Study and Analysis of Lean Techniques in Indian Industry

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Abstract : The Indian industry is one of the fastest growing industries and investments are flowing in to increase its manufacturing capacity. But, India is facing many more challenges such as customer's expectation, widening customer base of existing ones, fluctuating demand, taxation, lack of infrastructure facilities and intense competition. Thus, India needs to be more efficient in her key activities or processes to cope with the problems. Lean manufacturing could be a solution in order to improve the performance in this competitive world market where uncertainty is prevalent. The purpose of this study is to examine the techniques of adopting lean and the tools implemented the motivators, obstacles and challenges in adopting lean in Indian manufacturing industries. Lean is not simply a business improvement tool. It is a philosophy which needs to be extracted from the top team down if it is to generate required levels of understanding and belief. In this paper, the implication of lean manufacturing used in manufacturing industries needs to be explored .Does the modern technology facilitate the implementation lean techniques like value stream mapping, just in time (Jit) production systems or can it serve as a substitute for lean. Some of the examples of use of lean Manufacturing techniques for these purposes are presented.

Keywords*: lean manufacturing, value stream mapping, just in time, Toyota lean system, Indian industry, waste elimination.*

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I. INTRODUCTION

Lean manufacturing or waste management is a new type of production system, which includes mass and craft benefit together. This method is based on multiskill workers and automatic and flexible machines. In the lean techniques producers wish in reducing resource consumption. In this case work force, capital invested in machinery purchasing and installation, space required for production, material, inventories, and design. Therefore designing and making period as well as distribution and selling of a product would be reduced. And this is just the main goal of lean production (Womack et al. 1990). After lean production introduction in 1970s, many books and articles have been published regarding various aspects of leanness which show the effect of this paradigm on the world of production and operations. Orienting management research toward lean concepts, lot of attempts devoted to development of a tool to measure organizational leanness, since in order to have any kind of analysis, planning and then control (that from main elements of management), having a well-founded and structured style for evaluation of concepts is inevitable (Sink and Tuttle, 1989). In this regard, various styles are proposed by researchers for measuring organizational leanness, like methods according to logical concept of hierarchal process which are developed for organizations' comparison from view point of leanness (Agarwal et al., 2006). In this process, Pairwise comparisons are used to assess organizations' leanness capability. However, most researches use integrated index for measuring organizational leanness, that is sum of simple or weighted items' scores (Kojima and Kaplinsky, 2004; Rivera and Chen, 2007; Shah and Ward, 2007). Developed method in the previous stages is employed to assess an organization's leanness as a case study, and finally the last part covers the discussion and conclusion

II. LITERATURE REVIEW

Lean production two revolutions occurred in the production arena in 20th century. The first revolution was set by Henry Ford and Alfred Sloan after World War I which led to termination of craft production era the advent of mass production. The second revolution was set by Taiichi Ohno at Toyota Company which caused creation of lean production method. In 1945, Eiji Toyoda, founder of Toyota Company, in accompany with Kiichiro Toyoda and TaiiChi Ohno started to study Ford production system. They inspire from Ford mass production system in order to modify it to Toyota and Japan's needs that led to design and accomplishment of Toyota's production system named as "Just in time Production" (Wada, 2004). In 1988, the word "lean" was firstly used by Krafcik to describe Toyota production system (Krafcik, 1988). However, the wide-spread use of this word postponed until 1990 when a book entitled as "The machine that changed the world" was published (Womack et al., 1990). The book was compiled by Womack, Jones and Roos from MIT University through

