

A Survey on Implementation of the Lean Manufacturing in Automotive Manufacturers in the Eastern Region of Thailand

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Abstract. This paper presents an exploratory study on the attitude and level of understanding of manufacturer's related to automotive toward an implementation and benefits of the lean concepts. Questionnaires were sent to 76 sample factories located in Chonburi and Rayong Provinces. Responses were statistically analyzed in response to the set of research questions. The finding indicates that 61.8% of the sample factories implement the lean concepts. The 58.6% from the remaining 38.2% of those that have not implemented have planned to incorporate the lean concepts in their processes. The implementations have been mostly conducted for the production, planning and warehouse operations. The research also found that the average attitude of respondents toward the lean concept and its effectiveness are at positive levels but only at the moderate levels of satisfactoriness for action taken in actual implementation and effort to solve problems of managements. Additionally, it is indentified that respondents who have education higher than bachelor degree and more than 5 years of working experiences have better understanding of the lean concepts than others. Unfortunately, this survey indicated that about 81% and 70% of employees that involve with the production and operations management hold bachelor degree or lower and have less than 5 years of working experiences, respectively. Consequently, it is found that 93% of factories in this survey indicated the need of lean training for their employees. Awareness of the existence of such needs can help management and training providers to establish appropriate preparation strategies for the successful implementation of a lean program.

Keywords: Survey, Lean Production System, Automotive Manufacturers, Eastern Region of Thailand.

1. Introduction

Challenges in today's global competition have forced or required manufacturing firms to look for appropriate manufacturing management strategies in order to enhance their efficiency and competitiveness. The concepts of lean manufacturing (LM) have been one of the popular choices among others. Many of them have adopted lean techniques in many different forms and names [1] and [2]. The ultimate goal of the LM is to create a smooth, flexible and high quality process that is able to produce finished products concerning the customers demand with no wastes [3]. However, in reality, many companies are not able to alter and prepare themselves adequately for the formidable challenges, most particularly readiness of personals and understanding the real essence of LM concepts [6] and [7]. To be able to transform the entire organization into a lean organization, the lean culture must be implanted, understood and accepted across all levels of personal resources, just like what have been done years ago for the TPS at Toyota Motor [8].

There are huge evidences of studies and research done in Thailand that relate to the lean implementation [4] and [5]. Most of the evidences are actual implementation and applied research that aimed to improve some aspects of a process with the lean tools. However, there is no clear evidence of the level of success and problems/barriers of the implementation. The problems that might cause company to stumble may root from the perceptions of management and employees toward the LM [2], [11] and [13]. Thus, the purpose of this

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study is to explore the status of lean concepts in the automotive related manufacturing located in 4 industrial estates in Chonburi and Rayong provinces. The status aims to discover is the perception of employees toward the LM in terms of attitude, implementation, problems/barriers, effectiveness and level of understanding of the concepts. The discovery of such perceptions could be used as guidelines for setting company strategies for successful lean implementation program.

2. Backgrounds

2.1. Lean Manufacturing

The concept of LM was introduced by a Japanese automotive company, Toyota, during 1950's which was famously known as Toyota Production System or TPS [9]. The primary goal of TPS was to reduce the cost and to improve productivity by eliminating wastes or non-value added activities [10]. The concept of LM was transferred across the countries and industries due to its global superiority in cost, quality, flexibility and quick respond [12]. LM is a manufacturing strategy that aimed to achieve smooth production flow by eliminating waste and increasing the activities value. Shah and Ward [11] identified twenty two LM practices that are frequently mentioned in literatures and categorized them into four bundles associated with Just-in-Time, Total Quality Management, Total Preventive Management and Human Resource. Some other researchers also categorized the lean tools and techniques according to the area of implementation such as internally and externally oriented lean practices [12]. For example, Panizzolo [12] divided the lean practices into six areas which are process and equipment; manufacturing, planning and control; human resources; product design; supplier relationships; and customer relationships. However, changing from traditional manufacturing system to lean manufacturing is not an easy task [13] and [15]. The success of LM implementation depends on four critical factors: leadership and management; finance; skills and expertise; and supportive organizational culture. Despite the huge benefits gained from LM implementation, in reality not many companies are successful to implement this system [2], [7] and [13]. It was reported that the main problem lies on the misunderstanding of the real concept and purpose, cultural differences that occurs during transition or translation of LM [3], [7] and [13]. This type of misunderstanding could lead to more major issues such as misapplication of lean tools and lack of development of lean which could play a major role in success or failure of the lean implementation program.

