

Process Efficiency Improvement in Small Organization through Lean Supply Chain Approach

K.R. Dushyanth Kumar¹, Dr.G.S Shiva Shankar²,
Rajeshwar S. Kadadevaramutt³

¹(Department of Mechanical Engineering, Malnad College of Engineering, Hassan-573201, Karnataka, India)

²(Department of Mechanical Engineering, Siddaganga Institute of Technology, Tumkur-572103, Karnataka, India)

³(Department of IE & M, Siddaganga Institute of Technology, Tumkur-572103, Karnataka, India)

Abstract: Due to their insufficient production systems and their setups the small and medium scale organizations (SMES) are facing problems of product accuracy and quality in par with the customer satisfaction and competitor's impact also. Which leads poor market values in their product? In another way, Due to increased customer demands, high product variety, and a push production system, the organizations have been suffering from excessive wastes, poor work stations set up, and its environment. In such cases continuous improvement process using advanced manufacturing technologies are most useful as solution this paper aims to identify the performance factors and their characteristics in SMEs organizations, for which the case study is considered in public organization, where the 5s is applicable to the file searching process and the efficiency is achieved through the reduction of process time in simple manner and the same will effect on the supply line also to the customer end. In this way 5S techniques would strongly support the main objectives of SMEs organization to achieve continuous improvement and higher performance.

Keywords: 5S, productivity, quality improvement, process time reduction.

I. Introduction

In current situations, the organizations are based on the certain standards which pursuit to the continuous improvement on the basis of Total Quality Management (TPM) [1] , Here maximum equipment efficiency can obtain in an organizations, where an integrity of effective and autonomous maintenance is considered through the small group activities. TPM is a protective maintenance system requiring the participation of all departments in order to obtain maximum equipment efficiency in an organization, which involves all human resources, but further improvement in this regard on operating level in work atmosphere will becomes more popular called as 5S first developed by Hiroyuki Hirano. Initially this technique was originated from Japan. The 5S is the methodology of creation and maintaining well organized, clean, high effective and high quality workplace. Its result is the effective organization of the workplace, reduction of work's environment, elimination of wastes in manufacturing process, which leads to the quality and safety of work [2]. The concept centers around good housekeeping that will result in reduction of waste, better cleanliness and creation of a culture to sustain long time. The philosophy of the 5S has its roots in Japan, which is an affective tool in lean manufacturing for the programme of improvement in the quality and accuracy in products. 5S is required where the organization can organize and manage companies which require less space, human effort, time, quality and capital to make products with less faults and make a workplace well ordered, [3]. Disciplined and clean. actually in first stage the requirement to the work place is decided, next stage providing best support to the functions and finally identification of root cause and best solution is provided. [4]. the total study of the 5s aims to analysis of previous drawbacks in the process of work stations and improve its efficiency of an organization. 5S is a Japanese Management Philosophy for safe Working Environment suited for especially shared work place like shop floor, office space. Originated from Japanese house keeping idea their meanings are Seiri (sort), Seiton (set in order), Seiso (shine), Seiketsu (standardize), Shitsuke (sustain). For reducing ineffective time or waste in process. 5S application will improves personal standards and motivation to operators in their workplace and definitely which is an high impact on work area, work safety, quality, efficiency through the continuous observation with team work soul Regarding the importance of 5S implementation in today's organizations, this study aims to review previous studies about benefits of 5S implementation and its efficiency in organizations. Then the same 5S application to the medium scale industry and its improvement is considered with the suitable case study approach is made in systematic manner.

1.1 Description of 5s

5S is a Lean Tool which is implemented for obtaining a clean, effective and pleasant work environment. Which is the first step of approaching the Lean Manufacturing. 5S is a strategy that delivers results by a systematic approach of planning and organizing the activities. 5S is a system to decrease wasting and optimize quality and productivity via monitoring an organized environment and use visual evidences to obtain more firm results. In routine activity of every organization, daily works that support company and neatness are fundamental to efficient activities flow. 5S is a philosophy rooted from Japan and branched into other countries. 5S is an acronym for the following Japanese terms:

SEIRI (Sorting and disposing unnecessary items): This first step refers to the removal of all unwanted materials near the workplace, sorting all the tools, materials and other equipment in the workplace. Important equipment is stored accordingly, which reduces the hazards at the work place.