research. They introduced lean production as a combination of Ford traditional production model and social control model at Japanese production environment. From the year 2000 up to now, a lot of experimental papers (Shah and Ward, 2003) and books with different orientations are being written about lean production. Although, these researches enriched the literature of production system, did not provide a unique and adaptive definition for lean production (Hopp and Spearman, 2004; De Treville and Antonakis, 2006). In continuation, appropriate scales are defined through investigation of leanness conceptual and operational definitions and used methods for measuring the lean scale at the literature. Shah and Ward (2007) pointed out that three main problems exist in defining lean measures: The first problem is that some concepts are changing through passing of time. For example preventive maintenance regarded as one of the important dimensions of Just in time production (Sakakibara et al., 1993) but now is considered as an independent construct (McKone and Weiss, 1999). The second problem is that similar items are used to operationalize highly different concepts and finally, the third problem is opposite to the second one, in such a manner that different items are used to operationalize a single concept. Measures for evaluating concepts are derived from definitions of those concepts in literature. Therefore, we first try to investigate the discussed definition for leanness and present an appropriate definition for it. According to different researchers, definition of lean production is trapped in a halo of ambiguity. Existing two approaches about lean production caused this ambiguity to be exacerbated. The first approach is a philosophical one in relation to the guidelines and lean goals (Womack and Jones, 1996; Spear and Bowen, 1999); the second approach, however, is a executive and experimental one comprised of a collection of managerial practices, tools or techniques which might be seen directly (Shah and Ward, 2003; Li et al., 2005). Such a difference may not necessarily cause inconformity; however, it affects conceptual transparency of this domain. Through a comprehensive study of presented researches and by mixing the mentioned elements in these definitions, Shah and Ward (2007) give the following comprehensive definition for leanness: "Lean production is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability". Wacker (2004) suggests that a conceptual definition should show evidence of clarity, communicability, consistency, parsimony, differentiability, inclusivity, and exclusivity. This definition meets these criteria and can be used as a lean definition in the present research. Different researchers, consider various dimensions and parts for presented concepts in lean production's definition. Simons and Zokaie (2005) consider lean production philosophy based on waste elimination and searching for perfection and Kaizen; moreover they define lean production strategy as lean stock, smooth production flow, workers training, encourage workers to participate and giving suggestion, quality circles, long range relations with suppliers, preventive maintenance policy, and commitment to continuous improvement. Kojima and Kaplinsky (2004) believe that lean production is measurable in three parts: flexibility, continuous improvement, and quality.

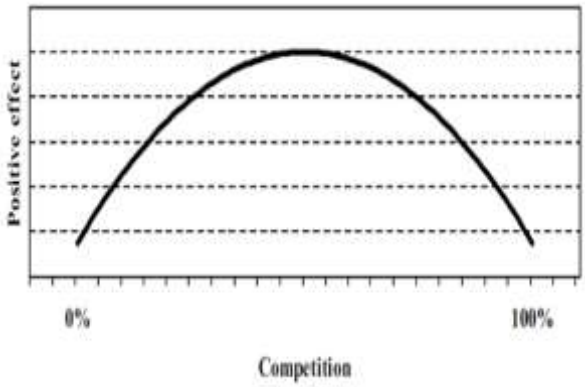

Fig 1: positive effect of competition on innovation, and productivity

Sancheze and Perez (2000) measured leanness on the base of following criteria: inventory turnover, lead time, and percentage of productive procedures documented in the organization. However, three 146 general parts, Just in Time production, total quality management, and total productivity management are referred by many researchers (Cua et al., 2001; Katayama and Bennett, 1996; Sakakibara et al., 1997). Many of researchers consider another important category as "human resources management" (Flynn and Sakakibara, 1995; Forza, 1996; Lowe, 1997; MacDuffie, 1995; Smith et al., 2003; Shah and Ward, 2003). By deep examination of the literature, Shah and Ward (2007) presented researches related to operational tools used to measure lean production elements as table (1). The table shows that there are a lot of overlapping and confusion in this regard. In this table, operational scales are in fact questions of survey questionnaires regarded as lean practices and tools and are presented as manifest variables/items in the researches. These variables are settled in latent variables using factor analysis and data reduction.

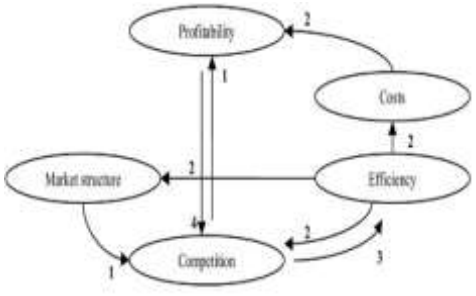

Fig 2: relations between market structure, competition, profitability and efficiency

These latent variables may be first hand (whenever the items are the base of their exploitation) or second hand or more (whenever the latent variables themselves are under data reduction and factor analysis). These scales show visible items of lean production. Totally, there are only three studies that specifically measured lean production (Shah and Ward, 2003; Li et al., 2005; Shah and Ward, 2007). Shah and Ward (2003) developed some criteria for lean production and made them operational as a set of practices related to total quality management, total preventive maintenance, and human resources management. At the other hand, Li and his Colleagues (2005) measured lean production with only 5 items including set up time.

