



Barriers Analysis for '5S' Implementation in Small Scale Plastic Water Tank Manufacturing Industry Using Interpretive Structural Modeling

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Abstract—The purpose of this thesis is to find out the barriers in the implementation of “5S” in small and medium scale industry and for this Utkarsh Polyworld Water Tank manufacturing industry is taken as experimental industry. “5S” is a very simple tool for small scale industries that will support them for simplicity in work and provide a work culture which will increase productivity and prosperity. Small and medium scale industries are mainly suffered from experienced guidance and support for the implementation of “5S”. Therefore in this research work barriers are find out with the help of experts from industries and academies and suggested process is implemented in Utkarsh Polyworld Manufacturing industry. By deep analysis of literature review and brain storming with experts a effective mathematical tool Interpretive Structure Modelling tool is used to prioritize the barriers as per their weight age in the implementation of “5S”.

Design/methodology/approach—The foundation of the thesis is mainly set by detailed study of literature survey and brain storming with the experts from industry and academic. Therefore with the help of brainstorming 09 barriers were selected those are mainly affect the implementation of “5S” in Utkarsh Polyworld Water Tank

Manufacturing industry and to find out the driver and dependent barriers Interpretive Structure Modelling mathematical tool methodology is used. This barrier analysis of “5S” was implementing in “Utkarsh Polyworld Water Tank” manufacturing industry situated in Maneri district Mandla. The 5S barriers analysis results were shown with the help of MICMAC analysis and by ISM model.

Practical implications – The research work was providing a good culture and procedure to the organization by which limited resources of small scale industry can be fully utilized and enhance productivity, profitability and competition from market. The implementation of “5S” also reduces the chance of accidents and safety of all employees also improves.

Keywords:— Small Scale industry; 5S industrial tool and Interpretive Structure Modelling tools.

1. INRODUCTION

The 5's practice is a collection of working tools of lean manufacturing that organization, set in order, cleanliness, standardization and discipline in any workplace. This research worker presents a case study on the implementation of the 5's industrial tool in a small and medium

enterprise (SME); so as to they become more efficient, effective, productive and able to compete with big industries market competition.

Japanese 5S is a technique, offers a support to 'Small and Medium Enterprises' in reducing engineering time, increases productivity, enhance worker productivity, reduce their manufacturing costs and make easy employee's supervision, better space utilization, improves process flows. The 5S is fantastic tools which drastically increase the working comfort and provide a systematic working environment which enhance an organization's working practices. Takashi Osada was the first to formalize the practice of 5S in 1980s using the Japanese terms Seiri, Seiton, Seiso, Seiketsu and Shitsuke to represent different phases in the process of workplace organization [Gapp R, Fisher R, Kobayashi K.(2008) Implementing 5S within a Japanese context: an integrated management system. *Management Decision*; 46: 565-579].

5S is a basically developed in Japan and has generated substantial results in industrial and service sectors. These results are briefly known as incidents prevention, delays 'education and productivity enhancement in work environment. The ultimate goal of 5S is to prevent losses. Despite seeming simplicity of 5S in concept and implementation, organizations have great difficulty in its execution. In fact, managers and executive personnel are not well aware of goals of 5S. Therefore, it is quite difficult to set appropriate ground for implementing 5S, unless its principles are well comprehended. These principles are known in form of five Japanese words, beginning with letter which later formed the term 5S.

Small and Medium Enterprise (SME)

In 2018, a bill was introduced by the then Minister of MSME, Giriraj Singh, who proposed changes to the definition of MSMEs in the existing MSMED Act 2006. The new classification approached the changes in MSME classification from a structural point

of view. Instead of an investment-based approach, they changed it to a turnover based approach. Moreover, the demarcation between manufacturing and service MSME was also dissolved. According to the new definition, the following classification system will be followed:

- Micro enterprise: Enterprises having an annual turnover less than or equal to Rs. 5 crores.
- Small enterprise: Enterprises having annual turnover between Rs. 5 and Rs. 75 crores.
- Medium enterprise: Enterprises having annual turnover between Rs. 75 and Rs. 250 crores.