SEITON (Set in order, Orderliness): Place for everything, and everything must be in its place. Tools, equipment, and materials must be systematically arranged for the easiest and the most quick access and movement. If everyone has quick access to an item or materials, work flow becomes efficient, and the worker becomes productive. Every single item must be allocated its own place for safekeeping, and each location must be labeled for easy identification

SEISO: (Shining, Cleaning, Removal of waste and dust) consists of cleaning up the workplace and giving it a 'shine', it is clean enough to make a good impression. Cleaning should become a daily activity. Every tools and equipments should clean at regular intervals and also restored at their own places after their use.

SEIKETSU (Consistent and Standardized work environment along with Cleanliness): Seiketsu encompasses a clean and regular working and living environment, both personal and environmental cleanliness. This is because dust, dirt and wastes are the source of untidiness, indiscipline, inefficiency, faulty production and work accidents

SHITSUKE (Sustain, realization of the above set of rules in order): Implementing this idea will demand self discipline from the workers from the compact self-discipline connected with implementing and obeying the rules of regularity in cleaning and sorting. It leads to increasing the consciousness of staff, and decreasing the number of non-conforming products and processes, improvements in the internal communication with human relations

II. Literature Review

The various author's are analyzed and contributed their visions towards the 5S application in different organizations were discussed on the basis of following references, which is most useful to our further developments.. 5S system is a method using for set up and keeps quality of working environment in an organization. Such organization can organize and manage companies which require less space, human effort, time, quality and capital to make products with minimum defects and make a workplace well ordered, disciplined and clean manner [5]. 5S have two components as per Japanese organizations, a high level of management and organizational system with complexity meaning and it translates to perfect performance and the other one is management provision tools position Most of the ideas believes that 5S is a mainly lean tool and supportive way for Lean and TQM [6]. 5S is a Japanese management skill roots from their house keeping activities in their work place, which can link with total productive maintenance (TPM) and JIT are focused clearly [7]. In other cases 5S Implementation in Industrial and Business Organization improving health and safety standard and performance in a holistic operation with high level of efficiency and also helps improving data management system in factories were discussed [8]. The 5S practice is beneficial for every organization, because it helps everyone having a better life, In fact, many successful organizations in the world have already included some aspects of the 5S in their daily activities without complete awareness of its benefits [9]. A useful environmental tool for organization management is 5S, which comes from lean manufacturing process. The 5S practice simplifies the workplace and maintenance system's procedures, decrease waste and non-value added activities. It also improves quality, efficiency and safety. It is the most effective tool of controls, which at least reduce or totally avoid different types of pollutions [10]. Most of operating companies in Hong Kong has successfully improved quality of product as well as increasing the working life underneath of 5S deployment. The 5S concept is applicable for many industrial business natures, including service sectors also has been analyzed [11]. In Malaysia, the Standards and Industrial Research Institute of Malaysia or SIRIM has played an effective role to encourage the utilization 5S concept among Malaysian [12]. It is assumed that standards should not be implemented only in the typical operational processes e.g. production, movement maintenance, storing,

but also in the administrative processes, for example: book-keeping, customer service, human resources management, or secretariat service [13]. Critical problems facing by small scale industries while selling their product. SSE (Small Scale Enterprise) is not having huge financial backup and therefore they are depending upon the revenue eared after selling their product were studied [14]. the development of key areas which could be used to assess the adoption and implementation of lean manufacturing practice also presented some of the key areas developed to evaluate and reduce the most optimal project so as to enhance their production efficiency are described[15]. The implementation of 5S has immediate and significant effect on the sequence of activities in the work place of plastic molding industry are analyzed with sufficient background [16]. By the above 5S review the most important barrier for implementation of 5S effectively is poor communication in work place among employees which causes wasting resources, time and money with defective parts in nature. Another significant barrier poor awareness in training nature between top management and workers in shop floor. Therefore, it is believed that continuous training is the key applying to change the organization culture, and assessment should focus on improvement and progress regarding all input from the organization until complete establishment of 5S system [17]. The methodology for calculation of each S in 5S system explained clearly. But Especially in SMEs improvement in productivity with reduced cycle time can achieved by the help of 5S technology implementation in effective manner is required for their existence in market with customer pull system manner.