2.2. Applications of Lean Manufacturing in Thailand

In Thailand, there are numerous evidences of industries that have adopted the lean concepts in the operations [4], ranging from retailing, banking to manufacturing. In addition, there are vast numbers of applied researches related to the lean concepts across many types of manufacturing, especially, automotive industries. These studies could be found in terms of Thesis and independent studies [5]. There is also an indication that the level of success in actual implementations was not fully satisfactorily but limited to basic application of general IE and/or improvement tools [1]. Some big and medium size organizations often set the lean concepts as the management philosophy, then, fail to establish an implementable policy and an action plan [1]. The actions are left to perform by managers of related operations and teams in the form of improvement projects *beside* their daily works. Success of failure is then lies on how much free time they have and willingness to work on the project. Attitude of project participants, attention and support of management along with effective communications could lead to the success of the lean program.

This research aimed to explore the attitude toward the lean concepts, perception of employees on implementation, problems/barrier of the concept when put into action and its effectiveness. Additionally, the survey wanted to observe the level of lean understanding of personals involved with operation functions.

3. Research Methodology

The objectives of this research were to explore the status of lean concepts in the automotive related manufacturing located in 4 industrial estates in Chonburi and Rayong provinces by surveying the perception of their employees in terms of the following;

- Attitude
- Implementation

- Problems/barriers
- Effectiveness
- Level of understanding

These items were incorporated into set of questions in the questionnaires. The research follows 5 steps. They are; definition of population and sample, design and testing of questionnaires, data collection, analysis of data and conclusions.

3.1. Definition of population and sample

The main inquiry of study was to find out the attitude and level of understanding of manufacturers whose production processes related to automotive manufacturing, located in the eastern part of Thailand. However, overall area was separated into 2 zones (A and B). This paper reports the finding of a survey study for Zone A covering manufacturing located in Leam Chabang, Pinthong, Amata City and Eastern Seaboard industrial estates. The population of the study was defined as 250 factories (Chonburi Industrial Office, 2011). The sample size was determined to be 152 factories for both zones (76 for zone A), based on the concept of Krejcie and Morgan [14]. For each factory, 3 representatives were chosen, one from the management team and the other two people from employees who work in the department that relate to production management.

3.2. Design and testing of questionnaires

A questionnaire consisted of 4 parts was developed. Parts I, II, III and IV were designed to collect information of personal information, general information of each factory, attitude toward lean-implementation-problems/barrier-effectiveness, and lean understanding evaluation, respectively. Parts I and II consist of 4 and 10 questions, respectively. Part III consists of 22 questions to survey the perception of respondents on attitude toward lean, implementation, problems/barrier and effectiveness of the lean concepts. Part IV consists of 10 multiple choice questions to evaluate the level of the lean understanding.

The questions for Part III were setup on a five-point Likert scale. The scale was ranged from 1 to 5 representing the perception levels ranging from totally disagree to totally agree for positive questions, and vice versa for negative questions. The result would be interpreted according to three classes of average score; 1-2.33, 2.34-3.67 and 3.68-5.00 as negative, neutral and positive perception for each item. Score of Part IV questionnaires would be interpreted according to the range of 0-3, 4-6 and 7-10 as low, moderate and high levels of understanding of the lean concepts. The questionnaire was reviewed by experts. Some minor corrections were made accordingly. The reliability and validity were tested with 30. Cronbach's alpha was determined to be 0.88 which was acceptable [15] for the internal consistency of the questionnaires.

3.3. Data collection

Three sets of questionnaires were sent to selected factories. A two step sampling was applied in selecting of sample factories, stratification and random samplings. The factories were separated into zones based on locations. The proportions of samples were determined relative to the number of factories located in each zone. Convenience samplings were used to select factories within a zone. Three representatives from each selected factory were required to fill the questionnaires that were sent via electronic and regular mails. The research required 1 representative from management or a person in charge or involve in directing how a firm operates its production systems. Response from this one would be counted for parts II, III and IV of the survey. The remaining 2 representatives were required to be from engineering or supervising and operating teams. Their responses would be used for parts III and IV of the survey.

3.4. Analysis of data

Data were statically analyzed. Descriptive statistics based on the mean and standard deviation were used to analyze the status of the lean concepts in sample factories. The t and F tests were used in the tests that were performed in response to the set of hypotheses of the research with 0.05 level of significance.

4. Results

Emails, phone and direct contact were utilized in effort of collecting information. From 76 sample factories, 228 respondents were finally retrieved, 76 each from the management team, engineer or supervising team and operating teams. Result form part I of the survey is as shown in Table 1.