III. METHODOLOGY

Current Research Gap and Problem Defining The review of the existing frameworks of lean above highlighted some shortcomings in the literature through a lack of suitable framework for SMEs. As a matter of fact, none of the frameworks proposed in the literature provide a simple and practical guidance for SMEs. Some are too generic and bet on longterm changes which do not satisfy SMEs who want often see quick results (Smeds, 1994; Åhlström, 1998; Womack & Jones, 2003; Motwani, 2003), while others rely on the implementation of lean tools without any regard for the efficiency of actions compared to the resources consumed (Anand & Kodali, 2010; -790- Journal of Industrial Engineering and Management – http://dx.doi.org/10.3926/jiem.1907 Karim & Arif-Uz-Zaman, 2013; Mostafa et al., 2013). This could cause many obstacles for the effective deployment of lean. In short, these frameworks are derived from the experiences of large companies. They are therefore unsuitable and cannot guarantee the desired results for SMEs. Subsequently, there are a real need for a new framework for lean implementation designed on the basis of the own experience of SMEs in lean implementation as presented in Figure 3.

Figure 3:The need of SME's for a suitable lean framework

The purpose of this paper is to develop an effective methodology for implementing lean manufacturing strategies and a leanness evaluation metric using continuous performance measurement (CPM). Based on five lean principles, a systematic lean implementation methodology for manufacturing organizations has been proposed.

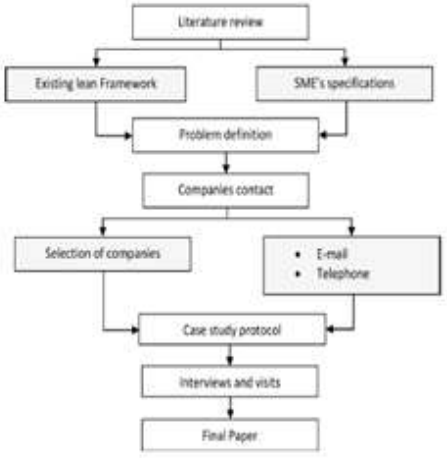

Figure 4: lean methodology

A simplified leanness evaluation metric consisting of both efficiency and effectiveness attributes of manufacturing performance has been developed for continuous evaluation of lean implementation. A case study to validate the proposed methodology has been conducted and proposed CPM metric has been used to assess the manufacturing leanness.

Proposed methodology is able to systematically identify manufacturing wastes, select appropriate lean tools, identify relevant performance indicators, achieve significant performance improvement and establish lean culture in the organization. Continuous performance measurement matrices in terms of efficiency and effectiveness are proved to be appropriate methods for continuous evaluation of lean performance. Effectiveness of the method developed has been demonstrated by applying it in a real life assembly process. However, more tests/applications will be necessary to generalize the findings.

According to our best knowledge, this is a study that proposed a systematic lean implementation methodology based on lean principles and continuous improvement techniques. Evaluation of performance improvement by lean strategies is a critical issue. This study develops a simplified leanness evaluation metric considering both efficiency and effectiveness attributes and integrates it with the lean implementation methodology.

IV. CONCLUSION

Developing lean production in recent years, there are some steps to its maturity. In fact there are some questions about

leanness requirements: to what extent a company should be lean? What index should be used to measure organization leanness? How could organization leanness be measured? Answering this question is vital for leanness specialists and for developing lean theory. Then this research goal is answering some of these questions by special attention on leanness measuring. At the first step, we defined leanness concepts, dimensions and measures using a deep study of literature. Considering vagueness and uncertainty in human evaluation, at the second step, we developed a fuzzy method to measure organizational leanness. The fuzzy method include three stages: at the first, each measure's performance and importance weight and each subdimensions and dimensions` importance weight were measured in linguistic variables. At the second step, subdimensions and dimensions performance were calculated using performances and importance weights were asked in the last stage. At the end of this step fuzzy leanness index was calculated using dimensions performance and weights and finally third step dedicated to converting fuzzy leanness index to a linguistic variable. At the end, developed method was used for measuring an organization leanness and results showed the power and accuracy of this method.

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