III. Functions Of Company And Process Background

The City Municipal Council (CMC) of Hassan was constituted in 1976, it is situated along Bangalore-Mangalore National Highway at a distance of 194 KM from Bangalore, the city is located in the south Indian state of Karnataka and extends from 13 Degree North to 76 Degree East having a very pleasant climate throughout the year. Hassan City consists of 35 wards, 35 councilors, 5 Nominated councilors. As per the 2011 census the city population is 15, 5006 area stretches about an area 26.5Sq Km. the details of the Hassan CMC functions are given in Table.1

“Table”1 CMC functions

Details /Functions of CMC	Capacity
Population	1,55,000
Area	26.5 Sq km
Number of Properties	27740
Number of Wards	35
Length of Roads	211 Km
Total Water Supply	18.9 MLD (Million Liter/Day)
Per Capita Water Supply	135 LPCD (Liter Per Capita /Day)
Summer Temp.	19-33
Winter Temp.	14-26

IV. Problem definition

From the past years, lean manufacturing and SCM concepts were incorporated in medium and large scale industries, but in case of SME,s and public enterprises are very limited in nature and very challenging also. Here the present work focuses with public problems and their requirements in the office of City Municipal Corporation (CMC) at Hassan. As per the above table. 2.1 The most of the customer problems and their needs are associate with public related and answering them in documentation form in CMC office is very difficult problem. To resolving the public problem, maintenance of records in record room in systematic manner is needed, and also searching files with in a short time is also essential to minimize the cycle time in office. in CMC office the files are stored in bulk manner randomly at record room which is very difficult to searching the required files with in a short time and the maintenance is also very poor manner as shown in below Fig.1



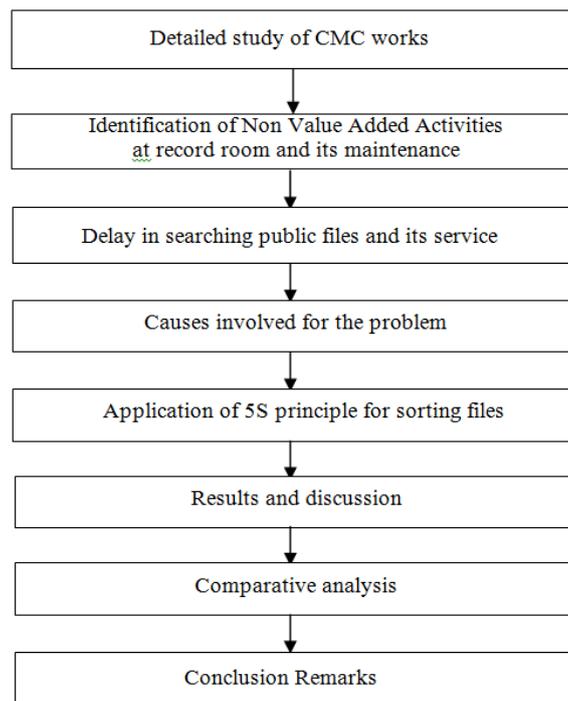
“Fig. 1” Poor maintenance of records in record room

V. Objectives

In current days, the customers are highly concern with the expectation of quick and quality service from the organization, for which the public enterprises have to improve their efficiency related with their system in their working environment. This research work is related to problems of CMC office hassn for their poor maintenance of record documentation for publics’ requirements, hence which is required to improve the working system in the CMC office through the incorporation of 5S principle from the lean manufacturing. Here in this case study the main objective is to reducing the total cycle time required to searching the required record from the record room.