Let us breakdown this meteoric rise of MSME sector in India. But before that, let us understand the challenges faced by the SME sector in India. While SME contributes a total of 45% of total manufacturing and output of over 40% to the nation, the sector is still clogged by several factors, such as the lack of ease of MSME Loans, not getting enough support from governments; banks have too many uncomplicated MSME loan schemes, and competition from more sophisticated outfits. Other latent challenges are – the sector is often a one-man-show, the products are qualitatively average and mired with limited understanding and limit to scale.

2 . STRUCTURE OF THE LITERATURE

Literature work of this thesis has been prepared by the help of guide, industry owner and research paper deep study. The including all the literature structure is shown by below given frame work:

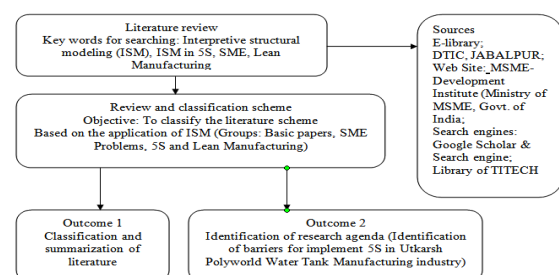


Figure 1: Literature review framework

3. PROBLEM STATEMENT

The small-scale industries are very important for Madhya Pradesh because SME helps to promote industrialization, producing new jobs and increase economy of Madhya Pradesh. Madhya Pradesh GDP is 9.62 lakh crore in 2019-2020 in which industrial sector GDP is 20% only and human development index rank is 32 hence Madhya Pradesh need to improve industrialization. To improve and enhance industrialization in Madhya Pradesh, state government has taken lots of steps like “Mukhya Mantri Swarojgar Yojana” etc. and also supported by Central government schemes. Apart from government schemes the entrepreneur of Madhya Pradesh SME’s are lacking technical and marketing support.

The strong Technical and Marketing strategy will help in sustainable growth. To consider the above issues of lacking technical and marketing support, in this research work the technical support is apply in one of the SME’s of plastic water tank manufacturing industry Utkarsh Poly World. The Utkarsh Poly World water tank manufacturing industry already has implemented “5S” technique for improvise productivity but they are unable to attend the all problems and issues in the implementation of “5S”. Therefore to prioritize the barriers in the implementation of “5S” process is the main objective of this research work.

4. RESEARCH STRUCTURE

The aim of this paper is to help out the “Utkarsh Polytank water tank” manufacturing industry to prioritize the barriers as per their weightage in the implementation process of “5S”. Therefore in this research work a research structure is prepared by which Utkarsh Polytank manufacturing industry can easily find out the barriers in the implementation process of “5S” and at the same time knows about their weightages.

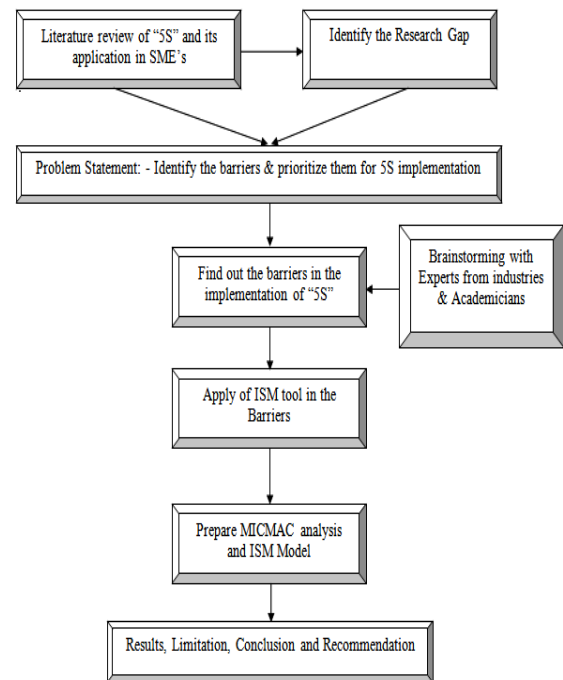


Figure 2: Research Flow Chart

Barriers to implement “5S” in Polyworld Water Tank Manufacturing Industry

Based on literature analysis and consultation with various expert from industries and academicians following 09 barriers were find out for implementation of green supply chain management in Utkarsh Polyworld Water Tank industry. These barriers are given explanation in the following sub-sections:-

1. Lack of importance from top management.
2. Lack of clarity of purpose of 5S implementation
3. Organization work culture
4. Problem of skilled manpower
5. Absence of adequate infrastructure
6. Lack of finance
7. Lack of training
8. Lack of incentives and rewards
9. Low awareness towards its benefits

