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Quantification of Leanness in a Textile Industry

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ABSTRACT:
Right from the industrial revolution, industrial sectors are in the continuous process of improving their productivity. Researchers and practitioners working in productivity improvement area are deriving various strategies. One among these strategies is lean manufacturing. Lean manufacturing aims to identify and eliminate wastes in their working environment. The implementation of lean manufacturing has to be initiated with lean assessment. The lean assessment indicates the criteria which are not practiced for lean implementation in the industry. The scope of this paper is to carryout lean assessment in a textile industry by name Anjaneya Cotton Mill (ACM). The questionnaires for lean assessment have been developed by considering thirteen criteria grouped under four lean enablers. The assessment indicated that, ACM is practicing 51.83 % of leanness. However, a gap of 48.17% is prevailing in ACM. In order to fill this gap proposals were drawn. Most of the proposals drawn have been accepted by the management of ACM. The case study presented in this paper shall be utilized by the contemporary practitioners in implementing lean manufacturing.

KEYWORDS: *Lean manufacturing, Lean assessment, Leanness, Textile industry*.

I. INTRODUCTION

Textile manufacturers have sought to improve their manufacturing processes so that they can more readily compete with global manufacturers. Lean manufacturing techniques are the primary methods for a fair competiveness by reducing wastes. Lean manufacturing is defined as "A systematic approach to identifying and eliminating waste (non-value-added activities) through continuous improvement". Lean is concerned with eliminating all types of waste, which is much more than eliminating waste by reducing inventory. Wastes can be classified as: overproduction, time on hand, transportation, over processing, inventory, movement and defective products. All the lean tools work towards common goals of eliminating this waste in order to bring the most value to the customers. The lean tools are: visual management, policy deployment, quality methods, standardized work, just-in-time and improvement methods (5s, TPM, poka-yoke, kanban, cellular manufacturing, SMED, kaizen, value stream mapping) (Hodge et.al., 2011). One of the research agenda in lean manufacturing is the assessment of leanness (Vinodh & Vimal., 2012). The work reported in this paper was carried out to contribute a refined, exhaustive and simple leanness assessment tool. Accordingly a tool called 13 LM criteria assessment tool was designed during this work. Using this tool, the total leanness level in a textile industry was assessed. After a comprehensive analysis, the percentages of implementation of lean tools were identified. Subsequently, the success ingredients for overcoming them were evolved and suggested. These details of this work are presented in this paper.

II. LITERATURE REVIEW

Hodge et.al. (2011) determined which lean principles are appropriate for implementing in textile industry. This paper investigates the different tools and principles of lean and the use of lean manufacturing in the textile industry was examined by the researchers by considering plant tours and case studies. From this case study the researchers came to a conclusion that lean manufacturing is a strategy that does not require large investment in automation or IT and it can be implemented in both small and large companies where all employees can be involved in improving operations to meet customer needs.

Chauhan and Singh (2012) aimed to identify the measuring the associated parameters of lean. The paper provides the most important parameters to measure the status of lean manufacturing. The author concluded that, there is a broad scope to focus on the elimination of different forms of wastes from manufacturing system for the lean manufacturing in India. Green et.al (2010) wants to implement lean in a material handling system for petroleum drill bit manufacturing company. They addressed that the operational group with a tool to assist in defining the objectives of lean manufacturing has been developed by the authors. At the end, it is concluded that a special solution was developed from the process of implementing the project. The methodology was developed using lean manufacturing concepts and the material handling issues and the author identified through assessing the cells selected for the implementation of lean manufacturing in material handling operations. Review based on leanness assessment is presented in Vinodh & Vimal(2012). This paper presents the 30 criteria based leanness assessment methodology using fuzzy logic. Fuzzy logic has been used to overcome the disadvantages with scoring method such as impreciseness and ambiguity. In this paper, a conceptual model for lean assessment has been designed. Then the fuzzy lean index which indicates the lean level of the organization and fuzzy performance importance index which helps in identifying the obstacles for leanness has been analyzed. The results indicate that the model is capable of effectively assessing leanness and has practical significance. Taj (2005) presented a spreadsheet-based assessment tool to evaluate nine key areas of manufacturing namely, inventory team approach, processes, maintenance, layout/handling, suppliers, setups, quality, and scheduling/control. The results are then displayed in the score worksheet and finally a lean profile chart is created to display the current status of the plant and the gap from their specific lean targets. It is found from the results that lean assessment tool have revealed significant gap from the lean manufacturing target, and also identified opportunities for improvement. This paper provides a practical and easy way to use assessment tool to help manufacturing managers to make their manufacturing operations more productive. The literature survey presented in this section indicates that researcher have applied various tools for achieving leanness. However there is a lot of scope to implement this tool in other industrial sector for achieving leanness. In this background the scope of this paper is to quantify leanness in a textile industry.