VI. Methodology

Here getting productivity by reducing the file searching time and its maintenance using simple 5S concept is used to improve the problem of publics. Here study of old system of record maintenance and its service to publics are considered. Hence the sorting technique is applying through the incorporation of 5S principle. Then the removal of non value added activities in the office system of CMC, hassan and showing the improvement in the record maintenance and its service to publics are shown in the below flow diagram of methodology in Fig..2



“Fig. 2” Methodology

VII. Data Collection, Analysis

To improve the efficiency in a simple manner in any system or organization is the most challenging task, which requires the previous data's and its analysis with the real documentation. Here the following record room data,s like descriptions of all papers of 5 years to 30 years documentations are needed as per the guidance of Karnataka municipalities (Guidance of officers, Grant of copies and miscellaneous provisions) (Amendment) Rules, 1967, Karnataka gazette are given in Table. 2

“Table 2” Papers descriptions of municipal guidance

Paper type	Validity	Descriptions of papers
“A” Papers	Permanent	<ul style="list-style-type: none"> ▪ Register of proceedings of municipal council ▪ Records connected with expenditure on works ▪ Records connected with claims to service and personal matters affecting person in service ▪ Settlement of sites reserved for public purposes ▪ Correspondence of introduction and abolition of taxes, Register the municipal buildings and properties
“B” Papers	30 years	<ul style="list-style-type: none"> ▪ Collection of register of taxes ▪ Register of licenses ▪ Register of miscellaneous sales ▪ Assessment list of buildings and lands liable to tax ▪ Contractors bills and annual accounts
“C” Papers	10 years	<ul style="list-style-type: none"> ▪ Work files with estimation of municipal works ▪ Register of public improvement funds ▪ Register of objections to assessed taxes ▪ Register for improvement of public sanitation ▪ Sales register to establishment
“D” Papers	5 years	<ul style="list-style-type: none"> ▪ Bill of payment of suppliers ▪ Statement showing the construction, reconstruction, and enlargement ▪ Receipts for goods deposited in warehouse ▪ Papers related to criminal complaints ▪ Declaration of goods imported by a public body from municipality
“E” Papers	1 year	<ul style="list-style-type: none"> ▪ Daily reports of plague, cholera, and small pox ▪ Periodical returns ▪ Papers related to annual administration report ▪ Register of casual leaves ▪ Report of periodical reports

5.1 Data analysis

From the above set of data's collected is in form of papers descriptions and kept in respective files. Totally around 1, 00000 files were stored in record room randomly. Searching of 1980-82 data with respect to one customer is required 30 days in one simple case. Maintenance of files is not in a systematic manner, there are no numbering, labeling, bundles and files with the particular racks as per the order of priority basis considerations.

5.2 5s Principle and its implementation to process

After the data processing, the different 5S terminologies are suitable with the functions of CMC hassan and the details of the various functionalities are described in the below table for the exact 5S applications to reducing the wastes through the proper destruction of files after that the exact systematic arrangement of files and maintain consistency throughout the work environment process is obtained in simple manner is explained in the Table.3

“Table 3” 5S implementation to CMC functions

5S Terminologies	Suitable CMC functions
SEIRI (Sorting and disposing unnecessary items)	Segregation of files
SEITON (Set in order, Orderliness)	Numbering, Labeling, Bundling of files
SHITSUKE (Sustain, realization of the above set of rules in order)	Preparation of check lists and files arrangement in proper racking system
SEIKETSU (Consistent and Standardized work environment along with Cleanliness)	Application of software
SEISO: (Shining, Cleaning, Removal of waste and dust)	Closing or destruction of files

5.3 Data processing approach

After collecting respective files of papers descriptions, the files segregation process in record room starts with systematic manner through the following different steps as follows

- Segregation of files
- Numbering of files
- Preparation of check lists
- Application of software
- Labeling of files
- Bundling of files
- Files arrangement in proper racking system
- Closing or destruction of files

5.4 Segregation of files

Initially segregation process starts systematically as per the year wise, ward wise, subject wise and type wise as per the Table.4

“Table 4” File segregation descriptions

Sl.no.	Descriptions
Year wise	From 85-86 to 2014-15
Ward wise	Total 35 ward wise
Subject wise	Engineering, SAS declaration, accounts, mutation
Type wise	A type, B type, C type, D type, E type as per permanent, 30, 10, 5, and 1 year storage types respectively

5.5 Numbering of files

Particular page numbers are allotted from first page to last pages as per type of files of every year . serial numbers are given from starting page to ending page of the complete year after that fresh number is allotted to next year file.