5S Data for finding barriers in the Implementation of “5S” in Utkarsh Polyworld Water Tank Manufacturer

To conduct this research work number of meetings and interview were organize with the owner of Utkarsh Polyworld Water Tank Manufacturer and academician of relevant area or have work on with similar areas. To collect the data for this research work following steps has been taken:

- Study the research journal in the area of SME’s and 5S implementation.
- Select the most relevant research journals and thesis work done by previous research scholars.
- Segregate the relevant barriers from all research papers and discuss about the barriers with the expert from industry and academic.
- Write down the all barriers and discuss with the owner of Utkarsh Polyworld and academician from different colleges.
- All this brainstorming work is summarize and 09 most suitable barriers are separated for further research work.

Data Collection & Processing

Data collected as per above describe in

chapter point 5.1 next step is to processing the data to prioritize the barriers by finding out the weightage of barriers for this purpose “Interpretive Structure Modeling” tool is used.

Interpretive Structure Modeling tool is used for processing the data because this tool provides the drivers and driven barriers for the implementation of “5S” in Utkarsh Polyworld Water Tank manufacturing industry.

Development of SSIM

After recognizing and write down the various barriers an SSIM matrix is created. For this purpose, a group consisting of academicians and industrial experts was formed and their judgments regarding the various interrelationships existing between the barriers was listed in the form of a SSIM sheet.

In this above given SSIM four symbols are used V, A, X and O, these symbols notations are given below:

Symbols — Meaning

V — Barrier i will drive to barrier j;

A — Barrier j will drive to banner i;

X — Barrier i and j will drive to each other;

Table 1: Structural Self Intersection Matrix (SSIM)

Barrier Number	Barrier Description	9	8	7	6	5	4	3	2
1	Lack of importance from top management	A	V	V	A	O	V	O	A
2	Lack of clarity of purpose of 5S implementation	A	V	O	O	V	A	X	X
3	Organization work culture	A	O	X	A	X	A	X	
4	Problem of skilled manpower	V	O	A	A	A	X		
5	Absence of adequate infrastructure	O	O	V	A	X			
6	Lack of finance	A	V	V	X				
7	Lack of training	A	A	X					
8	Lack of incentives and rewards	A	X						
9	Low awareness towards its benefits	X							

O — Barrier i and j will not drive to each other;

As per SSIM it's clear according to VAXO that in column1 & row1 "A" is write it means barrier 9 will drive to barrier 1. It means barrier 9 "low awareness towards its benefits" will drive the barrier 1 "lack of importance from top management". Similarly in row1 and column 2 write "V" it mean barrier-1 "lack of importance from top management" will drive barrier-8 "Lack of incentives and rewards". According to table 2 experts panel will fill the SSIM and final SSIM prepared which will further useful to form initial reachability matrix.

Development of IRM

To cultivate the reachability matrix, the symbols of SSIM table 3 are transformed into binary numbers '0s' and '1s' in the initial reachability matrix. To produce an initial reachability matrix following 4 steps are following:

> if the (i, j) entry in the SSIM is V, then the (i, j) Entry in the reachability matrix become 1 and the (j, i) entry becomes 0.

Entry in the SSIM — V

Entry in the reachability matrix (i, j) — 1

Entry in the reachability matrix (j, i) — 0

> if the (i, j) entry in the SSIM is V, then the (i, j) Entry in the reachability matrix become 1 and the (j, i) entry becomes 1.

Entry in the SSIM — X

Entry in the reachability matrix (i, j) — 0

Entry in the reachability matrix (j, i) — 1

5. ITERATION SUMMARY

Below given the iteration summary of all the barriers and this will useful in the formation of ISM model. Iteration summary will give the level of all barriers. Level of barriers will help the owner to find the weightage and priority of barriers.