III. METHODOLOGY

The study begins with the literature review on lean manufacturing. Based on literature review lean assessment tool has been developed which is divided in to two levels namely criteria and enablers. Then Anjaneya Cotton Mill (ACM) is selected as a case company. The questionnaire has been developed and responses were collected for the study. The leanness has been identified by scoring method and finally suitable suggestions were derived to overcome the leanness gap.

IV. CASE STUDY

4.1 About the case company

ACM is located in Davangere. In ACM yarn types of product are producted. The current turnover of ACM is 45 to 50 lakh. Presently 1500 employers are working in ACM.

4.2 Interviews

Leanness assessment was carried out using 13 criteria LM assessment tool in industry ACM. ACM is in the process of implementing LM strategy like 5s, kaizen, TPM, etc. these existed a need for organisation to measure leanness.

The case study was begun by exposing the developed 13 criteria LM assessment tool to General manager, Factory manager, Maintenance engineer of ACM. Subsequently questions concerning LM criteria were supplied to these personnel. These questions were so simple that respondent experienced no difficult in responses to these questions. As a sample, the questionnaire concerning LM criteria as shown in table 1. The marks allotted for each response of the questionnaire as shown in table 2.

Table 1: Questionnaire used to assess multifunctional team criteria

(I) Multifunctional team (MT):

1.	Cross training of workers is a regular feature?		
a.	Yes [ ]	b. Partially [ ]	c. No [ ]
2.	Empowerment of workers is enough?		
a.	Yes [ ]	b. Partially [ ]	c. No [ ]
3.	Projects are finalized with the consent of experts of various areas?		
a.	Yes [ ]	b. Partially [ ]	c. No [ ]
4.	Quality circle concept is utilized holistically?		
a.	Yes [ ]	b. Partially [ ]	c. No [ ]

Table 2: Marks allotted for each response in multifunctional team criteria

No.	CRITERIA	Q. No.	a	b	c
1	Multifunctional teams (MT)	1	15	8	0
		2	10	5	0
		3	10	5	0
		4	15	8	0

Converting responses into marks is illustrated here with the support of table 3. The first responder response against the questions 1-4 are shown in the table 3. By referring to the marks allotment given in the table 3 marks obtained against the responses of R1 (respondent 1) under LM criteria is computed. As shown in table 3 marks obtained is 23 out of 50. Similarly the computations of marks against the responses of all respondents against 13 criteria were carried out. The computed marks are present in table 4.

Table 3: Computation of marks obtained against the responses of R1 under LM criterion (multifunctional team)

LM criterian	Question no.	Responses of R1	Marks obtained
Multifunctional teams	1	b	8
	2	b	5
	3	a	10
	4	c	0
		Total	23

V. QUANTIFICATION OF LEANNESS

Table 4: Quantification of leanness under 13 criteria:

Leanness enablers	Leanness criteria	Maximum marks	Respondents			Average marks
			R_1	R_2	R_3	
Employees	Multifunctional teams	50	23	43	18	28
Technology	TPM	100	78	70	92	80
	Visual management	100	70	55	80	68.33
	SMED	100	55	100	80	78.33
	Automation	100	26	65	50	47
Manufacturing management	JIT	75	18	51	23	30.66
	Pull of raw material	25	8	20	16	14.66
	Supplier feedback	50	25	40	20	28.33
	Continuous improvement	150	84	120	56	86.66
	Elimination of waste	100	58	92	50	66.66
	Kanban	50	10	20	10	13.33
	Zero defects	50	15	40	20	25
Manufacturing strategy	Status of quality	50	22	50	22	31.33
					Total average marks	518.29
				Total leanness (TL)		0.5182 ≈51.83%

As shown in table 4 TL of ACM is 51.83%. The calculation of TL in ACM is given below

TL = total average marks/1000

TL = 518.26/1000

= 0.518 ≈ 51.83%

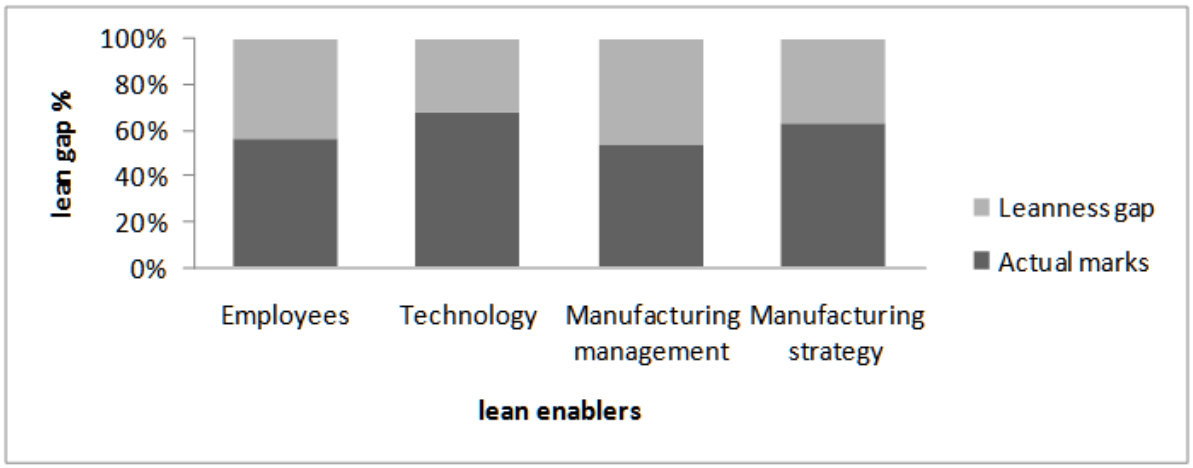

Figure 1: Gaps under LM enablers in percentage at ACM

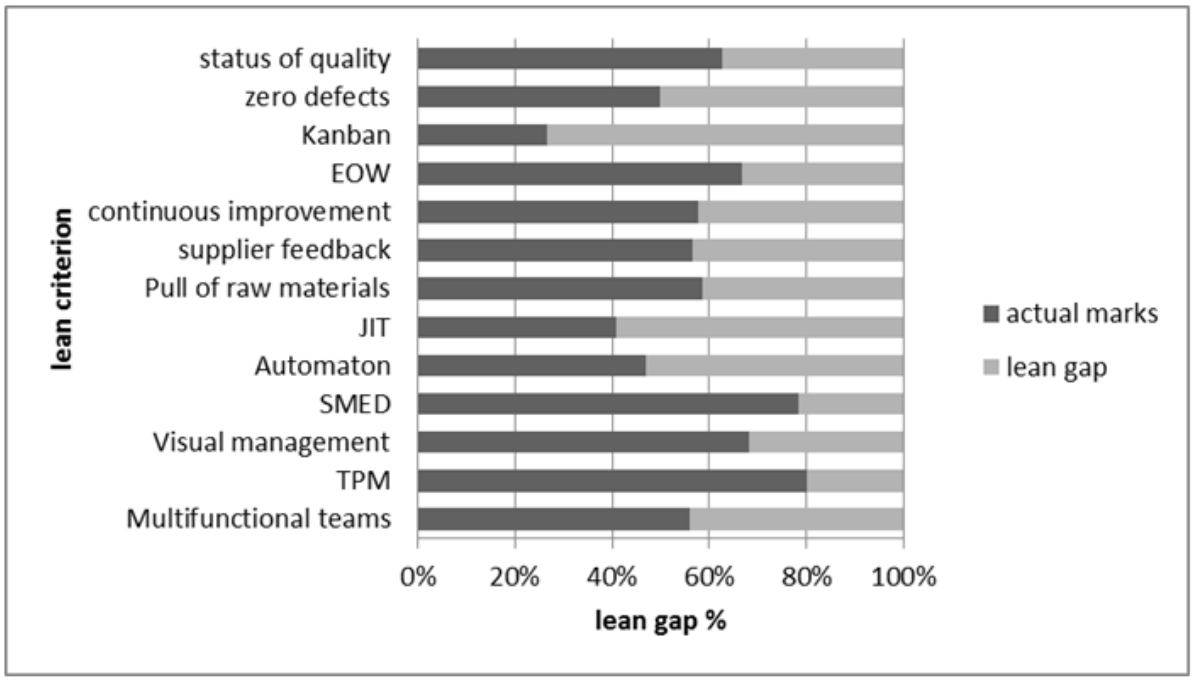

Figure 2: Gaps under LM criteria in percentage at ACM

As TL at ACM was found to be 0.518. It can be inferred that ACM has also potentials to increase its leanness level. In order to identify these potentials, the gap analysis of each LM criteria was carried out. Fig 1 shows the gaps between the actual and goal computed in terms of percentage under the four lean enablers. Fig 2 displays pictorially the gaps prevailing in each lean criterion in term of percentage. As shown in Fig 1 lean enablers such as employees and manufacturing management has more leanness gap compare to another two lean enablers. Among all criteria jit, supplier feedback, continuous improvement, kanban, automation, multi-functional teams are less than 60%. However to overcome leanness gap suitable suggestions are proposed to management.

Table 5: Identified the weak factors and suggested improvement methods

Serial No.	Weak factors	Improvement methods	Opinion/reaction of MD (in his own words)
