards reduction of wastage and enhancement of productivity in the organisation.

Ramesh et al. (2014) have implemented the 5S technique in bio mass processing unit to solve the problems faced by the plant such as wastage, disorganised workplace and bad environment. The utilisation of 5S technologies in the plant controlled the wastage to low level and provided a smooth, neat and clean work environment with good efficiency and
effectiveness. The authors concluded that 5S brings a continuous improvement and helped in obtaining best quality, variety and fulfils the customer demand.

8 Conclusions

In order to maintain the competitiveness of organisations, the top management has to continuously strive to imbibe innovative tools and techniques. 5S initiatives offer significant benefits to manufacturing and service organisations to attain drastic improvements at workplace, thereby motivating the organisations to learn more knowledge about 5S technique for its effective implementation in their organisations. But the challenge is, how effectively, they implemented the 5S technique into day to day activates of the organisation for successful running of program in the long term. The manuscript clearly provides step-by-step 5S methodologies reported in literature by different authors in the successful implementation of 5S technique in the organisations. The paper highlights the success factors and obstacles of 5S implementation for the organisations in the support of knowledge who are interested to run the program. An insight into 5S implementation methodologies will be significantly helpful for researchers and practitioners to understand 5S program from its meaning to the end of its successful implementation and sustainability.

References

ABK-AOTS Dosokai (2001) Annual Award Program Me for the Best Implementation of 5S Technique in Related Industries in South India, ABK-AOTS Dosokai – A Registered society of Indian professional trained on Japanese management techniques, Tamil Nadu, India.


Robertson, B. (2003) *Project Plan Development for 5S implementation*, Unpublished Master’s degree Directed Project, Purdue University, West Lafayette, IN.