Development of ISM Model

The ISM is a very useful block diagram because this will provide the level and weightage of the barriers in at a glance. This research work interpretive structure model is

Table 2: Initial Reachability Matrix

Barrier Number	Barrier Number									Driving Power
	D1	D2	D3	D4	D5	D6	D7	D8	D9	
D1	1	0	0	1	0	0	1	1	0	4
D2	1	1	1	0	1	0	0	1	0	5
D3	0	1	1	0	1	0	1	0	0	4
D4	0	1	1	1	0	0	0	0	1	4
D5	0	0	1	1	1	0	1	0	0	4
D6	1	0	1	1	1	1	1	1	0	7
D7	0	0	1	1	0	0	1	0	0	3
D8	0	0	0	0	0	0	1	1	0	2
D9	1	1	1	0	0	1	1	1	1	7
Dependence Power	4	4	7	5	4	2	7	5	2	40

Table 3: Iteration Summary

Criterion Number	Reachability Set	Antecedent Set	Intersection	Level	Iteration Number
8	7,8	1,2,6,8,9	8	I	Iteration I
7	3,4,7	1,3,5,6,7,8,9	3,7	II	Iteration II
1	1,4,7,8	1,2,6,9	1	III	Iteration III
3	2,3,5,7	2,3,4,5,6,7,9	2,3,5,7	III	Iteration III
4	2,3,4,9	1,4,5,6,7	4	III	Iteration III
5	3,4,5,7	2,3,5,6	3,5	III	Iteration III
2	1,2,3,5,8	2,3,4,9	2,3	IV	Iteration IV
6	1,3,4,5,6,7,8	6,9	6	V	Iteration V
9	1,2,3,6,7,8,9	4,9	9	V	Iteration V

divided in 5 levels. The arrows shown in the ISM will guide from bottom to top. The arrow directions bottom to top means that the most important barriers lies bottom of the ISM and less important barriers will lies on top. It means barriers importance and weightage will increase from bottom to top. Continuous arrow with both side head is shows the interrelation between the barriers, it means both will drive to each other.

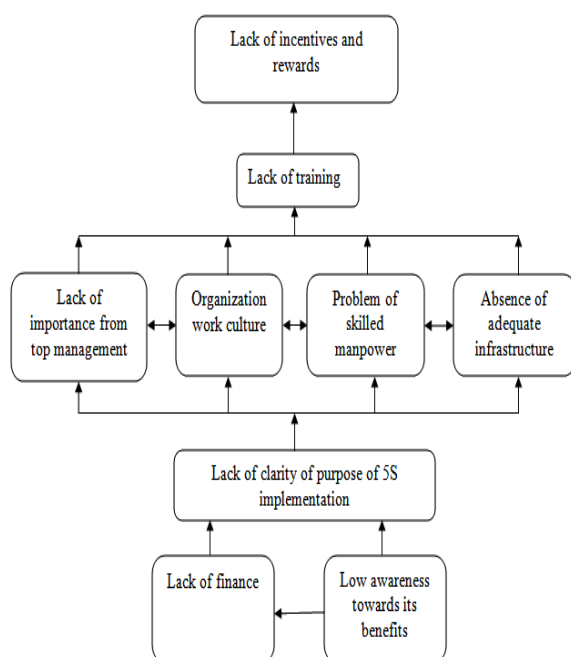


Figure 3. Interpretive Structure Model (ISM)

6. RESULTS

This research work is mainly considered the problem faced by the Utkarsh Polyworld Water Tank manufacturing industry in the implementation of “5S” in their organization. Hence to solve the implementation problem brainstorming and interview with owner have been done by considering the Utkarsh Polyworld Water Tank manufacturing industry work culture and environment. In this research work brainstorming and ISM tool are become very useful because this tool provide the following results:

- 09 important barriers were found out; those affect the implementation of “5S” in Utkarsh Polyworld Water tank manufacturing industry.
- ISM tool is providing the level of all barriers and also give the interrelation, priority and weightage of the barriers.
- Interpretive Structure modeling diagram has been providing the importance of all barriers by at a glance.

The reachability matrix complete iteration is done in 5 levels. All the nine

barriers come under in these five levels. The barriers in the implementation of “5S” have been identified into 5 levels. The fifth level of iteration have two barriers “Lack of finance” and “Low awareness towards its benefits”; it means these two barriers are most important in the implementation of “5S” in Utkarsh Polyworld Water Tank manufacturing industry.

Similar above level 4 and 3 have medium important it means barriers “Lack of clarity of purpose of 5S implementation”, Lack of importance from top management, Organization work culture, Problem of skilled manpower and Absence of adequate infrastructure are important but have less importance than level 5.

Level 2 and 1 have less important for SME owner in the implementation process of “5S” in Utkarsh Polyworld manufacturing industry.