1	Weak in Streamlining of processes	Adoption of value stream mapping	Yes we will try to adoption
2	Regular employer–employees meeting not conducted	Regular meeting will convey the company objective clearly	Always not possible
3	No job rotation system	Job rotation system make existing employee multi-skilled	Partially existed
4	Not conducting Education and cross-training employees	Regular conduction of training/ workshops will give knowledge of new manufacturing practices	Always not possible
5	Machines cannot accommodate varied jobs.	Incorporate advance technology	Lack of initial investment
6	Cross functional teams not fully successful.	Employ quality circle	ok
7	Long term manufacturing planning	Implement JIT production system	Try to implement
8	No inclusion of employee suggestion scheme	Reward scheme	ok
9	Not conducting training in continuous improvement methods and group technology	Regular conduction of training	Always not possible

VI. CONCLUSION

Despite this fact, not all companies have been able to fully acquire lean characteristics. These companies are in need of assessing the level of leanness at which they operate and the efforts that have to be exerted by them to acquire all LM capabilities. A simple and exhaustive lean assessment tool with 13 criteria has been contributed in this paper. Using this tool, leanness of ACM has been found. This quantification indicated that the TL of ACM is 51.8%. This would mean that the ACM has acquired 51.8% of LM capabilities. This quantification coincides with the assessment made at ACM. A 13 criteria LM assessment tool contribute percentage implement of lean in ACM. After that suggestions were proposed to overcome the leanness level. The company can use this leanness assessment procedure as a test kit for periodically evaluating the leanness level. This kind of leanness assessment helps to survive and grow in the competitive business environment by minimizing wastes.

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