Table 1. Summary results of general information (GI), education, position and experience of respondents

Items	GI		Education			Position			Experience (years)				
	M	F	HS /VC	BD	>BD	Mgt	Engr / SV	Opt	<5	5-10	11-15	16-20	>20
Count	186	42	11	172	45	100	40	88	10	147	48	12	11
Percentage	82	18	5	75	20	44	18	39	4	64	21	5	5

M=male, F=female, HS=high school, VC=vocational certificate, BD=bachelor degree, Engr=engineering, SV=supervising, Opt=operating

It can be seen that most of the respondents were male (82%), hold bachelor degree (75%), work in the management team (44%) and have 5-10 years of working experience (64%). It was identified that 52 factories or 68.4% employed more than 200 employees (big sizes companies, the remaining are medium sizes). Their functions in the automotive industry are as shown in Fig.1 below. Majority of them are automotive part manufacturing's and car assemblies.

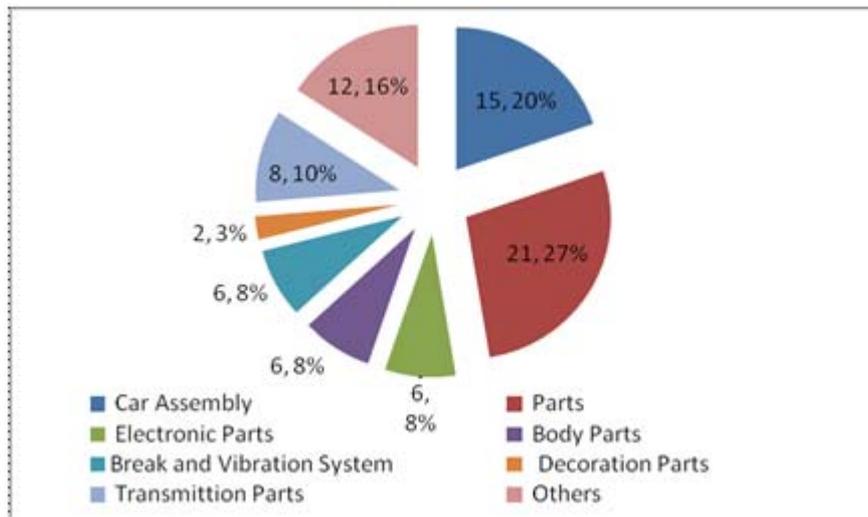


Fig. 1 Functions of Sample Factories

The finding indicates that 61.8% of the sample factories implement the lean concepts. The 58.6% from the remaining 38.2% of those that have not implemented have planned to incorporate the lean concepts in their processes. The implementations have been mostly conducted for the production, planning and warehouse operations. The mean and standard deviation (SD) of perceptions of respondents about attitude toward the lean concepts, implementation, problem/barriers and effectiveness are as shown in Table 2. The finding of level of understanding of the lean concepts is as shown in Table 3. The attitude and effectiveness are at positive levels but only at the moderate levels of satisfactoriness for action taken in actual implementation and effort to solve problems of managements. Most of respondents (68%) expressed high level of understanding of the lean concepts.

Table 2. Mean and SD of perceptions from respondents

Perception	mean	SD	Meaning
Attitude	3.85	0.52	Positive
Implementation	2.94	0.89	Neutral
Problem/barriers	2.83	0.87	Neutral
Effectiveness	3.88	0.67	Positive

Table 3. Lean concepts understanding level

Level of understanding	Count	Percentage
High	156	68%
Moderate	55	24%
Low	17	7%

The t and F tests revealed that there were no differences in the perceptions from gender, education, working position and experience. The level of understanding of the lean concepts found to be at high level and depended on education and experience. It was further identified that respondents who have education higher than bachelor degree and more than 5 years of working experiences have better understanding of the lean concepts than other groups. The majority (93%) of the respondent firms indicate that their engineers and supervisors do not have sufficient knowledge about the LM and more training required.

5. Discussions and Conclusions

The objective of this study is to explore the status of lean concepts in the automotive related manufacturing located in 4 industrial estates in Chonburi and Rayong provinces. The results show that most of the respondents' firms (61.8%) implement the lean concepts. The 58.6% from the remaining 38.2% of those that have not implemented have planned to incorporate the lean concepts in their processes and need more training. The respondents who have education higher than bachelor degree and more than 5 years of working experiences have better understanding of the lean concepts than others. Unfortunately, as indicated in the survey that about 81% and 70% of employees that involve with the production and operations management hold bachelor degree or lower and have less than 5 years of working experiences, respectively. Consequently, it is found that 93% of factories in this survey indicated the need of lean training for their employees. Therefore, from the finding of this research, it can be concluded that the lean manufacturing is an acceptable philosophy for production management of the automotive related industries located in Chonburi and Rayong provinces. However, more attention and effort to solve problems from management are needed. In addition, training for engineering, supervising and operating teams are required for the success of the lean implementation.

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