5.6 Preparation of check lists

Check list follows the 18 columns with their details as follows in Table 5

“Table 5” Check list formulation

Sl.no.	Contents	Details
1.	Office name	Hassan municipality
2.	subject type	Mutation, bill payment..
3.	date of file commencement	Date of first page of file
4.	File number	Type, year, ward wise .
5.	Ward number	Respective ward
6.	subject details	Name, address..
7.	Movement	Type of files
8.	Date of closing	Date of last page of the file
9.	Total number of pages in file	First page to last page
10.	Paragraph	
11.	Color scanning pages	
12.	White and black scanning	
13.	Date of file destruction	Type wise
14.	Date of receive in record room	Date of file transfer to record room
15.	Date of acknowledgement receipt	
16.	Racking numbers	As per 35 wards
17.	Roll number	Mention rack number
18.	Bundle number	Mention bundle number (100 files per bundle)

5.7 Labeling of files

Different colors are used to label the files as per their types, 100 files per one bundle and each bundles are with separate label should prepare. And labels are highlighting the details of check list given in Table 6

“Table 6” Check list details

Type of files	Colors used
A type	Red (Permanent files)
B type	Green (30 years)
C type	Yellow (10 years)
D type	White (5 years)
E type	Blue (1 year)

5.8 Bundling of files

The distributed files in random manner at record room were bundling as per the year wise as shown below Fig.3



“Fig.3” File Bundling process

5.9 Files arrangement in proper racking system

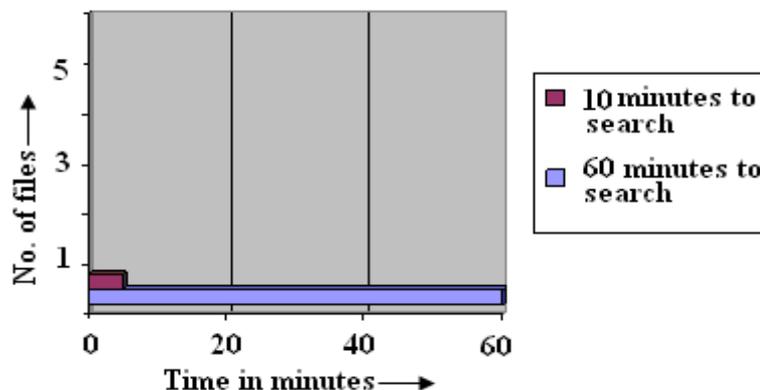
1 to 35 numbers are allotted as per the total number of wards in hassan city. As per their storage pattern for permanent storage, storage up to 30 years, 10 years, 5 years and 01 year with different colour code as red, green, yellow, white and blue respectively are made using 5s as a principle.

5.10 Closing or destruction of files

For 30 years old files are destroyed as per the higher instructions some of the images of files storage in racks with their color identifications are given below sketches

VIII. Comparative Study

The comparison results of reduction of searching a file process time given by graphical method after the implementation of 5S technology to a file searching process at record room of CMC, hassan from previous to current status is as shown below. Fig. 4



“Fig 4” File search comparison before and after 5s application

IX. Results And Discussions

After the implementation of lean tools like 5S technology to the file searching process of CMC, Hassan, the total reduction time comparing with previous manual searching of file method is 60 minutes and

after implementation of 5s principles to file segregation and sorting process the total file searching time for the public (customer) is reduced to 10 minutes only. This increases the time efficiency in terms of 83.4% . Especially in public organization like CMC, Hassan, in this way the customer is getting maximum benefit by using 5s application like segregation, labeling, checklist preparation, software application and closing of destructive files through the seiry, sheiton, shitsuke, seiketsu and seiso respectively. In this way simple changes in any process using lean manufacturing technology in supply chain activities can make better results and giving more satisfaction to the customer can achieve easily.