7. CONCLUSIONS

This research work is very useful for most of the relevant SME’s because by this thesis SME’s owner knows the weightage and importance of the barriers in the implementation process of” 5S’ in their organization.

For Utkarsh Polyworld Water Tank industry owner can easily concluded by the help of interpretive structure modeling, that the priority and importance of barriers have following sequence:

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Barriers Number	Level As Per ISM	Level of Importance
9	V	Most Important
6	V	Most Important
2	IV	Medium Important
5	III	Medium Important
4	III	Medium Important
3	III	Medium Important
1	III	Medium Important
7	II	Less Important
8	I	Less Important

REFERENCES:

- [1] A.P. Puvanasvaran, Robert S.T. Kerk1 and A.R. Ismail “A Case Study of Kaizen Implementation in SMI” National Conference in Mechanical Engineering Research and Postgraduate Studies (2nd NCMER 2010) 3-4 December 2010, Faculty of Mechanical Engineering, UMP Pekan, Kuantan, Pahang, Malaysia; pp. 374-392.
- [2] Aman Gupta*, Sanjeev Verma, Shaman Gupta” An Application of 5s Concept to Organize the Workplace at A Small-Scale Manufacturing Company” IJESRT Vol. January 2015.
- [3] Amit Kumar Gupta, Dr. R. K. Garg, “OEE Improvement by TPM Implementation: A Case Study” IJIEASR Volume 1, No. 1, October 2012.
- [4] B. Modarress, A. Ansari & D. L. Lockwood “Kaizen costing for lean manufacturing: a case study” International Journal of Production Research, Vol. 43, No. 9, 1 May 2005, 1751–1760.
- [5] Bullington, 2003; Cooper et. al, 2007; Womack & Jones 1991.

- [6] Gupta, S. and Jain, S.K. (2014), "The 5S and kaizen concept for overall improvement of the organization: a case study", *International Journal of Lean Enterprise Research*, Vol. 1, No.1.
- [7] Hirano, H. (1993) *Putting 5S to Work: a Practical Step-by-Step Approach*. English Translation edn. Tokyo, kyoto, New York, Singapore: PHP Institute Inc.
- [8] HungLin, Chi "5S implementation in Wan Cheng Industry Manufacturing Factory in Taiwan" May 2011.
- [9] Jie Ma "The Adoption and Implementation of Kazen in Sino-Japanese Automotive Joint Ventures" Newcastle University Business School, September 2013.
- [10] Jos Frijns and Bas Van Vliet , "Small -Scale Industry and Cleaner Production Strategies" *World Development* Vol. 27, No. 6, pp. 967±983, 1999 Elsevier Science Ltd.
- [11] Katarzyna Łyp-Wrońska1, and Bartłomiej Tyczyński1, "Analysis of the 5S method in production enterprise - case study" *MATEC Web of Conferences* 183, 01016 (2018).
- [12] *Khanna V.K., (2009), "5S and TQM status in Indian organizations", The TQM Journal, Vol. 21 Iss: 5, pp. 486 – 501.*
- [13] Kumar and Kumar, Steps for Implementation of 5SI, *International Journal of management. IT and Engineering*. vol. 2, no.6, pp.402-416, 2012.
- [14] Manuel F. Sua´rez-Barraza and Juan Ramis-Pujol "Implementation of Lean-Kaizen in the human resource service process A case study in a Mexican public service organization", *Journal of Manufacturing Technology Management* Vol. 21 No. 3, 2010 pp. 388-410.
- [15] Nonxuba admin icarntombekaya, "The application of total quality management within small and medium enterprises" by Cape Peninsula University of Technology Bellville September 2010.
- [16] *Pheng, L.S. and Khoo, S.D. (2001), "Towards TQM-integrating Japanese 5-S principles with ISO 9001:2000 requirements", The TQM Magazine, Vol. 13, No. 5, pp. 334-341.*
- [17] *R. S. Agrahari, P.A. Dangle, K.V. Chandratre" Implementation of 5S Methodology In The Small Scale Industry: A Case Study IJSTR©2015 Volumn 4 , Issue 04, April 2015.*
- [18] Sorooshian, S., Salimi, M., Bavani, S. and Aminattaheri, H. (2012), "Case Report: Experience of 5S Implementation", *Journal of Applied Sciences Research*, Vol. 8, No. 7, pp. 3855-3859.