X. Future Work

The total study intension is to improve the CMC office from manual to computerized environment through the application of simple 5s principle to their work environment, which reduces the total time required for searching files. Which helps to reduce the process time in office relate to record room files. In other way we can use this lean technology to other processes like health and safety projects like garbage maintenance, hygienic management for hotels in city, water distribution network to publics are more powerful factors to study and their improvement through the application of lean and supply chain principles with minimum changes in the existing process is more powerful tool for any of the small and medium organizations. This will also give more powerful satisfaction to the customers.

XI. Conclusion

Implementation of lean manufacturig principle to the supply chain line activities can helps to reduce the waste in the small and medium enterprises for the betterment of the customer or publics through the reduction of manpower and their errors in terms of time, quality and perfection towards the customer views in smooth manner and also strong data management and their documentation can successfully achieved for the longer services to the publics with minimum expenditure is the main motive of this work.

References

- [1]. J. Michalska, D. Szewieczek, The improvement of the quality management by the activity-based costing, *Journal of Achievements in Materials and Manufacturing engineering*, 21(1), 2007, 91-94.
- [2]. T. Karkoszka, D. Szewieczek, Risk of the processes in the aspect of quality, natural environment and occupational safety, *Journal of Achievements in Materials and Manufacturing Engineering* 20, 2007, 539-542.
- [3]. Brah SA, Chong WK Relationship between total productive maintenance and performance. *International Journal of Production Research*, 42(12), 2004, 2383-2401.
- [4]. Bayo-Moriones, A., A. Bello-Pintado, and J.M.D. de Cerio, 5S use in manufacturing plants: contextual factors and impact on operating performance. *International Journal of Quality & Reliability Management*, 27(2), 2010. p. 217-230.
- [5]. Chapman, C.D., *Clean house with lean 5S. Quality progress*, 2005. 38(6), 27-32.
- [6]. Kumar, M., et al., Implementing the Lean Sigma framework in an Indian SME: a case study. *Production Planning and Control*, 17(4), 2006. 407-423.
- [7]. Gapp, R., R. Fisher, and K. Kobayashi, Implementing 5S within a Japanese context: an integrated management system. *Management Decision*, 46(4), 2008, 565-579.
- [8]. Ananthanarayanan, K., Application of 5S Management System in NDE Laboratory. *National Seminar on Non-Destructive Evaluation*, 2006.
- [9]. Ho, S.K.M., Japanese 5-S where TQM begins. *The TQM Magazine*, 11(5), 1999, 311-321.
- [10]. Nilipour, A. and M. Jamshidian, 5S As an Environmental Organization Management Tool; Benefits and Barriers. *International Management Conference*, 2005.
- [11]. Ho, S.K., S. Cicmil and C.K. Fung., The Japanese 5-S practice and TQM training. *Train. Qual*, 3, 1995, 19-24. DOI: 10.1108/09684879510098222.
- [12]. Ho, S.K. and S. Cicmil, Japanese 5-S practice. *The TQM Magazine*, 8(1), 1996. 45-53.
- [13]. M. Dudek-Burlikowska, Quality estimation of sale process with usage of quality methods in chosen company, *Journal of Achievements in Materials and Manufacturing Engineering* 20, 2007, 531-534.
- [14]. Chauhan et al., Measuring the status of Lean manufacturing using AHP, *International journal of Emerging technology*, 1(2), 2010, 115-120.
- [15]. Hudli and Imandar, "Areas of Lean manufacturing for productivity improvement in a manufacturing unity, *World academy of science, engineering and technology*, 69, 2010.
- [16]. Khedkar et al. "Study of implementing 5S techniques in Plastic Molding, *International Journal of modern engineering research*. 2(5), 2012, 3653-3656.
- [17]. A. Nilipour, & M. Jamshidian, "5S as an environmental organization management tool: Benefits and barriers," *Proceedings of the 3rd International Management Conference*, 2005, Dec 20-25, Tehran, Iran.